3-2021

Air Force Institute of Technology Research Report 2020

Graduate School of Engineering and Management, Air Force Institute of Technology

AFIT/EN/TR-21-01
TECHNICAL REPORT
MAY 2021

Air Force Institute of Technology
Research Report 2020

Period of Report: 1 Oct 2019 to 30 Sep 2020

Graduate School of Engineering and Management

GRADUATE SCHOOL OF ENGINEERING AND MANAGEMENT
AIR FORCE INSTITUTE OF TECHNOLOGY
WIRHGT-PATTERSON AIR FORCE BASE, OHIO

AIR FORCE INSTITUTE OF TECHNOLOGY

Wright-Patterson Air Force Base, Ohio

This report was edited and produced by the Office of Research and Sponsored Programs, Graduate School of Engineering and Management, Air Force Institute of Technology. The Department of Defense, other federal government, and non-government agencies supported the work reported herein but have not reviewed or endorsed the contents of this report.

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Air Force Institute of Technology
Research Report 2020
Forward

The Air Force Institute of Technology (AFIT) research activities deliver dual purpose results: valuable educational experiences to enhance our graduates' performance throughout their careers, and innovative solutions of importance to our sponsors. AFIT works closely with research sponsors from many Air Force and DOD organizations to identify high interest problems that match our faculty expertise and educational requirements to maximize value.

AFIT's Autonomy and Navigation Technology Center, Center for Cyberspace Research, Center for Directed Energy, Center for Operational Analysis, Center for Space Research and Assurance, Center for Technical Intelligence Studies and Research, and Nuclear Expertise for Advancing Technologies Center serve as focal points for many of our research initiatives. Other research groups are addressing game-changing technologies including hypersonics, human-machine systems, data sciences, and additive manufacturing applications. AFIT advises over 50 major acquisition programs through the Scientific Test & Analysis Techniques Test & Evaluation Center of Excellence to improve effectiveness of test resources. New consultation efforts include exploration of multi-domain approaches to the Air Force's core missions.

AFIT's research programs support both the USAF and USSF. Strategic partnerships with the Air Force Research Laboratory, the National Air and Space Intelligence Center, the Air Force Life Cycle Management Center, the United States Transportation Command, and many other organizations and operational communities maximize the contributions of our research programs to national defense needs. Our faculty and students also engage in collaborations with researchers at universities throughout the nation to advance the state-of-the-art in a variety of disciplines. AFIT cooperates with commercial enterprises to ensure timely transfer of new technology to US industry through Cooperative Research and Development Agreements (CRADAs).

This Research Report is prepared annually to summarize the significant contributions of AFIT; to solicit continued involvement and support from our Air and Space Forces, DOD, and other federal partners; and to encourage new sponsors to participate in AFIT's research programs. AFIT welcomes new opportunities to engage in research projects that are of mutual interest to our customers, faculty, and students. Additional information is available at https://www.afit.edu/ENR/.

Heidi R. Ries, PhD
Dean for Research
Graduate School of Engineering
and Management

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1. INTRODUCTION

1.1. OVERVIEW

This Research Report presents the FY20 research statistics and contributions of the Graduate School of Engineering and Management (EN) at AFIT. AFIT research interests and faculty expertise cover a broad spectrum of technical areas related to USAF needs, as reflected by the range of topics addressed in the faculty and student publications listed in this report. In most cases, the research work reported herein is directly sponsored by one or more USAF or DOD agencies.

AFIT welcomes the opportunity to conduct research on additional topics of interest to the USAF, DOD, and other federal organizations when adequate manpower and financial resources are available and/or provided by a sponsor. In addition, AFIT provides research collaboration and technology transfer benefits to the public through Cooperative Research and Development Agreements (CRADAs). Interested individuals may discuss ideas for new research collaborations, potential CRADAs, or research proposals with individual faculty using the contact information in this document or via the AFIT Directory at https://www.afit.edu/BIOS/.

Additional information on the research programs at AFIT may also be found on the research web home page at https://www.afit.edu/ENR/. The Office of Research and Sponsored Programs, Graduate School of Engineering and Management can be reached at (937) 255-3633, (DSN 785-3633) or by Email: research@afit.edu. The primary points of contact are Ms. Bobbie J. Bowling, the Director of Sponsored Programs, (937) 255-3636 x4396, DSN 785-3636 x4396 and Dr. Heidi R. Ries, Dean for Research, (937) 255-3636 x4544, DSN 785-3636 x4544.

1.2. THE GRADUATE SCHOOL OF ENGINEERING AND MANAGEMENT RESEARCH COLLABORATION

As detailed in the 2019-2020 catalog at https://www.afit.edu/ENER/doclib.cfm?dl=31, AFIT offers Master's and Doctoral programs in a variety of disciplines through six departments: Department of Aeronautics and Astronautics (ENY), Department of Electrical and Computer Engineering (ENG), Department of Engineering Physics (ENP), Department of Mathematics and Statistics (ENC), Department of Operational Sciences (ENS), and Department of Systems Engineering and Management (ENV). In all of these disciplines, research is an integral component of graduate education, developing an individual student's skills and providing new knowledge of interest to many. A brief listing of each department's research areas of emphasis appears below. Please contact the faculty or relevant departmental office for further information, or visit the Graduate School of Engineering and Management departmental websites at https://www.afit.edu/en/.

The Department of Aeronautics and Astronautics, as well as its resident **Center for Space Research & Assurance,** invites research topic proposals and collaborative suggestions for the Aeronautical Engineering, Astronautical Engineering, Materials Science, and Space Systems programs. The following list highlights the Department's research specialties:

Aeroelasticity and Design Optimization
Aerospace Structures and Materials
Aircraft Survivability
Autonomous Control of UAVs
Compact Combustor Development
Computational Fluid Dynamics
Control of High Performance Aircraft
Dynamic Flight Simulation
Experimental Fluid Dynamics
High Velocity Impact
Impact Dynamics
Inflatable Space Structures
Materials and Structural Analysis
Mechanics of Materials and Structures
Micro Air Vehicles
Non-Linear Dynamics
Re-entry Dynamics
Rocket & Space Propulsion
Rotorcraft Aeromechanics
Satellite Cluster Dynamics, Navigation, & Control
Spacecraft Dynamics & Control
Spacecraft/Sensor Integration and Testing
Thermal Control of Spacecraft
Turbine Heat Transfer
Weapon Aerodynamics

The Department of Electrical and Computer Engineering, as well as its resident **Autonomy and Navigation Technology Center** and **Center for Cyberspace Research**, invites research topic proposals and collaborative suggestions for the Electrical Engineering, Computer Engineering, Computer Science, Cyber Operations, and Cyber Warfare programs. The following list highlights the Department's research specialties:

Advanced Security-Focused Computing
Antennas
Architectures
Artificial Intelligence
Automatic Target Recognition
Communications
Computer Communication Networks
Cryptography
Cyber Operations and Security
Digital Forensics
Electromagnetics/Low Observables
Electro-Optics
Electronic Warfare
Evolutionary Algorithms
Guidance, Navigation, and Control
Hardware Assurance
Human Computer Interfaces
Human Machine Systems
Information Visualization
Micro-and Nano-Systems
Navigation Warfare
Parallel and Distributed Processing
Quantum Computing
Radar
Remote Sensing
Signal and Image Processing
Space Domain
Software Protection
Wireless Networks
Wireless Sensor Networks

The Department of Engineering Physics, as well as its resident **Center for Directed Energy** and **Center for Technical Intelligence Studies and Research**, invites research topic proposals and collaborative suggestions for the Applied Physics, Nuclear Engineering, Optical Sciences and Engineering, Materials Science (jointly operated with the Department of Aeronautics and Astronautics), and Combating Weapons of Mass Destruction programs. The following list highlights the Department's research specialties within these programs:

Adaptive Optics, Aero-Optics and Beam Control
Atmospheric Characterization and Compensation
Atmospheric Effects on Weapons Systems
Atmospheric Electricity
Aviation Weather Forecasting
Biological and Chemical Weapon Technologies
Computational Physics
Defects in Crystalline Solids
Directed Energy Weapons Effectiveness
High Energy Density Physics
Imaging Science
Lasers and Electro-Optics
Muon Detection
Materials – Bio, Nuclear and Sensor
Microscopic Imaging of Surfaces
Modeling and Simulation of Atmospheric Effects
Molecular Reaction Dynamics
Nanomaterials
Nanomechanics
Nuclear Forensics
Nuclear Survivability
Nuclear Weapons Effects
Numerical Weather Prediction
Physics-Based Scene Modeling
Positron Spectrometry
Radiation and Particle Detection
Radiation Effects on Materials and Electronics
Radiation Transport
Remote Sensing and Signature Analysis
Satellite Meteorology
Semiconductors
Space Physics
Tropical Cyclone Analysis and Forecasting
Weather Radar

The Department of Mathematics and Statistics invites research topic proposals and collaborative suggestions for the following research specialties:

Acoustic Wave Scattering
Bayesian Analysis
Biostatistics
Categorical Data Analysis
Control Theory
Data Analytics
Design of Experiments
Electromagnetics
Fluid Dynamics
Human Performance
Information Fusion
Network Analysis

Nonlinear Waves
Numerical Analysis
Optimization
Partial Differential Equations
Rarefied Gas Dynamics
Regression Modeling
Stochastic Processes
Structural Health Monitoring Wavelets

The Department of Operational Sciences, as well as its resident **Center for Operational Analysis**, invites research topic proposals and collaborative suggestions within the areas of Operations Research, Logistics, and Supply Chain Management programs. The following list highlights the Department's research specialties:

Agile Combat Support Prioritization
Automatic Target Recognition
Autonomous System Operations and Testing
Big Data and Analytics
Combat Modeling
Decision Analysis
Design and Analysis of Experiments
Enterprise Level Depot Sustainment
Evaluation of Autonomous Systems
Facility Location Optimization
Force Structure Analysis Tool Development
Information Modeling
Inventory Analysis
Irregular Warfare
Irregular Warfare Model Development
Lean Operations
Logistics
Machine Learning
Maintenance and Production Management
Managerial Economics
Manpower Modeling and Forecasting
Materials Research Test Planning
Mathematical Programming
Modeling and Simulation
Network Analysis
Neural Networks
Operations Management
Operations Research
Optimization
Organization Behavior
Petroleum Management
Repair Network Integration
Robust Decision Making
Robust Design
Robust Mobility Modeling
Scheduling
Service Operations Management
Social Network Modeling and Analysis
Statistical Process Monitoring
Stochastic Modeling
Strategic Sourcing
Supply Chain Management and Resource Optimization
Test and Evaluation
Test Science
Time Series Analysis
Transportation Policy and Strategic Modeling

The Department of Systems Engineering and Management is a multidisciplinary department offering graduate degrees in seven different majors and conducting research in collaboration with the wide spectrum of programs throughout AFIT. The mission of the Department is to provide defense-focused graduate education and engage in interdisciplinary research to achieve integrated solutions to current and future Air Force challenges and enhance the interface between technology and human resources by focusing on systems, processes, and management. The following list highlights the Department's research specialties:

Acquisition Learning Curves
Agricultural Production and Climate
Applied Environmental Sciences
Built Environment Microbiome
Climate Impact on Built Infrastructure
Computer and Network Security
Construction Management
Cost Analysis
Cyber Attack on UAS
Data Analytics
Decontamination of CBRN Casualties
Design and Analysis of Experiments
Ecological Engineering
Emergency Management
Energy and Water Systems Interactions
Extreme-Event Impacts to Installation Infrastructure
Facility and Infrastructure Management
Fuels Microbiology
Geographical Information Science
Human Systems Integration
Human-Agent Interaction
Image and Display Science
Indoor Air Quality
Information Assurance and Security
Infrastructure Asset Management
Installation Energy Use Prediction
Knowledge Management
Model-Based Systems Engineering
Modeling and Simulation

Neck and Injury Biomechanics
Occupational/Environmental
Operations Research
Organizational Change
Permafrost
Photovoltaics
Physiologically-Based Pharmacokinetic Modeling Analysis
Product Design and Development
Project Management
Project Delivery
Reliability Engineering
Resilient Infrastructure Engineering
Strategic Decision Support
Structural Health Monitoring
Structural Performance
Surface Science
Sustainability and Life Cycle Assessment
System Architecture
Systems Engineering
Unmanned Air System Design and Test
Vigilance
Water Quality
Water Resources Systems
Waste-to-Energy Conversion Modeling

Another avenue for educational and research collaboration with the Graduate School of Engineering and Management is through association with one or more of AFIT's Research Centers. A brief listing of each Center's research or educational areas of emphasis appears below. Please contact the Centers directly (see Chapter 6) or visit http://www.afit.edu/ENR/page.cfm for further information.

The Autonomy and Navigation Technology (ANT) Center is a forward-looking research center seeking to identify and solve tomorrow's most challenging navigation and autonomous and cooperative control problems by focusing on three research thrusts: autonomous and cooperative systems, non-GPS precision navigation, and robust GPS navigation/NAVWAR.

The Center for Cyberspace Research (CCR) conducts cyber security and cyber operations research at the Master's and PhD levels. CCR affiliated faculty teach and direct graduate research focusing on understanding and developing advanced cyber-related theories and technologies, such as critical infrastructure protection, cyber-physical systems, network intrusion detection and avoidance, insider threat mitigation, cyberspace situational awareness, malicious software detection and analysis, software protection, and anti-tamper technologies. The CCR is forward-looking and responsive to the changing educational and research needs of the Air Force, Department of Defense, and the federal government. CCR faculty's research and teaching establishes AFIT as a national Center of Academic Excellence in Research (CAE-R) and Center of Academic Excellence in Cyber Operations (CAE-CO), designated by the Department of Homeland Security (DHS) and the National Security Agency (NSA).

The Center for Directed Energy (CDE) is dedicated to Air Force and DOD research in high energy lasers (HELs), high power microwaves (HPMs), and their enabling technologies. The Center is an advocate for transitioning these systems to the battlefield through vigorous scientific and engineering research, graduate education programs and diverse consulting activities.

The Center for Operational Analysis (COA) conducts defense-focused research which directly supports DOD strategic objectives. The COA applies rigorous quantitative and qualitative tools, methodologies and approaches to identify, analyze and solve complex operations and supply chain problems while developing critical and forward- thinking analysts, managers, and leaders.

The Center for Space Research and Assurance (CSRA) is focused on delivering highly-valued resilient, responsive and reliable space capabilities to the DOD and Intelligence Community through executing cutting-edge space technology development, science and space experiments in collaboration with government organizations, to meet the challenges of tomorrow by developing the technical space cadre through world-class research and immersive hands-on graduate education.

The Center for Technical Intelligence Studies and Research (CTISR) is focused on Air Force, DOD and Intelligence Community's scientific, technical and operational activities through graduate research programs. Activities are directed on improving technical intelligence gathering via remote sensing. Current research is focused on signature measurement, phenomenological understanding, and algorithm development for target detection and tracking, battle space combustion characterization, event classification, and material identification.

The Center of Excellence (COE) for Scientific Test and Analysis Techniques (STAT) in Test & Evaluation (T&E) is a reach-back T&E capability that provides advice and assistance in the application of scientific test and analysis techniques in the development of Test & Evaluation Master Plans (TEMP). The COE provides value to the PEOs/PMs across the DOD through assistance provided to the Chief Developmental Tester (T&E Program Leads) during the T&E planning, execution and assessment. The COE provides an additional resource of subject matter expertise for the program managers and chief developmental testers of Major Defense Acquisition Programs (MDAP) and Major Automated Information Systems (MAIS) during the T&E planning, execution, and assessment process.

The Nuclear Expertise for Advancing Technologies (NEAT) Center is a new AFIT center established on 1 May 2019. The NEAT Center's mission is to provide the nation with relevant expertise to address emergent and future nuclear warfighting capabilities across all domains. The NEAT Center will be the first place organizations turn to when they require intellectual capital, knowledge, or assistance in solving technical nuclear acquisition and warfighting challenges. The NEAT Center's vision is to be the recognized center for the development of competent and knowledgeable technical expertise and innovative research in support of present and future strategic operations.

2. SPECIAL RECOGNITIONS

2.1. FACULTY FELLOWS

AKERS, BENJAMIN F., ENC Instructor of the Quarter, 2020 Spring Quarter

BADIRU, ADEDEJI B., Dean, Graduate School of Engineering and Management, Fellow of the Institute of Industrial Engineers, Fellow of the Nigerian Academy of Engineering

DECKRO, RICHARD F., Professor of Operations Research, Department of Operational Sciences, Fellow of the Military Operations Research Society

***ELROD, WILLIAM E.,** Professor Emeritus of Aerospace Engineering, Department of Aeronautics and Astronautics, Fellow of American Society of Mechanical Engineers International

FICKUS, MATTHEW C., Dean's distinguished Teaching Professor, 2019

***FRANKE, MILTON E.,** Professor Emeritus of Aerospace Engineering, Department of Aeronautics and Astronautics, Fellow of the American Society of Mechanical Engineers

***GOLTZ, MARK N.,** Professor of Engineering and Environmental Management, Department of Systems Engineering and Management, Fellow of the Society of American Military Engineers

GRIMAILA, MICHAEL R., Professor and Head, Department of Systems Engineering and Management, Fellow of the Information System Security Association

***HENGEHOLD, ROBERT L.,** Professor Emeritus of Physics, Department of Engineering Physics, Fellow of the American Physical Society

JACKSON, JULIE A., 2019 AFIT/EN Nominee for the 2019 Gage H. Crocker Outstanding Professor Award, 2019 AFIT Graduate School of Engineering and Management Research Award

MALL, SHANKAR, Professor of Aerospace Engineering, Department of Aeronautics and Astronautics, Fellow of the American Society of Mechanical Engineers International

MULLINS, BARRY E., Research Advisor for AOC Academic Research Excellence Award–Information Superiority (Best Information Superiority thesis), Y. Park – Mar 20

NYKL, SCOTT L. 2019 Air Force Level Winner - S&T Advanced Technology Development Award

OXLEY, MARK E., AFTAC Endowed Term Chair in AI/ML, October 2019

PACHTER, MEIR, Appointed AFIT Distinguished Professor of Electrical Engineering, July 2019

PALAZOTTO, ANTHONY N., Distinguished Professor, Aerospace Engineering, Department of Aeronautics and Astronautics, Fellow of American Institute of Aeronautics and Astronautics, Fellow of the American Academy of Mechanics, Fellow of the American Society of Civil Engineers, Fellow of the Engineering Mechanics Institute

PERRAM, GLEN P., Professor of Physics, Department of Engineering Physics, Fellow of the Directed Energy Professional Society

PIGNATIELLO, JOSEPH J., Professor of Operations Research; Head, Department of Operational Sciences, Fellow of the Institute of Industrial Engineers; Fellow of the American Society for Quality

POLANKA, MARC D., Professor of Aerospace Engineering, Department of Aeronautics and Astronautics, Fellow of the American Society of Mechanical Engineers International

RUGGLES-WRENN, MARINA B., Professor of Aerospace Engineering, Department of Aeronautics and Astronautics, Fellow of the American Society of Mechanical Engineers International

***TORVIK, PETER J.,** Professor Emeritus of Aerospace Engineering and Engineering Mechanics, Department of Aeronautics and Astronautics, Fellow of the American Institute of Aeronautics and Astronautics, Life Fellow of American Society of Mechanical Engineers International, Fellow of the Ohio Academy of Science

WEIR, JEFFERY W., Professor and Deputy Department Head, Department of Operational Sciences, Fellow of the Southwestern Ohio Council for Higher Education

WHITE, EDWARD D., Dean's Distinguished Teaching Professor, 2019

WOOD, AIHUA W., ENC Instructor of the Quarter, 2019 Fall Quarter**,** ENC Instructor of the Year, 2019-2020, ENC Instructor of the Quarter, 2020 Summer Quarter

*Emeritus faculty

2.2. PROFESSIONAL CERTIFICATIONS

AHNER, DARRYL K., Professional Engineer (Commonwealth of Virginia)

BADIRU, ADEDEJI B., Certified Project Management Professional (PMP), Leadership Certificate (University of Tennessee Leadership Institute), Professional Engineer (State of Oklahoma)

CHRISSIS, JAMES W., Professional Engineer (Florida #37247)

COOPER, CASEY W., Lt Col, Certified Industrial Hygienist

CUNNINGHAM, WILLIAM A., Certified in Transportation and Logistics (CTL)

DELORIT, JUSTIN D., Maj, Professional Engineer (State of Ohio), Registered Environmental Professional

FASS, ROBERT D., Certified Cost Estimator/Analyst (International Cost Estimating and Analysis Association)

FREELS, JASON K., Maj, Systems Planning, Research, Development and Engineering (SPRDE) Certification, Level III

GOLTZ, MARK N., Board Certified Environmental Engineer (American Academy of Environmental Engineers), Professional Engineer (State of Minnesota)

GREENDYKE, ROBERT B., Professional Engineer (State of Texas)

GRIMAILA, MICHAEL R., Certified Information Security Manager (CISM); Information Systems Audit and Control Association (ISACA); Certified Information System Security Professional (CISSP); International Information Systems Security Certification Consortium, Inc. (ISC)2; National Security Agency INFOSEC Assessment Methodology (IAM) Certification; National Security Agency INFOSEC Evaluation Methodology (IEM) Certification; National Security Agency 4011/4012/4013 Certification.

HARPER WILLIE F., Jr., Professional Engineer (State of Arizona)

HAZEN, BENJAMIN T., Maj, Certified Lean Six Sigma Black Belt, Certified Six Sigma Green Belt, Certificate in Transportation and Logistics Regulation, Certification in Transportation and Logistics (CTL)

KUNZ, DONALD L., Professional Engineer (Commonwealth of Virginia)

LOPER, ROBERT D., APDP Level II Certification – SPRDE, APDP Level II Certification – S&T Management, APDP Level I Certification – Program Management

MAILLOUX, LOGAN O., Maj, Certified Information System Security Professional (CISSP), Certified Systems Engineering Professional (CSEP)

MARCINIAK, MICHAEL A., APDP Level II Certification – SPRDE, APDP Level II Certification – Program Management, APDP Level I Certification – Test and Evaluation, Certified Laser Safety Officer (Board of Laser Safety, Orlando, FL)

MBONIMPA, ERIC G., Professional Engineer (State of Michigan)

OVERSTREET, ROBERT E., Lt Col, Certified in Transportation & Logistics (CTL)

PALAZOTTO, ANTHONY N., Professional Engineer (State of Ohio)

PERRAM, GLEN P., Professional Engineer (State of Ohio)

REEDER, MARK F., Professional Engineer (State of Ohio)

REITH, MARK G., Certified Information System Security Professional (CISSP), Certified Ethical Hacker (CEH)

RITSCHEL, JONATHAN D., APDP Business-Cost Estimation Certification, Level II

RUTLEDGE, JAMES L., MAJ, Professional Engineer (State of Texas)

SCHULDT, STEVEN, J., Lt Col, Professional Engineer (State of Ohio)

SHATTAN, MICHAEL B., LTC, Professional Engineer (Commonwealth of Virginia)

SLAGLEY, JEREMY M., Board Certified Industrial Hygienist, Board Certified Safety Professional

STONE, BRIAN B., Maj, Six Sigma Black Belt Certification (Arizona State University), Certificate in Statistics (Arizona State University)

TUTTLE, RONALD F., APDP Level III Certification – Program Management, APDP Level III Certification – SPRDE

WAGNER, TORREY J., Lt Col, Scaled Agile Framework Agilest, Systems Planning, Research, Development and Engineering (SPRDE) Systems Engineering Certification, Level III; Systems Planning, Research, Development and Engineering (SPRDE) Science & Technology Manager Certification, Level III

*Emeritus Faculty

2.3. RESEARCH AND TEACHING AWARDS

2.3.1. FACULTY

AHNER, DARRYL K., Council of Supply Chain Management Professionals Global Conference, 2014 E Grosvenor Plowman Award for Best Paper

BADIRU, ADEDEJI B., Air Education and Training Command National Public Service Award

BAUER, KENNETH W., Jr., Elevated to Senior Member of IEEE

BICKLEY, ABIGAIL A., 2019 AETC Nuclear Deterrence Operations Professional Team of the Year Award, February 2020

CHINI, CHRISTOPHER M., Journal of Sustainable Water and the Built Environment, Publication selected for Editor's Choice, Vol 6 Issue 3 (2020) Water Resources Research Top Downloaded Paper of 2018-2019 Award (2020)

DELORIT, JUSTIN D., 2019 Sigma Iota Epsilon Faculty Instructor of the Year, 2019 Best Research-Oriented Paper, Journal of Water Resources Planning and Management, 2019 Air Force Maj Gen Dean L. Fox Senior Military Manager of the Year

ELSHAW, JOHN J., 2019 Dean's Distinguished Professor Award

FREELS, JASON K., Maj., The Lloyd S. Nelson Award: Awarded by the American Society for Quality (Statistics Division) - This award recognized the paper "Accelerated Test Methods for Reliability Prediction," by David H. Collins, Jason K. Freels, Aparna V. Huzurbazar, Richard L. Warr and Brian P. Weaver published in Journal of Quality Technology as the technical paper with the "Greatest Immediate Impact to Practitioners" for 2014.

GEFFRE, JENNIFER L., Maj, Western Decision Science Institute Conference—Best Student Paper Award (#1/11), Mar 2013, Military Operations Research—81.1 Virtual Symposium—Most Recommended Presentation (one of three out of 61 presentations), June 2013

HARPER, WILLIE F., Jr., 2019 Elected to the Board of Directors for the Association of Environmental Engineering and Science Professors

HOLLAND, DARREN E., 2019 AETC Nuclear Deterrence Operations Professional Team of the Year Award, February 2020

JACKSON, JULIE A., 2019 AFIT/EN Nominee for the 2019 Gage H. Crocker Outstanding Professor Award, 2019 AFIT Graduate School of Engineering and Management Research Award

JOHNSON, ALAN W., SIE Instructor Award for Outstanding Contributions to the Understanding of Management Sciences, Sigma Beta Chapter, Mar 2014

KOWASH, BENJAMIN R., 2013 AETC Nuclear Deterrence Operations Professional Team of the Year Award

LANGHALS, BRENT T., 2018-2019 Sigma Iota Epsilon Outstanding Instructor Award

LIU, DAVID, Capt, 2014 Best Student Paper Competition, 2nd Place – 2014 AIAA Region III Student Paper Conference, April 2014

MULLINS, BARRY E., Research Advisor for AOC Academic Research Excellence Award–Information Superiority (Best Information Superiority thesis), Y. Park, March 2020

NYKL, SCOTT L., 2019 Air Force Level Winner - S&T Advanced Technology Development Award

OGDEN, JEFFREY A., 2013 Professor of the Year Award – AFIT/ASAM

PACHTER, MEIR, Appointed AFIT Distinguished Professor of Electrical Engineering, July 2019

PETROSKY, JAMES C., 2019 AETC Nuclear Deterrence Operations Professional Team of the Year Award, February 2020

SCHULDT, STEVEN J., Lt Col, 2019 AFIT Leslie M. Norton Teaching Excellence Award, 2020 Junior Chamber International USA Ten Outstanding Young American

SLAGLEY, JEREMY M., 2019 Dean's Distinguished Professor Awards, 2019 Fulbright Scholar selected for period of July 2020 – June 2021

STRAKOS, JOSHUA K., Maj, University of Houston Bauer College of Business, Dean's Award for Academic Excellence, 2013

TOURNAY, ROBERT C., Lt Col, 2020 Dr. Leslie M. Norton Teaching Excellence Award, March 2020

VARSHNEY, GAIVEN 2019 AETC Nuclear Deterrence Operations Professional Team of the Year Award, February 2020, 3rd Quarter CY20 Team Award with the Countering Weapons of Mass (CWMD) Destruction Team Members

WIRTHLIN, JOSEPH R., Lt Col, 2013 Shingo Research Award for the "Guide to Lean Enablers for Managing Engineering Programs"

YAMAMOTO, DIRK P., Lt Col, 2013 Department Journal Publication of the Year

*Emeritus Faculty

2.3.2. STUDENTS

BLAIR, MARC, Maj, USMC 2020 Best Poster Presented at American Industrial Hygiene Conference and Exposition

BOECKENSTEDT, ALEXANDER S., 2Lt, 2020 Dean's Award, March 2020, 2020 Chancellor's Award and Russ Prize, March 2020

COOKSEY, GEORGE D., 1st Lt, USAF 2020 American Industrial Hygiene Foundation Scholarship

GUM, DANIEL A., 1Lt, 2020 American Nuclear Society Thesis Award, March 2020

STEELE, MEGAN, 2020 Best Poster Presented at American Industrial Hygiene Conference and Exposition, 2020 Dean's Award for best thesis in Department of Systems Engineering and Management

TITUS, EMILY, 2020 Best Poster Presented at American Industrial Hygiene Conference and Exposition, 2020 Summer Distinguished Graduate

WILLIAMS, JOANNA E., Capt, 2020 Lieutenant Edwin E. Aldrin Sr. Award, March 2020

WOOD, JASON C., LTC, 2020 Center for Technical Intelligence Studies and Research, March 2020

3. RESEARCH STATISTICS

3.1. RESEARCH AND CONSULTING MEASURES

There are measurable indicators of AFIT's contribution to the engineering and scientific community and AFIT's success in staying well informed of technical possibilities and scientific opportunities. These indicators include the number and quality of technical publications accepted by the editors of journals; the number of presentations accepted for regional, national and international conferences; the number of Sponsor Funded Research Projects conducted; and finally, the number of student Graduate Research Papers, MS theses, and PhD dissertations completed and submitted to the Defense Technical Information Center. For FY20, these output measures are shown in Table 3.1 and Table 3.2 for the Departments and Centers, respectively.

Table 3.1 Faculty Research and Sponsored Programs Output by Department

		Graduate School, by Department					
	Graduate School (EN) Total	Math & Stats (ENC)	Electrical & Comp Eng (ENG)	Engineering Physics (ENP)	Operational Sciences (ENS)	Sys Eng & Management (ENV)	Aeronautics & Astro (ENY)
Number of Faculty (FTE)*	176	21	36	38	27	28	26
Number of Research Faculty (FTE)	14	1	2	11	0	0	0
Refereed Publication Authorships**	398	21	52	97	63	88	77
Refereed Conferences on the Basis of Full Paper Review**	182	11	82	36	5	30	18
Refereed Conferences on the Basis of Abstract Review**	235	6	32	76	24	40	57
Sponsor Funded Projects***	256	5	55	62	34	23	76
Books & Chapters in Books**	20	2	6	1	1	9	1
Patents****	37	0	8	15	1	4	9
Doctoral Dissertations Advised	15	0	8	2	1	2	2
Master's Theses Advised	234	1	46	34	62	58	33
Graduate Research Papers Advised	0	0	0	0	20	0	0

*FTE: Full-time equivalent military and permanent civilian faculty
**Publications/Presentations are counted by faculty authorships.
***One project associated with the Office of Research and Sponsored Programs (ENR) is reflected in Graduate School (EN) Total.
****Includes: Patents Awarded, Patent Applications, and Invention Disclosures counted by faculty authorships.

Table 3.2 Faculty Research and Sponsored Programs Output, by Center

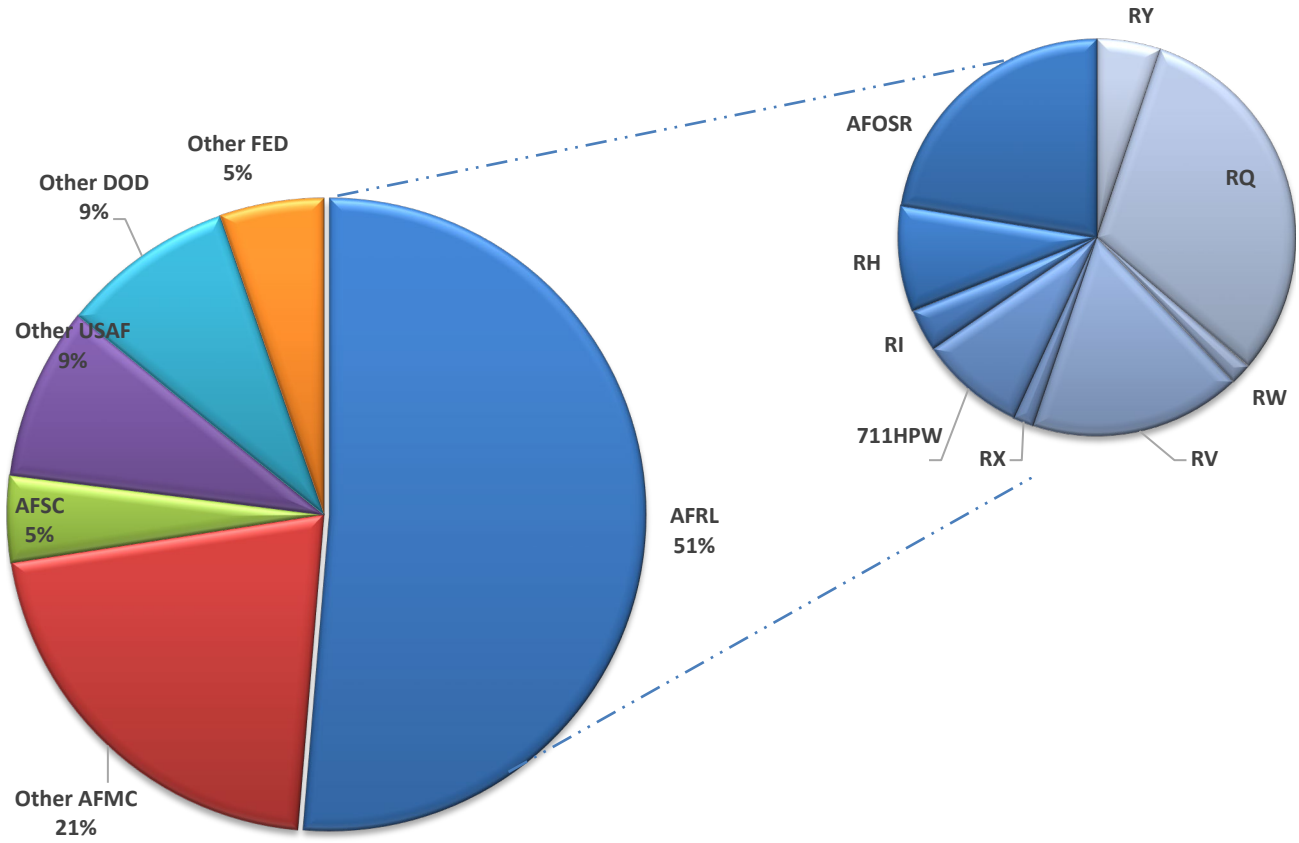
	Total All Centers	ANT	CCR	CDE	COA	CSRA	CTISR	NEAT
Number of Affiliated Faculty*	127	23	19	19	7	41	16	2
Refereed Publication Authorships**	296	60	49	49	15	80	40	3
Refereed Conferences on the Basis of Full Paper Review**	189	50	45	28	7	42	13	4
Refereed Conferences on the Basis of Abstract Review**	169	20	11	40	8	60	30	0
Sponsor Funded Projects	132	34	7	21	9	37	17	7
Books & Chapters in Books**	12	2	6	0	0	2	1	1
Patents***	34	5	3	9	0	10	4	3
Doctoral Dissertations Advised	8	3	3	0	0	0	1	1
Master's Theses Advised	98	24	12	12	9	25	3	13
Graduate Research Papers Advised	0	0	0	0	0	0	0	0

*Some faculty are affiliated with multiple centers.
**Publications/Presentations are counted by faculty authorships.
***Includes: Patents Awarded, Patent Applications, and Invention Disclosures counted by faculty authorships.

3.2. RESEARCH AND CONSULTING SPONSORSHIP

As part of an Air Force institution, the faculty members of the Air Force Institute of Technology focus their research on current problems as well as future systems of the Air Force and other DOD organizations. Evidence of this focus is that 98% of all theses, dissertations, and graduate research papers listed in Table 3.1 are externally sponsored by Air Force, DOD and government agencies. In addition, most of the research projects and consultations are carried out for Air Force and DOD units. The data are summarized in Figure 3.1 and Table 3.3.

Figure 3.1 Sponsors of AFIT Theses, Dissertations, and Graduate Research Papers



*Pie Chart on the right shows breakdown by AFRL Technology Directorates

Table 3.3 AFIT External Sponsorship by Organization

SPONSOR ORGANIZATION	PhD Dissertations	Master's Theses	Graduate Research Papers	Funded Projects
OFFICE OF THE SECRETARY OF THE AIR FORCE		4		13
United States Air Force Academy				1
HQ UNITED STATES AIR FORCE		6		29
AIR COMBAT COMMAND				1
AIR EDUCATION AND TRAINING COMMAND		1		1
Air Force Institute of Technology		1		
AIR FORCE MATERIEL COMMAND		5		5
704th Test Squadron				1
Air Force Arnold Engineering Center				1
Air Force Civil Engineering Center		11		2
Air Force Life Cycle Management Center		8		7
Air Force Nuclear Weapons Center				1
Air Force Security Force Center				1
Air Force Research Laboratory (AFRL)		12		1
711 Human Performance Wing (RH)		5		17
Air Force Office of Scientific Research (AFOSR)		13		26
Aerospace Systems Directorate (RQ)		18		32
Directed Energy Directorate (RD)				4
Information Directorate (RI)		2		2
Materials & Manufacturing Directorate (RX)		1		8
Munitions Directorate (RW)		1		6
Sensors Directorate (RY)		3		7
Small Business Office (SB)				1
Space Vehicles Directorate (RV)		10		20
Air Force Installation and Mission Support Center				
Air Force Sustainment Center		1		
Strategic Development Planning and Experimentation				
AIR MOBILITY COMMAND		5		
AIR FORCE SPACE COMMAND				
45th Weather Squadron		3		1
Space Security and Defense Program				
Space and Missile Systems Center		1		3
AIR FORCE SPECIAL OPERATIONS COMMAND		1		
USAF FIELD OPERATING AGENCIES/DIRECT REPORTING UNITS				
Air Force Communications Command				
Air Force Cost Analysis Agency				
Air Force Technical Applications Center		7		6
National Air and Space Intelligence Center	1	2		3
DEPARTMENT OF DEFENSE		1		
Air Force Specialty Code				
Defense Advanced Research Projects Agency		2		
Defense Intelligence Agency		3		
Defense Threat Reduction Agency				1

Directed Energy Joint Technology Office		3		
High Performance Computing Modernization Program				
Joint Aircraft Survivability Program Office		1		
Joint Chiefs of Staff		1		
Joint Warfare Analysis Center				
Missile Defense Agency				2
National Geospatial-Intelligence Agency				
National Security Agency				2
Naval Information Warfare Center Pacific				1
Naval Postgraduate School				2
Navy Sea Systems Command				1
Office of the Secretary of Defense				12
Office of Naval Research				4
United States Army		1		4
US Army Combat Capabilities Development Command C5ISR				1
US Army Engineer Research and Development Center				1
US Army Tactical Protection System				
United States Navy				
US Africa Command		1		1
US Pacific Command				1
US Strategic Command		1		
US Transportation Command		1		3
OTHER FEDERAL AGENCIES				
Department of Energy				
National Nuclear Security Administration		1		3
Department of Homeland Security		2		2
Department of Veterans Affairs				
Environmental Protection Agency		3		1
Federal Emergency Management Agency				
National Aeronautics and Space Administration				
NON-FEDERAL ORGANIZATIONS				
Ball Aerospace				1
Creare				5
Draper Laboratory		1		
Lidomika, LLC				
Lockheed Martin				1
Lockheed Martin Missiles and Fire Control		5		
NextGen				4
Spectral Energies				1
The Boeing Company				
The Ohio State University				1
University of New Hampshire				1
TOTALS	**1**	**148**	**0**	**256**

3.3. EXTERNAL SPONSOR FUNDING FOR THE GRADUATE SCHOOL OF ENGINEERING AND MANAGEMENT

Many of the Graduate School of Engineering and Management's theses and research projects, completed under faculty supervision, are funded in part by other Air Force, DOD and government units and agencies. Often, this funding results from collaboration between faculty and thesis sponsors and occurs when the research project can be leveraged by the purchase of equipment or services not otherwise available. Figure 3.2 summarizes the past ten fiscal years of sponsored funding. Table 3.4 and Table 3.5 along with Figure 3.3, summarize external funding for FY20.

Figure 3.2 New Award History FY10-FY20

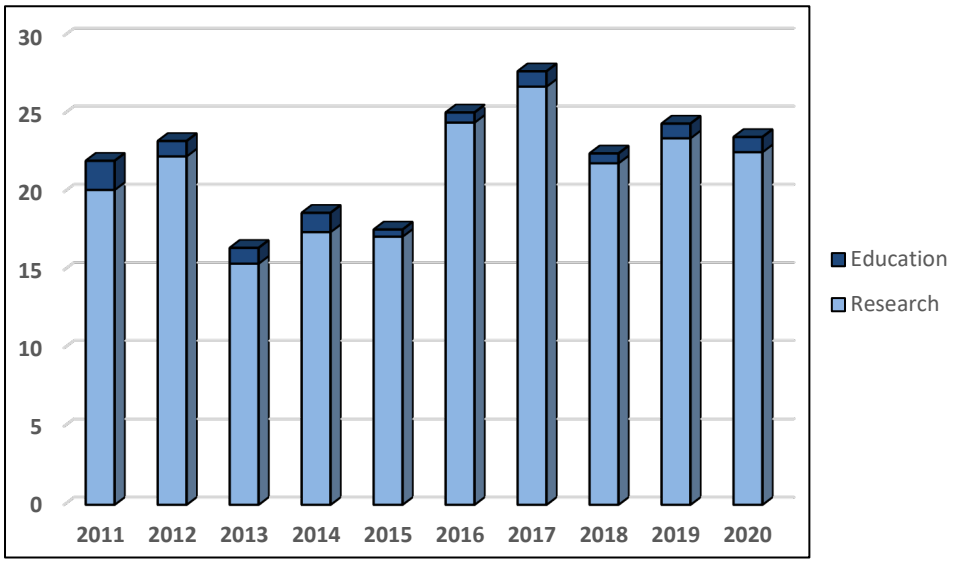
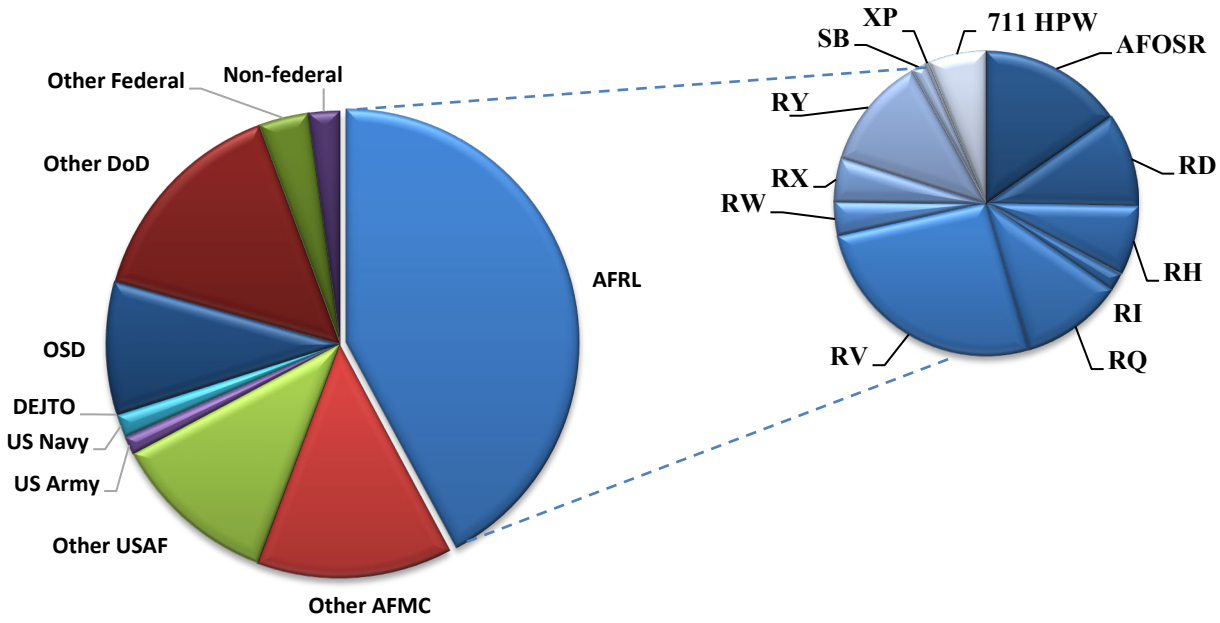


Table 3.4 FY20 External Funding & Research Expenditures for Academic Departments & Research Centers ($1,000's)

	Newly Awarded Research Projects		*Newly Awarded Education Projects*		*Total FY20 Newly Awarded Projects*		*Total FY20 Research Expenditures*
Department	#	*$k*	#	*$k*	#	*$k*	*$k*
Mathematics & Statistics (ENC)	5	213	0	0	5	213	644
Electrical & Computer Eng (ENG)	53	4,834	2	160	55	4,994	7,799
Engineering Physics (ENP)	60	5,824	2	410	62	6,234	7,299
Research & Sponsored Programs (ENR)	0	0	1	7	1	7	-
Operational Sciences (ENS)	30	6,490	4	76	34	6,566	8,760
Systems Eng & Management (ENV)	20	1,235	3	295	23	1,530	1,595
Aeronautical & Astronautical Eng (ENY)	75	3,944	1	24	76	3,968	8,380
	243	**22,540**	**13**	**972**	**256**	**23,512**	**34,477**
Center							
Autonomy and Navigation Technology (ANT)	31	3,144	3	260	34	3,404	4,530
Center for Cyberspace Research (CCR)	7	684	0	0	7	684	1,551
Center for Directed Energy (CDE)	20	2,305	1	110	21	2,415	2,993
Center for Operational Analysis (COA)	9	1,944	0	0	9	1,944	2,256
Center for Space Research and Assurance (CSRA)	37	2,581	0	0	37	2,581	4,542
Center for Tech Intel Studies & Research (CTISR)	17	2,319	0	0	17	2,319	2,935
Nuclear Expertise for Advancing Technologies (NEAT)	7	190	0	0	7	190	59
TOTAL	**128**	**13,167**	**4**	**370**	**132**	**13,537**	**18,866**

Notes: Total research expenditures reported include institutional cost sharing, which is not included in newly awarded projects. Numbers reported to the NSF research expenditure surveys vary somewhat due to differences in definitions. All Center funds are also included in departmental funding.

Figure 3.3 New FY20 Awards by Sponsor



*Pie Chart on the right shows breakdown by AFRL Technology Directorates

Table 3.5 New FY20 Awards to Academic Departments & Research Centers by Sponsor

Dept.	AFRL *$k*	AFMC (Non-AFRL) *$k*	Other USAF *$k*	Other DOD *$k*	Other Federal *$k*	Non-Federal *$k*	Total *$k*
ENC	231	-	-	-	-	-	213
ENG	3,382	250	759	455	-	148	4,994
ENP	2,315	-	2,047	941	687	244	6,234
ENR	7	-	-	-	-	-	7
ENS	1,706	2,645	96	2,119	-	-	6,566
ENV	462	113	600	229	81	45	1,530
ENY	1,284	-	2,399	245	-	40	3,968
TOTAL	**9,369**	**3,008**	**5,901**	**3,989**	**768**	**477**	**23,512**

Note: "Other DOD" in this table includes the DEJTO, OSD, NGA, NSA, US Army, and US Navy pie slices from Figure 3.3, plus funding from other DOD organizations.

Center							
ANT	2,676	-	80	455	-	193	3,404
CCR	434	250	-	-	-	-	684
CDE	1,677	-	100	603	-	35	2,415
COA	950	865	-	-	-	19	1,944
CSRA	337	-	1,247	997	-	-	2,581
CTISR	50	-	1,722	496	-	50	2,319
NEAT	-	-	190	-	-	-	190
TOTAL	**6,124**	**1,115**	**3,339**	**2,552**	**0**	**407**	**13,537**

Note: All Center funds are also included in departmental funding

4. SPONSORSHIP OF STUDENT RESEARCH

4.1. OFFICE OF THE SECRETARY OF THE AIR FORCE

Master's Theses

ESPEGIO, GIOVANNA, Data Cleaning for Air Force Applications. AFIT-ENS-MS-20-J-033. Sponsor: SAF/IEN

GILBERT, CHRISTOPHER, R., Modeling Composite Fleets Utilizing Hybrid Airships. AFIT-ENS-MS-20-J-036. Faculty Advisor: Dr. Jeffery D. Weir. Sponsor: AFWIC

MADDEN, ERIK, M., Extracting Range Data From Images Using Focus Error. AFIT-ENG-MS-20-M-037. Faculty Advisor: Dr. Stephen C. Cain. Sponsor: USAFA

MATTESON, DONOVAN, J., Comparative Analysis of Theater Tanker Planning Software. AFIT-ENS-MS-20-J-046. Faculty Advisor: Lt. Col. John M. Dickens. Sponsor: SAF/IEN

4.2. HEADQUARTERS OF THE UNITED STATES AIR FORCE

Master's Theses

GLADNEY, KYLE, MC80: Quantifying the Effect of Fleet Health on Sortie Execution in the F-16 Fleet. AFIT-ENS-MS-20-M-151. Faculty Advisor: Lt. Col. John M. Dickens. Sponsor: HAF/A4P

INGRAM, MICHEAL, D., Explaining Weapon System Sustainment's Impact to Aircraft Availability. AFIT-ENS-MS-20-M-156. Faculty Advisor: Lt. Col. John M. Dickens. Sponsor: HAF/A4P

LOHR, COLLIN, A., Analysis of the Impact of Distributed Logistics Operations on Mobility Aircraft. AFIT-ENS-MS-20-J-043. Faculty Advisor: Maj. Timothy W. Breitbach. Sponsor: AF/A5Aa

PUJATS, TREY, S., Forecasting Attrition by ASFC for the United States Air Force. AFIT-ENS-MS-20-M-166. Faculty Advisor: Dr. Raymond R. Hill Jr. Sponsor: HAF/A1PF

STANTON, MARY, A., Autonomous Rovers: Flight Line Delivery of Maintenance Tools and Parts. AFIT-ENS-MS-20-J-052. Faculty Advisor: Lt. Col. Jason R. Anderson. Sponsor: HAF/A4/A4L

STRENGTH, RYAN, N., How are the Air Force pilot retention measures working in the Mobility Air Forces? AFIT-ENS-MS-20-J-055.Faculty Advisor: Dr. Alfred E. Thal. Sponsor: HAF/ACTF

4.3. AIR EDUCATION AND TRAINING COMMAND

Master's Theses

GIDDINGS, AARON, C., Predicting Pilot Success Using Machine Learning. AFIT-ENS-MS-20-M-150. Faculty Advisor Dr. Raymond R. Hill Jr. Sponsor: AETC/DE 21

AIR FORCE INSTITUTE OF TECHNOLOGY

Master's Theses

FLACK, NATHANIEL, W., Developing a Serious Game to Explore Joint All Domain and Control. AFIT-ENG-MS-20-M-019. Sponsor: AF/CYTCOE [CCR]

4.4. AIR FORCE MATERIEL COMMAND

Master's Theses

BROWN, MARC, R., One-Dimensional Multi-Frame Blind Deconvolution Using Astronomical Data for Spatially separable Objects. AFIT-ENG-MS-20-M-008. Faculty Advisor: Maj. David J. Becker. Sponsor: AFRL/RDSMC

BURFEIND, BRANDON, C., Interoperable ADS-B Confidentiality. AFIT-ENG-MS-19-M-009. Faculty Advisor: Dr. Robert F. Mills. Sponsor: AF/A3OJ [CCR]

ECHEVERRY, NICHOLAS, C., Signal Quality Monitoring of GNSS Signals Using a Chip shape Deformation Metric. AFIT-ENG-MS-20-M-017. Faculty Advisor: Maj. Joan A. Betances. Sponsor: AFMC [CSRA]

PEELE, ERIC, S., Restructuring Mobility Maintenance Organizations: Is it Time for Change? AFIT-ENS-MS-20-J-047. Faculty Advisor: Dr. Seong-Jong Joo. Sponsor: HQ AFMC/A4/10

RUSSELL, LEE, R., A Feasibility Analysis on the Air Force Employment of Escape Supply Chain Management Program. AFIT-ENS-MS-20-J-049. Faculty Advisor: Lt. Col. John M. Dickens. Sponsor: AFMC

AIR FORCE CIVIL ENGINEERING CENTER

Master's Theses

CANFIELD, MICHAEL, E., A Life-Cycle Analysis of the Thermal Energy Transfer in Prototypical Air Force Office Building Construction using Best Value Insulation Standards. AFIT-ENV-MS-20-M-191. Faculty Advisor: Dr. Brent T. Langhals. Sponsor: AFCEC/CFTP

GUERIN, SCOTT, R., Civil Engineer Company Grade Officer Competency-Based Education Modeling. AFIT-ENV-MS-20-M-207. Faculty Advisor: Dr. Tay W. Johannes. Sponsor: AFIT/CE

HERNANDEZ, NESTOR, An analysis of a hurricane loss model, validation from Tyndall AFB, and applications for the Air Force. AFIT-ENV-MS-20-J-063. Faculty Advisor: Lt. Col. Andrew J. Hoisington. Sponsor: AFCEC

JAGODA, JENEE, A., An Analysis of the Viability of 3D-Printed Construction as an Alternative to Conventional Construction Methods in the Expeditionary Environment. AFIT-ENV-MS-20-M-217. Faculty Advisor: Maj. Steven J. Schuldt. Sponsor: AFCEC

JOHNSON, JOHN, A., Three Views for Explaining and Resolving the Recruitment and Retention Challenges of the Explosive Ordinance Disposal (EOD) Career Fields. AFIT-ENV-MS-20-M-218. Faculty Advisor: Lt. Col. Scott T. Drylie. Sponsor: AFRL/FMC

PAQUETTE, RYLEY, R., Optimization of Airfield Parking and Fuel Asset Dispersal to Maximize Survivability and Mission Capability Level. AFIT-ENV-MS-20-M-231. Faculty Advisor: Maj. Steven. J. Schuldt. Sponsor: AFLCEC

PARKS, IAN, Analyzing Cost Effectiveness of Photovoltaic Pavements. AFIT-ENV-MS-M-232. Faculty Advisor: Dr. Brent T. Langhals. Sponsor: AFLCEC

SILVERBUSH, AMY, E., An Analysis of Tinker Air Force Base Thermal Spray Hazardous Waste Stream from 2003-2019 and its Potential Reclamation. AFIT-ENV-MS-20-M-239. Faculty Advisor: Dr. Jeremy M. Slagley. Sponsor: AFCEC/CZTQ [NEAT]

TABB, DANIELLE, Analysis of Construction Management at Risk Projects for Unites States Air Force Applicability. AFIT-ENV-MS-20-M-245. Faculty Advisor: Dr. Tay W. Johannes. Sponsor: AFCEC

THOMSEN, NATHANAEL, J., Going off the Grid: Optimizing Solar Renewable Energy Systems at Remote Locations to Minimize Logistics Requirements, Increase Sustainability, and Strengthen Energy Assurance. AFIT-ENV-MS-20-M-247. Faculty Advisor: Maj. Steven J. Schuldt. Sponsor: AFCEC/CXAE

YIP, ALVIN, T., Examining Healthy Community Design Characteristics and Its Influence on Physical Health. AFIT-ENV-MS-20-M-252. Faculty Advisor: Lt. Col. Andrew J. Hoisington. Sponsor: AFCEC

AIR FORCE LIFE CYCLE MANAGEMENT CENTER

Master's Theses

DANAHER, RICHARD, S., Hybrid Tri-Objective Optimization of F-15 Fleet Modernization Scheduling. AFIT-ENS-MS-20-M-142. Faculty Advisor: Lt. Col. Bruce A. Cox. Sponsor: AFLCMC [ANT]

EDWARDS, JORDAN, S., Developing Standard Production Cost Factors for Major Defense Acquisition Program (MDAP) Platforms. AFIT-ENV-MS-20-M-197. Faculty Advisor: Dr. Jonathan D. Ritschel. Sponsor: AFLCMC/FZCE

FILER, JAMIE, E., Optimizing the Environmental and Economic Sustainability of Contingency Base Infrastructure. AFIT-ENV-MS-20-M-201. Faculty Advisor: Maj. Steven J. Schuldt. Sponsor: AFCEC/DS

LUKETIC, DANA, P., The Utility of Self-Assessment in Predicting Program Office Estimate Accuracy. AFIT-ENV-MS-20-M-225. Faculty Advisor: Lt. Col. Scott T. Drylie. Sponsor: AFLCMC/FZCE

MARSH, JUSTIN, R., The Impact of Changing the Size of Aircraft Radar Displays on Visual Attention in the Cockpit. AFIT-ENV-MS-20-M-226. Faculty Advisor: Dr. Michael E. Miller. Sponsor: AFLCMC/WWMA [ANT]

MILLER, CHRISTOPHER, W., An Investigation into Subject Matter Expert Elicitation in Cost Risk Analysis. AFIT-ENV-MS-20-M-227. Faculty Advisor: Dr. Robert D. Fass. Sponsor: AFLCMC/FZCE

MYERS, BRADFORD, A., Quantifying the Effects of Aircraft Engine Upgrades on Operating and Support Costs. AFIT-ENV-MS-20-M-229. Faculty Advisor: Dr. Edward D. White. Sponsor: AFLCMC/FZCE

STATON, BENNETT, M., Design and Analysis of a Disk-Oriented Engine Combustor. AFIT-ENY-MS-20-M-281. Faculty Advisor: Maj. Brian T. Bohan. Sponsor: AFLCMC

AIR FORCE RESEARCH LABORATORY

Master's Theses

CROW, DAVID, R., Cyber-Physical System Intrusion A Case Study of Automobile Identification Vulnerabilities and Automated Approaches for Intrusion Detections. AFIT-ENG-MS-20-M-012. Faculty Advisor: Dr. Scott R. Graham. Sponsor: AFRL

DECHERT, JOSEPH, R., Development of a Small Scale Rotating Detonation Engine. AFIT-ENY-MS-20-M-257. Faculty Advisor: Dr. Fred R. Schauer. Sponsor: AFRL

ECHEVERRY, NICHOLAS, C., Signal Quality Monitoring of GNSS Signals Using a Chip shape Deformation Metric. AFIT-ENG=MS-20-M-017. Faculty Advisor: Maj. Joan A. Betances. Sponsor: AFMC [CSRA]

GARRETSON, JOSHUA, J., Zernike Piston Statistics in Turbulent Multi-Aperture Optical Systems. AFIT-ENG-MS-20-M-023. Faculty Advisor: Dr. Stephen C. Cain. Sponsor: AFRL/RYMT

LEONARD, DAVID, G., Detection and Quantification of Bacterial Species Important to Mental and Physical Health. AFIT-ENV-MS-20-M-224. Faculty Advisor: Lt. Col. Andrew J. Hoisington. Sponsor: AFRL

LLOYD, ANDREW, H., High Value Airborne Asset Defense with Integrated Technology Battle Management of Assets. AFIT-ENS-MS-20-M-159. Faculty Advisor: Dr. Brian J. Lunday. Sponsor: SDPE

MALONEY, JOSEPH, B., Simulating a Hypersonic Intelligence Surveillance and Reconnaissance (ISR) Aircraft's Military Utility in an Anti-Access Area Denial (A2AD) Environment. AFIT-ENS-MS-20-M-161. Faculty Advisor: Dr. Lance E. Champagne. Sponsor: SDPE [COA]

MATSUI, YOUSUKE, Z., Neal Real-Time ZigBee device Discrimination Using CB-DNA Features. AFIT-ENG-MS-20-M-043. Faculty Advisor: Maj. Joan A. Betances. Sponsor: AFRL

MIRELES, LUCUS, E., Implications and Limitations of Securing an InfiniBand Network. AFIT-ENG-MS-20-M-044. Faculty Advisor: Dr. Scott R. Graham. Sponsor: AFRL

PARK, EDWARD, Y., Global Basing of Air Force Squadrons: an Adversary Deterrence Model with Solution Resiliency Analyses. AFIT-ENS-MS-20-M-165. Faculty Advisor: Dr. Brian J. Lunday. Sponsor: SDPE

PETTIT, DILLION, M., Cyber Assessments and scoring Model for small Unmanned Aerial Vehicles. AFIT-ENG-MS-20-M-055. Faculty Advisor: Dr. Scott R. Graham. Sponsor: AFRL

PLACK, ERIC, A., Improving Acquisitions in Science and Technology Programs through Factor Development and Program Analysis. AFIT-ENV-MS-20-M-234. Faculty Advisor: Dr. Jonathan D. Ritschel. Sponsor: AFRL

AFRL: 711TH HUMAN PERFORMANCE WING

Master's Theses

ALMANNAEI, LORY, Y., Design and test of an Autonomy Monitoring Service to Detect Divergent Behaviors on Unmanned Aerial Systems. AFIT-ENV-MS-20-J-059. Faculty Advisor: Dr. John M. Colombi. Sponsor: RHCCT [ANT]

GEISELMAN, ERIC, E., Evaluation of a Text-Based Information Portrayal and Access Techniques for Constrained Area Presentation: A Comparison of Human Performance. AFIT-ENV-MS-20-M-205. Faculty Advisor: Dr. Michael E. Miller. Sponsor: 711 HPW/RHCSR

OHMS, STEPHANIE, A., Development and Characterization of a Filter-Based Bio aerosol Sampler Capable of Integration into Small Unmanned Aerial Systems. AFIT-ENV-MS-20-M-230. Faculty Advisor: Dr. Jeremy M. Slagley. Sponsor: AFRL/711th/RHM

TINUCCI, KAYLA, N., Multivariate Analysis of Human Performance STRONG Lab Data. AFIT-ENS-MS-20-M-177. Faculty Advisor: Dr. Raymond R. Hill Jr. Sponsor: 711th

WALLACE, LYNN, A., Steady State Visually Evoked Potentials from Simultaneous Dynamic Stimuli. AFIT-ENV-MS-20-M-251. Faculty Advisor: Dr. Michael E. Miller. Sponsor: AFRL/711th/HCSR [ANT]

AFRL: ADVANCED STRUCTURAL CONCEPTS TEAM

ACOSTA, SHAREE, B., Flight Characteristic Verification of the Variable Camber Compliant Wing. AFIT-ENG-MS-20-M-003.Faculty Advisor: Dr. Robert C. Leishman. Sponsor: AFRL/RQVS

AFRL: AIR FORCE OFFICE OF SCIENTIFIC RESEARCH

Master's Theses

AUNG, RONALD, M., Improving Closely Spaced Dim Stellar Objects through Improved Multi-Frame Blind Deconvolution. AFIT-ENG-DS-20-S-004. Faculty Advisor: Dr. Stephen C. Cain. Sponsor: AFOSR

BARRY, KAITLYN, A Pareto Analysis of Expired Shelf-Life Material at Six Air Force Material Command Bases. AFIT-ENV-MS-20-M-186. Faculty Advisor: Dr. Jeremy M. Slagley. Sponsor: AFCEC/CZTQ

BAXTER, ADAM, L., Modulation of Lightning Occurrence by the Solar Wind. AFIT-ENP-MS-20-M-079. Faculty Advisor: Lt. Col. Anthony L. Franz. Sponsor: AFOSR/RTB [CSRA]

BEARD, ANDREW, W., Alternative Material for High-Speed Projectile Casing. AFIT-ENY-MS-20-M-255. Faculty Advisor: Dr. Anthony N. Palazotto. Sponsor: AFOSR

BISHOP, MICHAEL, W., Enhanced BRDF Modeling Using Directional Volume Scatter Terms. AFIT-ENP-MS-20-M-081. Faculty Advisor: Lt. Col. Samuel D. Butler. Sponsor: AFOSR [CDE]

BROWN, TIMOTHY, Analytical Determination of a Helicopter Height Velocity Diagram. AFIT-ENY-MS-20-S-084. Faculty Advisor: Dr. Donald L. Kunz. Sponsor: NAVAIR

DECHERT, JOSEPH, R., Development of a Small Scale Rotating Detonation Engine. AFIT-ENY-MS-20-M-257. Faculty Advisor: Dr. Fred R. Schauer. Sponsor: AFRL

GALLAHER, JOSHUA, P., Gallaher, Joshua, P., Automated Detection and Mitigation of Inefficient Visual Searching Using Electroencephalography and Machine Learning. AFIT-ENG-MS-20-M-022. Faculty Advisor: Dr. Brett J. Borghetti. Sponsor: AFOSR [CCR]

GALE, NATHAN, J., Neutron Displacement Damage in Germanium-Tin Photodiodes. AFIT-ENP-MS-20-M-096. Faculty Advisor: Dr. John W. McClory. Sponsor: AFOSR/RTA [NEAT]

SCHNEIDER, MICHAEL, F., Operationalized Intent for Improving Coordination in Human-Agent Teams. AFIT-ENV-DS-20-S-074. Faculty Advisor: Dr. Michael E. Miller. Sponsor: AFOSR [ANT]

WHITNEY, TAYLOR, R., Detection of Reconnection Signatures in Solar Flares. AFIT-ENP-MS-20-M-121. Faculty Advisor: Dr. Robert D. Loper. Sponsor: AFOSR/RT [CSRA]

WILLIAMS, JEREMIAH, C., Dynamic Micromechanical Fabry-Perot Cavity Sensors Fabricated by Multiphoton Absorption onto Optical Fiber Tips. AFIT-ENG-MS-20-M-074. Faculty Advisor: Dr. Hengky Chandrahalim. Sponsor: AFOSR

WOLFGANG, RACHEL L., Comparison of the Accuracy of Rayleigh-Rice Polarization Factors to Improve Micro facet BRDF Models. AFIT-ENP-MS-20-M-123. Faculty Advisor: Lt. Col. Samuel D. Butler. Sponsor: AFOSR [CDE]

AFRL: AIRMAN SYSTEMS DIRECTORATE

Master's Theses

LEMMER, GEORGE, P., Survey of Airflow around a Heated Manikin as a Simulated Aeromedical Evaluation Patient on a Litter with Computational Fluid Dynamics Models. AFIT-ENV-MS-20-S-070. Faculty Advisor: Dr. Jeremy M. Slagley. Sponsor: AFRL/RHBAF

TITUS, EMILY, M., Development of a Semi-Quantitative Methodology for Evaluation of Chemical, Biological, Radiological and Nuclear (CBRN) Decontamination Using an Ultraviolet Fluorescent Aerosol. AFIT-ENV-MS-20-S-081. Faculty Advisor: Dr. Jeremy M. Slagley. Sponsor: AFRL/RHBAF [NEAT]

AFRL: AEROSPACE SYSTEMS DIRECTORATE

Master's Theses

BAUER, AARON, P., Design, Development and Testing of a Low Cost, Additively-Manufactured Centrifugal Compressor. AFIT-ENY-MS-20-M-254. Faculty Advisor: Dr. Fred R. Schauer. Sponsor: AFRL/RQTC

BOARDMAN, BRIAN A, Modeling Nonlinear Heat Transfer for a Pin-on-disc Sliding System. AFIT-ENC-MS-20-M-001. Faculty Advisor: Dr. William P. Baker. Sponsor: AFRL/RQQ

BROWER, AARON, B., Unstart Margin for a Supersonic Isolator when Coupled with a Rotating Detonation Engine. AFIT-ENY-MS-20-J-074. Faculty Advisor: Maj. Levi M. Thomas. Sponsor: AFRL/RQTC

DEMORET, ANNA, C., The Effect of Passive and Active Boundary-Layer Fences on Delta Wing Performance at Low Reynolds Number. AFIT-ENY-MS-20-M-258. Faculty Advisor: Lt. Col Michael M. Walker. Sponsor: JASPO

DEPAOLA, RICHARD, A., Microturbine Turbojets: Experimental Evaluations of Commercially Available Engines. AFIT-ENY-MS-20-M-259. Faculty Advisor: Dr. Fred R. Schauer. Sponsor: AFRL/RQTC

ENGEBRETSEN, COLIN, C., Laser Shock Peening Pressure Impulse Determination via Empirical Data-Matching with Optimization Software. AFIT-ENY-DS-20-M-260. Faculty Advisor: Dr. Anthony N. Palazotto. Sponsor: AFRL/RQ

LLOYD, ANDREW, H., High Value Airborne Asset Defense with Integrated Technology Battle Management of Assets. AFIT-ENS-MS-20-M-159. Faculty Advisor: Dr. Brian J. Lunday. Sponsor: SDPE

MATISSEK, KYLE, J., A Near-Real-Time Near-Optimal Shortest Path Solution for an Unmanned Aerial System (UAS) in a High Constrained Environment. AFIT-ENY-MS-20-M-271. Faculty Advisor: Dr. Richard G Cobb. Sponsor: AFRL/RQQA [ANT] [CDE] [CSRA]

MURALEETHARAN, KAVI, Detonation Confinement in a Radial Rotating Detonation Engine. AFIT-ENY-MS-20-M-273. Faculty Advisor: Dr. Marc D. Polanka. Sponsor: AFRL/RQTC

MACIAS, RICHARD, A., Effects of High Freestream Turbulence on Film Cooling Effectiveness of Shaped Holes. AFIT-ENY-MS-20-M-270. Faculty Advisor: Dr. Marc D. Polanka. Sponsor: AFRL/RQTT

NEWELL, DAVID, J., Solution Anneal Heat Treatment to Enhance Mechanical Performance of Additively Manufactured IN718. AFIT-ENY-DS-20-M-274. Faculty Advisor: Dr. Anthony N. Palazotto. Sponsor: AFRL/RQ

ODDO, RYAN, A., High-Speed Schlieren Imaging of Second-Mode Disturbances in a Super-Cooled Hypersonic Boundary Layer. AFIT-ENY-MS-20-M-275. Faculty Advisor: Dr. Mark F. Reeder. Sponsor: AFRL/RQHF (AFOSR)

PARK, EDWARD, Y., Global Basing of Air Force Squadrons: an Adversary Deterrence Model with Solution Resiliency Analyses. AFIT-ENS-MS-20-M-165. Faculty Advisor: Dr. Brian J. Lunday. Sponsor: SDPE

PIERCE, BRANDON, A., CN and C2 Spectroscopy on the Pulsed Ablation of Graphite in the Visible Spectrum. AFIT-ENP-MS-20-M-111. Faculty Advisor: Dr. Kevin C. Gross. Sponsor: AFRL/RQ

POWELL, AMBER, S., Effect of Ink Composition on the Physical Characteristics and Performance of Aerosol Jet Printed Lithium Cobalt Oxide Cathodes. AFIT-ENP-MS-20-M-114. Faculty Advisor: Maj. Nicholas C. Herr. Sponsor: AFRL/RQ

ROBERTS, CANDICE, R., Modeling Hybrid Composites Using Tsai-Wu and Hashing Failure Criterion. AFIT-ENY-MS-20-M-278. Faculty Advisor: Dr. Anthony N. Palazotto. Sponsor: AFRL/RQVS

SARANTSEV, KIRILL, A., Maximizing Accuracy through Stereo Vision Camera Positioning for Automated Aerial Refueling. AFIT-ENG-MS-20-M-059. Faculty Advisor: Dr. Clark. N. Taylor. Sponsor: AFRL [ANT]

WARREN, JOSHUA, R., Modeling of Wall Effects and Flow Control Devices for Store Separation in the AFIT SVDB Wind Tunnel. AFIT-ENY-MS-20-M-285. Faculty Advisor: Dr. Mark F. Reeder. Sponsor: AFRL/RQVI

AFRL: ELECTRO-OPTICAL DIVISION

Master's Theses

BROWN, MARC, R., One-Dimensional Multi-Frame Blind Deconvolution Using Astronomical Data for Spatially separable Objects. AFIT-ENG-MS-20-M-008. Faculty Advisor: Maj. David J. Becker. Sponsor: AFRL/RDSMC

BUCKMAN, MILES, D., Development and Application of a Theory for Predicting the Detection of Closely Spaced Objects. AFIT-ENV-MS-20-J-080. Faculty Advisor: Lt. Col. Torrey J. Wagner. Sponsor: AFRLRDSS [CDE]

AFRL: INFORMATION DIRECTORATE

Master's Theses

GUERRERO, NICHOLAS, J., Solving Combinatorial Optimization Problems Using the Quantum Approximation Optimization Algorithm. AFIT-ENP-MS-20-M-098. Faculty Advisor: Dr. David E. Weeks. Sponsor: AFRL/RI [CDE]

WAYNE, HENRY, C., Analytic Provenance for Software Reverse Engineers. AFIT-ENG-DS-20-S-010. Faculty Advisor: Dr. Gilbert L. Peterson. Sponsor: AFRL/RI

AFRL: MATERIALS AND MANUFACTURING DIRECTORATE

Master's Theses

ZUCKER, ADAM, B., Detection of Damage on Charge Coupled Device by Optical Cross Section Analysis. AFIT-ENP-MS-20-M-125. Faculty Advisor: Dr. Michael A. Marciniak. Sponsor: AFRL/RX [CDE]

AFRL: MULTISPECTRAL SENSING & DETECTION DIVISION

Master's Theses

BARTELT, BRYAN, Global Gradient Based Phase Unwrapping Algorithm for Increased Performance in Wave front Sensing. AFIT-ENG-MS-20-M-006. Faculty Advisor: Dr. Stephen C. Cain. Sponsor: AFRL/RYMT

AFRL: MUNITIONS DIRECTORATE

Master's Theses

BATE, TIMOTHY, J., The Design of a Continuous Wave Molecular Nitrogen Stimulated Raman Laser in the Visible Spectrum. AFIT-ENP-MS-20-M-078. Faculty Advisor: Dr. Christopher A. Rice. Sponsor: AFRL/RW

AFRL: SENSORS DIRECTORATE

Master's Theses

COLSON, BLAKE, M., effects of Long Term Evolution Waveform on Synthetic Aperture Radar Image Quality Metrics. AFIT-ENG-MS-20-M-011. Sponsor: AFRL/RYMD

KEMPF, JERROD, M., Mismatched Filters Effects on Synthetic Aperture Radar Image Quality Metrics. AFIT-ENG-MS-20-M-030. Faculty Advisor: Dr. Julie A. Jackson. Sponsor: AFRL/RYMD

O'GORMA, NICHOLAS A., Focus Beam System Biaxial Material Characterization. AFIT-ENG-MS-20-M-050. Faculty Advisor: Dr. Michael J. Havrilla. Sponsor: AFRL/RYS

AFRL: SPACE VEHICLES DIRECTORATE

Master's Theses

BURG, KEVIN, S., Validation Technique for Modeled Bottom side Ionosphere via Ray Tracing. AFIT-ENP-MS-20-M-085. Faculty Advisor: Maj. Daniel J. Emmons. Sponsor: AFRL/RV [CSRA]

CAMPBELL, BRITTANY, D., Evaluation of Multifunctional Composites Designed for Directed Energy and Ionizing Radiation Threats. AFIT-ENP-MS-20-M-087. Faculty advisor: Dr. John W. McClory. Sponsor: AFRL/RV

CROWL, MICHAEL, R., Use of LIDAR in Automated Aerial Refueling to Improve Stereo Vision Systems. AFIT-ENG-MS-20-M-013. Faculty Advisor: Dr. Scott L. Nykl. Sponsor: AFRL/RQQC [ANT]

FRENCH, BRADELY, S., Determining Virtual Practicality from Physical Stereo Vision Images and GPS. AFIT-ENG-MS-20-M-020. Faculty Advisor: Dr. Scott L. Nykl. Sponsor: AFRL/RQQC [ANT]

KLEIN, ADAM, W., Characterizing Over-the-Horizon Radar Noise Directionality Using a High-Resolution Lightning Detection Network. AFIT-ENP-MS-20-M-105. Faculty Advisor: Maj. Omar A. Nava. Sponsor: AFRL/RV [CSRA]

LEE, ANDREW, T., Objects Detection with Deep Learning to Accelerate Pose Estimations for Automated Aerial Refueling. AFIT-ENG-MS-20-M-035. Faculty Advisor: Dr. Scott L. Nykl. Sponsor: AFRL/RQQC [ANT]

LINVILLE, DAX, A., Linear Regression Models Applied to Imperfect Information Spacecraft Pursuit-Evasion Differential Games. AFIT-ENY-MS-20-M-269. Faculty Advisor: Maj. Joshuah A. Hess. Sponsor: AFRL/RV [CSRA]

SHOCKLEY, LIBERTY, M., Spacecraft Position and Attitude Estimation Using Terrestrial Illumination Matching. AFIT-ENY-MS-20-M-280. Faculty Advisor: Maj. Robert A. Bettinger. Sponsor: AFRL/RV [CSRA]

STAMBOVSKY, DANIEL, W., Simulation of Sporadic-E Parameters Using Phase Screen Method. AFIT-ENP-MS-20-M-117. Faculty Advisor: Maj. Daniel J. Emmons. Sponsor: AFRL/RV [CSRA]

WIGHTMAN, JESSICA, Space-Based Localization of Radio Frequency Transmitters Utilizing Macaulay Resultant and Heuristic Optimization Methods. AFIT-ENY-MS-20-M-286. Faculty Advisor: Maj. Joshuah A. Hess.

AFRL: AVIONICS VULNERABILITY MITIGATION BRANCH

Master's Theses

MAGNESS, JAKE, M., Silver: Simulation-Based Logic Bomb Identification/Verification for Unmanned Vehicles. AFIT-ENG-MS-20-M-039. Faculty Advisor: Lt. Col. Patrick J. Sweeney. Sponsor: AFRL/RYWA

AIR FORCE SUSTAINMENT CENTER

Master's Theses

O'NEAL, THOMAS, R., Sortie-based Aircraft Component Demand Rate to Predict Requirements. AFIT-ENS-MS-20-M-164. Faculty Advisor: Lt. Col. John M. Dickens. Sponsor: AFSC

4.5. AIR MOBILITY COMMAND

Master's Theses

CALLAHAN, DANA, K., Commercial Augmentation and the Need for Demand Forecasting. AFIT-ENS-MS-20-J-027. Faculty Advisor: Col. Adam D. Reiman. Sponsor: USAF AMC/A9

COPE, FRANK, T., A Quantitative Analysis of USAF C-17 Pilot Computer Based Continuation Training. AFIT ENS-M-030. Faculty Advisor: Dr. William Cunningham III. Sponsor: 97 AMW/CV

HARVEY, TRAVIS, C., Increasing Airlift Availability through Optimization of Presidential Support Missions. AFIT-ENS-MS-20-J-038. Faculty Advisor: Dr. Darryl K. Ahner. Sponsor: AMC/A9 [COA]

SLOTTJE, JONATHAN, J., C-130J Flight Pilot Development: An Empirical Mixed Method Analysis on Aircraft Commander Upgrade.AFIT-ENS-MS-20-051. Faculty Advisor: Lt. Col. Jason Anderson. Sponsor: HQ AMC/A3/10

KOSER, KORT, A., Wireless Technology for the Flight Line of the Future: A Multi-Criteria Decision Making and Utility Theory Analysis. AFIT-ENS-MS-20-J-042. Faculty Advisor: Lt. Col. Jason R. Anderson. Sponsor: AMC/A6 CTO

4.6. AIR FORCE SPACE COMMAND

45th WEATHER SQUADRON

Master's Theses

CHENG. ANSON, Lightning Prediction for Space Launch using Machine Learning Based Off of Electric Field Mills and Lightning Detection and Ranging Data. AFIT-ENS-MS-20-M-138. Faculty Advisor: Lt. Col. Andrew J. Geyer. Sponsor: 45thWS

LEE, STEPHEN, M., Ground Weather RADAR Signal Characterization through Application of Convolutional Neural Networks. AFIT-ENS-MS-20-M-158. Faculty Advisor: Dr. Lance E. Champagne. Sponsor: 45 WS/SYR

SKROVAN, CHARLES, A., 45 WS Electric Field Mill Lightning Prediction Threshold Analysis. AFIT-ENS-MS-20-M-171. Faculty Advisor: Lt. Col. Andrew J. Geyer. Sponsor: 45 WS/WXT

SPACE AND MISSILE SYSTEMS CENTER

Master's Theses

HOLMES, MATHEW, L., Pathways for Space-Based Technology Maturation. AFIT-ENV-MS-20-M-214. Faculty Advisor: Lt. Col. Amy M. Cox. Sponsor: SMC

4.7. AIR FORCE SPECIAL OPERATIONS COMMAND

Master's Theses

FORREST, NICHOLAS, C., Conceptualization and Application of Deep Learning and Applied Statistics for Flight Plan Recommendation. AFIT-ENS-MS-20-M-147. Faculty Advisor: Dr. Raymond R. Hill Jr. Sponsor: AFWERX

4.8. USAF FIELD OPERATING AGENCIES/DIRECT REPORTING UNITS

AIR FORCE TECHNICAL APPLICATIONS CENTER

Master's Theses

BURKHARDT, AARON, W., An Assessment of the Spatial Variation of Isotopic Ratios in a CANDU-6 Reactor for Nuclear Treaty Monitoring. AFIT-ENP-MS-20-M-086. Faculty Advisor: Maj. James E. Bevins. Sponsor: AFTAC [NEAT]

CHAPMAN, RYAN, K., Measurement of the 160GD (p, n) 160 Tb Excitation Function From 4-18 MeV Using a Stacked Foil Technique. AFIT-ENP-MS-20-M-088. Faculty Advisor: Maj. James W. Bevins. Sponsor: AFTAC [NEAT]

DICKEY, JOSHUA, T., Neural Network Models for Nuclear Treaty Monitoring: Enhancing the Seismic Signal Pipeline with Deep Temporal Convolution. AFIT-ENG-DS-20-J-004. Faculty Advisor: Dr. Brett J. Borghetti. Sponsor: AFTAC [CCR]

FIORETTI, JOHN, L., Characterizing Regime-Based Flow Uncertainty. AFIT-ENP-MS-20-M-093. Faculty Advisor: Lt. Col. Edward L. Hobbs. Sponsor: AFTACM

MYERS, LOREN, E., Verifying and Improving a Flight reference System's Performance. AFIT-ENG-MS-20-M-046. Faculty Advisor: Maj. Aaron J. Canciani. Sponsor: TS

RAO, ASHWIN, P., Rapid Analysis of Plutonium Surrogate Material via Hand-held Laser-induced Breakdown Spectroscopy. AFIT-ENP-MS-20-M-115. Faculty Advisor: Lt. Col. Michael B. Shattan. Sponsor: AFTAC; DTRA; DHS; LANL [NEAT]

WOOD, JASON, C., Determination of Lithium Isotope Concentration by Laser Induced Breakdown Spectroscopy Using Chemo metrics. AFIT-ENP-MS-20-M-124. Faculty Advisor: Lt. Col. Michael B. Shattan. Sponsor: AFTAC; AFOSR [NEAT]

NATIONAL AIR AND SPACE INTELLIGENCE CENTER

Doctoral Dissertations

WESTING, NICHOLAS, M., Physics-Constrained Hyperspectral Data Exploitation across Diverse Atmospheric Scenarios. AFIT-ENG-DS-20-S-021. Faculty Advisor: Dr. Richard K. Martin. Sponsor: NASIC/GSP

Master's Theses

REAGANS, MILES, E., Parametric Investigation of a Two-Dimensional Planar Scramjet Compression System. AFIT-ENY-MS-20-J-079. Faculty Advisor: Lt. Col Jeffery R. Komives. Sponsor: NASIC/CAN [CSRA]

PICKERING, ELIZABETH, Characterizing Full-Scale Scramjet Vehicle Performance Using RANS and Propulsion Cycle Code Analysis. AFIT-ENY-MS-20-M-277. Faculty Advisor: Lt. Col Jeffery R. Komives. Sponsor: NASIC/ACN, DARPA [CSRA]

4.9. DEPARTMENT OF DEFENSE

Master's Theses

FEKETE, ROBEEAL, J., A Qualitative Assessment of Air Force Logisticians' Knowledge of Advanced Manufacturing Techniques. AFIT-ENS-MS-20-J-035. Faculty Advisor: Lt. Col. John M. Dickens. Sponsor: DLA Aviation/CC

AIR FORCE MEDICAL READINESS AGENCY

Master's Theses

BRUBAKKEN, ADAM, J., Strategic Sourcing of Air Force Contingency Pharmaceuticals: A Cost-Benefit Analysis Approach. AFIT-ENS-MS-20-M-134. Faculty Advisor: Lt. Col. John M. Dickens. Sponsor: AFMRA/SG4M

DEFENSE ADVANCED RESEARCH PROJECTS AGENCY

Master's Theses

KANIPE, MICHELLE, K., Middle Atmosphere Response to Two Surface Teleconnections Using the Whole Atmosphere Community Climate Model-Extended. AFIT-ENP-MS-20-M-103. Faculty Advisor: Lt. Col. Rose H. Tseng. Sponsor: DARPA

URBANCIC, BRIAN, R., Relating Polar Climate Oscillations to Stratospheric and Mesospheric Conditions. AFIT-ENP-MS-20-M-118. Faculty Advisor: Lt. Col. Rose H. Tseng. Sponsor: DARPA

DEFENSE INTELLIGENCE AGENCY

Master's Theses

NICHOLS, TAYLOR, M., Determination and Simulation of the Neutron Spectrum of Nuclear Detonations and Surrogate Sources. AFIT-ENP-MS-20-M-109. Faculty Advisor: Dr. John W. McClory. Sponsor: DTRA/RD [NEAT]

OLESEN, ROBERT, J., Low-Information Radiation Imaging using Rotating Scatter Mask Systems and Neural Network Algorithms. AFIT-ENP-DS-20-S-028. Faculty Advisor: Maj. James E. Bevins. Sponsor: DTRA [NEAT]

FREEMAN, TRENTON, L., Effects of Water Entrainment on Shock Propagation from a Nuclear Detonation. AFIT-ENP-MS-20-M-091. Faculty Advisor: Lt. Col. Michael L. Dexter. Sponsor: DTRA [NEAT]

DIRECTED ENERGY JOINT TECHNOLOGY OFFICE

Master's Theses

BOECKENSTEDT, ALEXANDER, S., Validation of HTS Optical Turbulence Profiling via Sonic Anemometry. AFIT-ENP-MS-20-M-082. Faculty Advisor: Dr. Jack E. McCrae Jr. Sponsor: DEJTO [CDE]

GROSSNICKLE, JULIE, Determining Bulk Aerosol Absorption from Off-Axis Backscattering using Rayleigh Beacon Laster Pulses. AFIT-ENP-MS-20-M-097. Faculty Advisor: Dr. Steven T. Fiorino. Sponsor: DEJTO [CDE]

JAGODA, DANIEL, B., A Method for Routine PM2.5 Observation and Incorporation into Numerical Weather Prediction. AFIT-MS-20-M-102. Faculty Advisor: Dr. Steven T. Fiorino. Sponsor: DEJTO [CDE]

JOINT CHIEFS OF STAFF: LOGISTICS DIRECTORATE

Master's Theses

BORSZICH, AARON, A., Effects of KC-10 Divestment on Daily Competition. AFIT-ENS-MS-20-J-026. Faculty Advisor: Dr. Jeffery Weir. Sponsor: JCS/J4

NAVAL AIR WARFARE CENTER AIRCRAFT DIVISION

Master's Theses

BROWN, TIMOTHY, Analytical Determination of a Helicopter Height Velocity Diagram. AFIT-ENY-MS-20-S-084. Faculty Advisor: Dr. Donald L. Kunz. Sponsor: NAVAIR

4.10. OFFICE OF THE SECRETARY OF DEFENSE

UNITED STATES ARMY

Master's Theses

SPANGLER, TYLER, M., Analysis and Forecasting of the 360th Air Force Recruiting Group Goal Distribution. AFIT-ENS-MS-20-M-172. Faculty Advisor: Dr. Raymond R. Hill Jr. Sponsor: 360RCG

UNITED STATES AFRICA COMMAND

Master's Theses

TAPIA, WILSON, Effects of Relocating West African Logistics Network Hub. AFIT-ENS-MS-20-M-175. Faculty Advisor: Maj. Timothy W. Breitbach. Sponsor: USAFRICOM J34

UNITED STATES STRATEGIC COMMAND

Doctoral Dissertations

COTTON, JAMES, A., Behavioral Antecedents of Fuel Efficiency. AFIT-ENS-DS-20-M-290. Faculty Advisor: Dr. Seong-Jong Joo. Sponsor: USSSTATCOM

UNITED STATES TRANSPORTATION COMMAND

Master's Theses

THOMPSON, MAXWELL, C. Database Analysis to Improve U.S. Transportation Command Forecasting Processes. AFIT-ENS-MS-20-M-176. Faculty advisor: Dr. Brain J. Lunday. Sponsor: USTRANSCOM, JDPAC

4.11. OTHER FEDERAL AGENCIES

DEFENSE INNOVATION UNIT

Master's Theses

SCHOEMAKER, MATTHEW, R., An Analysis of the Factors That Correlate with Transition Outcomes of Commercial Technology Prototype Projects. AFIT-ENV-MS-20-S-093. Faculty Advisor: Lt. Col. Amy M. Cox. Sponsor: DIU

DEPARTMENT OF HOMELAND SECURITY

Master's Theses

PARK, YOUNGJUN, Development and Evaluation of a Security Agent for Internet of Thing. AFIT-ENG-MS-20-M-053. Faculty Advisor: Dr. Barry E. Mullins. Sponsor: DHS [CCR]

MADISON, ZACHARY, D., Honey Hive A Network Intrusion Detection System Framework Utilizing Distributed Internet of Things Honeypot Sensors. AFIT-ENG-MS-20-M-038. Faculty Advisor: Dr. Barry E. Mullins. Sponsor: DHS [CCR]

ENVIRONMENTAL PROTECTION AGENCY

Master's Theses

CARR, KATHERINE, A., Development of Work Breakdown Structure (WBS) Cost Models for the Techno-Economic Analysis of PFAS Contaminant Removal. AFIT-ENV-MS-20-M-192. Faculty Advisor: Lt. Col. John E. Stubbs. Sponsor: USEPA

HOLLIDAY, MATTHEW, D., Comparison of the PFAS Adsorption Capabilities of a Coconut Shell Based Granular Activated Carbon and a Bituminous Coal Based Granular Activated Carbon. AFIT-ENV-MS-20-M-213. Faculty Advisor: Lt. Col. John E. Stubbs. Sponsor: USEPA

OWENS, ANDREW, J., The Effect of Aeration Rate and Free-Floating Carrier Media on the Emission of Bacillus globigii in Bioaerosols. AFIT-ENP-MS-20-M-110. Faculty Advisor: Dr. Larry W. Burggraf. Sponsor: EPA

JOINT AIRCRAFT SURVIVABILITY PROGRAM

Master's Theses

DEMORET, ANNA, C., The Effect of Passive and Active Boundary-Layer Fences on Delta Wing Performance at Low Reynolds Number. AFIT-ENY-MS-20-M-258. Faculty Advisor: Lt. Col Michael M. Walker. Sponsor: JASPO

QUANTICO

Master's Theses

COOLS, JACOB, G., Marine Corps Base Quantico Solid Waste Characterization. AFIT-ENV-MS-20-M-194. Faculty Advisor: Dr. Jeremy M. Slagley. Sponsor: NREA, ISWM, QRP

NASA GLENN RESEARCH CENTER

Doctoral Theses

LITCHER, MICHAEL, J., Star Tracker Accuracy Improvement and Optimization for Attitude Measurement in Three-Axis. AFIT-ENG-DS-20-S-012. Faculty Advisor: Dr. Stephen C. Cain. Sponsor: NASA/GRC

NATIONAL NUCLEAR SECURITY ADMINISTRATION

Master's Theses

HORAN, LANSING, S., Neutron Energy Effects on Asteroid Deflection. AFIT-ENP-MS-20-M-101. Faculty Advisor: Dr. Darren E. Holland. Sponsor: NNSA [NEAT]

NATIONAL RADAR CROSS SECTION TEST FACILITY

Master's Theses

LEPLEY, THOMAS, A., Metasurface Antenna for Wideband Applications. AFIT-ENG-MS-20-M-036. Faculty Advisor: Dr. Peter J. Collins. Sponsor: NRTF [CCR]

4.12. INTERNATIONAL ORGANIZATIONS

BRAZILIAN AIR FORCE INSTITUTE OF LOGISTICS

Master's Theses

CHEROBINI, DANIEL, Inherent Jeopardy of Performance Based Contracting Metrics: A Simulation Experiment. AFIT-ENS-MG-20-M-139. Faculty Advisor: Dr. Seong-Jong Joo. Sponsor: ILA

4.13. NON-FEDERAL SPONSORS

DRAPER

Master's Theses

CARROLL, JASOAEROSPACEN, D., Aerial Laser Based Terrain Navigation a Limited Demonstration of the Airborne Laser Perception System. AFIT-ENG-MS-20-M-010. Faculty Advisor: Dr. John F. Raquet. Sponsor: Draper

ROCKY MOUNTAIN MENTAL ILLNESS RESEARCH EDUCATION AND CLINICAL CENTER

Master's Theses

KOHL, NATHANAEL, T., The Influence of Light in the Built Environment to Improve Mental Health Outcomes. AFIT-ENV-MS-20-M-222. Faculty Advisor: Lt. Col. Andrew J. Hoisington. Sponsor: MIRECC

LOCKHEED MARTIN MISSILES AND FIRE CONTROL

Master's Theses

BURNS, RYAN, D., Simulation and Analysis of High Value Airborne Asset Defense Effectiveness with Kinetic Weapons and Noise Jamming. AFIT-ENS-MS-20-M-135. Faculty Advisor: Dr. John O. Miller. Sponsor: SDPE LM MFC [ANT]

CIARAVINO, MARK, A., Simulation and Analysis of Cyber Operations for A2AD using AFSIM. AFIT-ENS-MS-20-M-140. Faculty Advisor: Dr. John O. Miller. Sponsor: SDPE LM MFC [ANT]

FRANCOIS, JOHN, K., Simulation of High Value Airborne Asset Defense with AFSIM. AFIT=ENS-MS-20-M-148. Faculty Advisor: Dr. John O. Miller. Sponsor: SDPE LM MFC [ANT]

LANGLAND, ANDREW, L., Resource and Capability Allocation Insights for A2/AD. AFIT-ENS-MS-20-M-157. Faculty Advisor: Dr. John O. Miller. Sponsor: SDPE LM MFC [ANT]

ROBERTSON, AUSTIN, P., Computational Evaluation of Jet Interaction for Thrust Vectoring Vanes and Control Surface Fins for a Missile. AFIT-ENY-MS-20-M-279. Faculty Advisor: Dr. Mark F. Reeder. Sponsor: Lockheed Martin MFC

SPIEGEL, CONOR, S., Simulation and Analysis of Cruise Missile Autonomous Behaviors. AFIT-ENS-MS-20-M-173. Faculty Advisor: Dr. John O. Miller. Sponsor: SDPE LM MFC [ANT]

UNIVERSITY OF MARYLAND MEDICAL CENTER

Master's Theses

DEITSCHEL, JAMES, L., Preferred Treatment Methods for Patients with Inflammatory Bowel Disease. AFIT-ENS-MS-20-M-143. Faculty Advisor: Lt. Col. Andrew J. Geyer. Sponsor: UMMC

5. ACADEMIC DEPARTMENT PUBLICATIONS AND FUNDING INFORMATION

5.1. DEPARTMENT OF AERONAUTICS AND ASTRONAUTICS

Access Phone: (937) 255-3069, DSN 785-3069
Fax: (937) 656-7053, DSN 986-7053
Homepage: https://www.afit.edu/ENY/

5.1.1. DOCTORAL DISSERTATIONS

ENGEBRETSEN, COLIN, C., Laser Shock Peening Pressure Impulse Determination via Empirical Data-Matching with Optimization Software. AFIT-ENY-DS-20-M-260. Faculty Advisor: Dr. Anthony N. Palazotto. Sponsor: AFRL/RQ.

NEWELL, DAVID, J., Solution Anneal Heat Treatment to Enhance Mechanical Performance of Additively Manufactured IN718. AFIT-ENY-DS-20-M-274. Faculty Advisor: Dr. Anthony N. Palazotto. Sponsor: AFRL/RQ.

5.1.2. MASTER'S THESES

BAUER, AARON, P., Design, Development and Testing of a Low Cost, Additively-Manufactured Centrifugal Compressor. AFIT-ENY-MS-20-M-254. Faculty Advisor: Dr. Fred R. Schauer. Sponsor: AFRL/RQTC.

BEARD, ANDREW, W., Alternative Material For High-Speed Projectile Casing. AFIT-ENY-MS-20-M-255. Faculty Advisor: Dr. Anthony N. Palazotto. Sponsor: AFOSR.

BECKER, JUSTIN, A., Autonomous Constrained Spacecraft Inspection via Model Predictive Control. AFIT-ENY-MS-20-J-073. Faculty Advisor: Maj. Costantinos Zagaris. Sponsor: N/A.

BROWER, AARON, B., Unstart Margin for a Supersonic Isolator when Coupled with a Rotating Detonation Engine. AFIT-ENY-MS-20-J-074. Faculty Advisor: Maj. Levi M. Thomas. Sponsor: AFRL/RQTC.

BROWN, TIMOTHY, Analytical Determination of a Helicopter Height Velocity Diagram. AFIT-ENY-MS-20-S-084. Faculty Advisor: Dr. Donald L. Kunz. Sponsor: NAVAIR.

DECHERT, JOSEPH, R., Development of a Small Scale Rotating Detonation Engine. AFIT-ENY-MS-20-M-257. Faculty Advisor: Dr. Fred R. Schauer. Sponsor: AFRL.

DEMORET, ANNA, C., The Effect of Passive and Active Boundary-Layer Fences on Delta Wing Performance at Low Reynolds Number. AFIT-ENY-MS-20-M-258. Faculty Advisor: Lt. Col Michael M. Walker. Sponsor: JASPO.

DEPAOLA, RICHARD, A., Microturbine Turbojets: Experimental Evaluations of Commercially Available Engines. AFIT-ENY-MS-20-M-259. Faculty Advisor: Dr. Fred R. Schauer. Sponsor: AFRL/RQTC.

BECKER, JUSTIN, A., Autonomous Constrained Spacecraft Inspection via Model Predictive Control. AFIT-ENY-MS-20-J-073. Faculty Advisor: Maj. Costantinos Zagaris. Sponsor: N/A.

BROWER, AARON, B., Unstart Margin for a Supersonic Isolator when Coupled with a Rotating Detonation Engine. AFIT-ENY-MS-20-J-074. Faculty Advisor: Maj. Levi M. Thomas. Sponsor: AFRL/RQTC.

BROWN, TIMOTHY, Analytical Determination of a Helicopter Height Velocity Diagram. AFIT-ENY-MS-20-S-084. Faculty Advisor: Dr. Donald L. Kunz. Sponsor: NAVAIR.

DECHERT, JOSEPH, R., Development of a Small Scale Rotating Detonation Engine. AFIT-ENY-MS-20-M-257. Faculty Advisor: Dr. Fred R. Schauer. Sponsor: AFRL.

DEMORET, ANNA, C., The Effect of Passive and Active Boundary-Layer Fences on Delta Wing Performance at Low Reynolds Number. AFIT-ENY-MS-20-M-258. Faculty Advisor: Lt. Col Michael M. Walker. Sponsor: JASPO.

DEPAOLA, RICHARD, A., Microturbine Turbojets: Experimental Evaluations of Commercially Available Engines. AFIT-ENY-MS-20-M-259. Faculty Advisor: Dr. Fred R. Schauer. Sponsor: AFRL/RQTC.

LEE, COREY, J., Hypersonic Vehicle Control and Trajectory Determination Through the Application of Artificial Intelligence. AFIT-ENY-MS-20-M-268. Faculty Advisor: Lt. Col Jeffery R. Komives. Sponsor: N/A. [CSRA]

LINVILLE, DAX, A., Linear Regression Models Applied to Imperfect Information Spacecraft Pursuit-Evasion Differential Games. AFIT-ENY-MS-20-M-269. Faculty Advisor: Maj. Joshuah A. Hess. Sponsor: AFRL/RV. [CSRA]

MACIAS, RICHARD, A., Effects of High Freestream Turbulence on Film Cooling Effectiveness of Shaped Holes. AFIT-ENY-MS-20-M-270. Faculty Advisor: Dr. Marc D. Polanka. Sponsor: AFRL/RQTT.

MATISSEK, KYLE, J., A Near-Real-Time Near-Optimal Shortest Path Solution for an Unmanned Aerial System (UAS) in a High Constrained Environment. AFIT-ENY-MS-20-M-271. Faculty Advisor: Dr. Richard G Cobb. Sponsor: AFRL/RQQA. [ANT] [CDE] [CSRA]

MURALEETHARAN, KAVI, Detonation Confinement in a Radial Rotating Detonation Engine. AFIT-ENY-MS-20-M-273. Faculty Advisor: Dr. Marc D. Polanka. Sponsor: AFRL/RQTC.

ODDO, RYAN, A., High-Speed Schlieren Imaging of Second-Mode Disturbances in a Super-Cooled Hypersonic Boundary Layer. AFIT-ENY-MS-20-M-275. Faculty Advisor: Dr. Mark F. Reeder. Sponsor: AFRL/RQHF (AFOSR).

PICKERING, ELIZABETH, Characterizing Full-Scale Scramjet Vehicle Performance Using RANS and Propulsion Cycle Code Analysis. AFIT-ENY-MS-20-M-277. Faculty Advisor: Lt. Col Jeffery R. Komives. Sponsor: NASIC/ACN, DARPA. [CSRA]

REAGANS, MILES, E., Parametric Investigation of a Two-Dimensional Planar Scramjet Compression System. AFIT-ENY-MS-20-J-079. Faculty Advisor: Lt. Col Jeffery R. Komives. Sponsor: NASIC/CAN. [CSRA]

ROBERTS, CANDICE, R., Modeling Hybrid Composites Using Tsai-Wu and Hashing Failure Criterion. AFIT- ENY-MS-20-M-278. Faculty Advisor: Dr. Anthony N. Palazotto. Sponsor: AFRL/RQVS.

ROBERTSON, AUSTIN, P., Computational Evaluation of Jet Interaction for Thrust Vectoring Vanes and Control Surface Fins for a Missile. AFIT-ENY-MS-20-M-279. Faculty Advisor: Dr. Mark F. Reeder. Sponsor: Lockheed Martin MFC.

SHOCKLEY, LIBERTY, M., Spacecraft Position and Attitude Estimation Using Terrestrial Illumination Matching. AFIT-ENY-MS-20-M-280. Faculty Advisor: Maj. Robert A. Bettinger. Sponsor: AFRL/RV.[CSRA]

STATON, BENNETT, M., Design and Analysis of a Disk-Oriented Engine Combustor. AFIT-ENY-MS-20-M-281. Faculty Advisor: Maj. Brian T. Bohan. Sponsor: AFLCMC.

TAMER, YASIN, Electro-Optic Satellite Constellation Design Using Multi-Objective Genetic Algorithm. AFIT-ENY-MS-20-D-071. Faculty Advisor: Dr. Andrew S. Keys. Sponsor: N/A.

TASSOS, NICHOLAS, Colony II CubeSat Component Reutilization For a Future Experimental Platforms. AFIT-ENY-MS-20-M-282. Faculty Advisor: Dr. Richard G Cobb. Sponsor: N/A. [CDE] [CSRA]

TOUMA, JEREMY, A., Spacecraft Propulsion and Power Using a Radioisotope Heat Exchanger. AFIT-ENY-20-M-284. Faculty Advisor: Dr. Fred R. Schauer. Sponsor: N/A. [CSRA]

WARREN, JOSHUA, R., Modeling of Wall Effects and Flow Control Devices for Store Separation in the AFIT SVDB Wind Tunnel. AFIT-ENY-MS-20-M-285. Faculty Advisor: Dr. Mark F. Reeder. Sponsor: AFRL/RQVI.

WIGHTMAN, JESSICA, Space-Based Localization of Radio Frequency Transmitters Utilizing Macaulay Resultant and Heuristic Optimization Methods. AFIT-ENY-MS-20-M-286. Faculty Advisor: Maj. Joshuah A. Hess. Sponsor: AFRL/RV. [CSRA]

WILLIAMS, THADDEUS, M, Fatigue Behavior Of An Advanced Melt-Infiltrated SIC/SIC Composite With Environmental Barrier Coating at 1200°C In Air and In Steam. AFIT-ENY-MS-20-M-287. Faculty Advisor: Dr. Marina B. Ruggles-Wrenn. Sponsor: N/A.

WITZGALL, SARAH, A., Tension-Tension Fatigue Behavior of Nextel 720/Alumina-Mullite Ceramic Composite at 1200°C in Air and Steam. AFIT-ENY-MS-20-J-078. Faculty Advisor: Dr. Marina B. Ruggles-Wrenn. Sponsor: N/A.

5.1.3. FACULTY BIOGRAPHIES & RESEARCH OUTPUT

Notes: Research Center affiliations are listed in [ ] if applicable.

AYRES, BRADLEY J.
Assistant Professor of Aerospace Engineering, Department of Aeronautics and Astronautics, AFIT Appointment Date: 2019 (AFIT/ENY); BS, Chemical Engineering, University of Missouri - Columbia,1982; MA, Procurement and Acquisition Management, Webster University, 1991; MS, Software Systems Management, Air Force Institute of Technology, 1992; PhD, Business Administration Specializing in Management Information Systems, Florida State University, 2003. Dr. Ayres' research interests include Model-Based Systems Engineering applied to the development of space systems, Mission Engineering, and Digital Engineering. He is an active member of the International Council on Systems Engineering's (INCOSE) Space Systems Working Group (SSWG). The SSWG has recently developed a CubeSat Reference Model that has been submitted to the Object Management Group (OMG) for approval as an OMG CubeSat specification. He is a member of Alpha Chi Sigma, Sigma Iota Epsilon, Phi Kappa Phi, and Beta Gamma Sigma. He is also an INCOSE Associate Systems Engineering Professional, OMG Certified Systems Modeler Professional Model Builder – Fundamental, and a member of AIAA. AFIT research center affiliation(s): [CSRA.] Tel. (937) 255-3636 x3422, Email: Bradley.Ayres@afit.edu

Refereed Conference Papers Accepted on the Basis of Full Paper Review

Kaslow, D., Cahill, P. T., Ayres, B., "Development and Application of the CubeSat System Reference Model," 2020 IEEE Aerospace Conference, Big Sky, MT, March 2020.

BETTINGER, ROBERT A., Maj
Assistant Professor of Astronautical Engineering, Department of Aeronautics and Astronautics, AFIT Appointment Date: 2017 (AFIT/ENY); BS, Astronautical Engineering, United States Air Force Academy, 2007; MA, History, American Public University, 2010; MS, Astronautical Engineering, Air Force Institute of Technology, 2011; PhD, Astronautical Engineering, Air Force Institute of Technology, 2014. Maj Bettinger's research interests include reentry dynamics, spacecraft safety and survivability, as well as optimization and control for aerospace applications. Recent research includes developing uncontrolled reentry prediction algorithms and skip reentry maneuver optimization. He is a member of Tau Beta Pi and Sigma Gamma Tau. AFIT research center affiliation(s): [CSRA] Tel. (937) 255-3636 x4578, Email: Robert.Bettinger@afit.edu

Sponsor Funded Research Projects

"Grissom 6U Bus Integration for Space Test Program." Sponsor: SMC/DCIP. Fsmc/ng: $210,000 - Bettinger 20%, Cobb 20%, Hartsfield 20%, Johnson 20%, Keys 20%. [CSRA]

"Nanosatellite Attitude Determination and Control Test Program." Sponsor: NIWC Pacific. Funding: $10,001 - Bettinger 100%. [CSRA]

"Constellation Optimization Study for Low Earth Orbiting Spacecraft." Sponsor: NASIC/SM. Funding: $20,000 - Bettinger 100%. [CSRA]

"Rapid CubeSat Design, Fabrication, and Test." Sponsor: SAF/FMBIB. Funding: $101,950 - Bettinger 60%, Keys 20%, Hartsfield 20%. [CSRA]

"AFIT MC3 Satellite Network Node Sustainment and Upgrade." Sponsor: NPS. Funding: $33,164 - Bettinger 100%. [CSRA]

Refereed Journal Publications

Shockley, L. M., Bettinger R. A., "Policy and Geopolitical Implications of Launch-on-Demand Capabilities," *Journal of DOD Research and Engineering*, Vol. 3, No. 1, March 2020, pp. 2-14.

Linville, D. A., Bettinger, R. A., "An Argument against Satellite Resiliency: Simplicity in the Face of Modern Satellite Design," *Air & Space Power Journal*, Vol. 34, No. 1, Spring 2020, pp. 43-53.

Bettinger, R. A., "Linear Model for Reentry Time Prediction of Spacecraft in Low-Eccentricity, Low Earth Orbits," *Journal of Spacecraft and Rockets*, Vol. 56, No. 5, pp. 1300-1311, September-October 2019.

Refereed Conference Papers Accepted on the Basis of Full Paper Review

Shockley, L. M., Bettinger, R. A., "Spacecraft Attitude Estimation using Terrestrial Illumination Matching," 2020 IEEE Aerospace Conference, Big Sky, MT, March 2020.

Refereed Conference Papers Accepted on the Basis of Abstract Review

Lomanno, C. P., Bettinger, R. A., Gindre, P., "Utility of Modular Attitude Determination and Control Subsystems for Small Satellites," 2020 Advanced Maui Optical and Space Surveillance Technologies Conference (AMOS), Maui, HI, September 2020.

Boone, N. R., Bettinger, R. A., "Spacecraft Survivability near the Stable Earth Lagrange Points," 2020 AAS/AIAA Astrodynamics Specialist Conference, Lake Tahoe, CA, August 2020.

Keys, A. S., Bettinger, R. A., Miller, S. K., Sheffield, C. A., Lomanno, C. P., "Balancing Project Management, Risk, and Educational Opportunities on the Grissom CubeSat Project," 2020 Small Satellite Conference, Logan, UT, August 2020.

Bettinger, R. A., Hess, J. A., "Hypervelocity Impact Vulnerability Assessment for a 6U CubeSat Bus," 2020 AIAA Science and Technology Forum and Exposition, Orlando, FL, January 2020.

Bettinger, R. A., Hess, J. A., "Fractionated Spacecraft Survivability following a Catastrophic Explosion," 2020 AIAA Science and Technology Forum and Exposition, Orlando, FL, January 2020.

Shockley, L. M., Bettinger, R. A., "Spacecraft Position Estimation using Terrestrial Illumination Matching," 2020 AIAA Science and Technology Forum and Exposition, Orlando, FL, January 2020.

Patent Applications

Shockley, L. M., Bettinger, R. A., "Aerospace Vehicle Navigation and Control System Comprising Terrestrial Illumination Matching Module for Determining Aerospace Vehicle Position and Attitude," AFD-2040, U.S. Provisional Patent No. 62/957,250, January 2020.

Other Significant Research Productivity

Bettinger, R. A., Hess, J. A., "Hypervelocity Impact Vulnerability Assessment for 6U and 12U CubeSat Bus Designs," 45th AIAA Dayton-Cincinnati Aerospace Sciences Symposium (DCASS), Dayton, OH, March 2020.

Derbis, R. M., Cunningham, P. B., Thornton, D. M., Bettinger, R. A., Schubert Kabban, C., "Refined Linear Models for Spacecraft Reentry Predictions," 45th AIAA Dayton-Cincinnati Aerospace Sciences Symposium (DCASS), Dayton, OH, March 2020.

Erickson, B., Bettinger, R. A., "Numerical Optimization of Six Degree-of-Freedom, Path-Constrained Satellite Skip Entry Trajectories," 45th AIAA Dayton-Cincinnati Aerospace Sciences Symposium (DCASS), Dayton, OH, March 2020.

Keys, A. S., Bettinger, R. A., Miller, S. K., Sheffield, C. A., "Development of the Grissom CubeSat Project," 45th AIAA Dayton-Cincinnati Aerospace Sciences Symposium (DCASS), Dayton, OH, March 2020.

Tassos, N., Bettinger, R. A., “Statistical Reliability Estimation of Small Satellites,” 45th AIAA Dayton-Cincinnati Aerospace Sciences Symposium (DCASS), Dayton, OH, March 2020.

Shockley, L. M., Bettinger, R. A., “Spacecraft Position Estimation using Terrestrial Illumination Matching,” 15th Dayton Engineering Sciences Symposium (DESS), Dayton, OH, October 2019.

BOHAN, BRIAN T., Lt Col

Assistant Professor of Aeronautical Engineering, Department of Aeronautics and Astronautics, AFIT Appointment Date: 2018 (AFIT/ENY); BS, Aeronautical Engineering, Clarkson University - Potsdam, NY 2005; MS, Aeronautical Engineering, Air Force Institute of Technology, 2011; PhD, Aeronautical Engineering, Air Force Institute of Technology, 2018. Lt Col Bohan's research interests include turbomachinery, combustion, heat transfer, applied fluid dynamics, and computational fluid dynamics. Lt Col Bohan teaches courses on turbomachinery, computational fluid dynamics, and aircraft design. He has experience in Air Force test and evaluation, propulsion integration, aerodynamic configuration, and as a propulsion subject matter expert for weapon system development. He is a member of Tau Beta Pi, Sigma Gamma Tau, AIAA, and ASME. Tel. (937) 255-3636 x4773, email: Brian.Bohan@afit.edu

Sponsor Funded Research Projects

"Integration of a UCC into a Small Gas-Turbine Engine." Sponsor: AFRL/RQ. Funding: $23,000 - Bohan 60%, Polanka 40%.

"LEED Small Heat Transfer Rig Modeling." Sponsor: AFRL/RQ. Funding: $5,000 - Bohan 100%.

"Engine Control Unit (ECU) for the Responsive Open Source Engine (ROSE) Phase II." Sponsor: AFRL/RQ. Funding: $20,000 - Bohan 100%.

Refereed Journal Publications

DeMarco K.J., Bohan B.T., Polanka M.D., Rutledge JL, Akbari P., “Computational Analysis of an Additively Manufactured Cooled Ultra Compact Combustor Vane.” *Journal of Thermal Science and Engineering Applications,* TSEA-19-1066, Volume 11, Number 5, Pages 051021 (9), October 2019, DOI : 10.1115/1.4043548.

Bohan, B.T., Polanka, M.D., and Rutledge, J.L., “Sweeping Jets Issuing from the Face of a Backward-Facing Step.” *Journal of Fluids Engineering,* FE-18-1755, Volume 141, Issue 12, Pages 121201 (17), Dec 2019, DOI: 10.1115/1.4043576.

Bohan, B.T., and Polanka, M.D., “Experimental Analysis of an Ultra Compact Combustor Powered Turbine Engine.” *Journal of Engineering for Gas Turbines and Power*, GTP-19-1767, Volume 142, Issue 5, Pages 051014 (10), May 2020, DOI: 10.1115/1.4046759.

Bohan, B.T., and Polanka, M.D., “The Effect of Scale and Working Fluid on Sweeping Jet Frequency and Oscillation Angle.” *Journal of Fluids Engineering*, FE-19-1787, Volume 142, Issue 6, Pages 061206 (9), June 2020, DOI: 10.1115/1.4046167.

Refereed Conference Papers Accepted on the Basis of Full Paper Review

Bohan, B.T., Polanka, M.D., Goss, L.P. “Circumferential Combustor Cavity Flow Fields with Decreasing Core Flow” Conference proceedings of the ASME Turbo Expo 2020, Virtual Conference, GT2020-14151, 21-25 September 2020.

Refereed Conference Papers Accepted on the Basis of Abstract Review

Holobeny, D., Polanka, M.D, Bohan, B.T., “Analysis of a Compact Combustor for Use in a JetCat P90 RXi.” *AIAA SciTech 2020 Forum*, Orlando, FL, AIAA 2020-0625, Jan 2020, doi.org/10.2514/6.2020-0625.

Staton, B.M., Bohan, B.T., Polanka, M.D, "Flow Characterization and Combustion Analysis for Disk-Oriented Engine." *AIAA SciTech 2020 Forum*, Orlando, FL, AIAA 2020-0626, Jan 2020, doi.org/10.2514/6.2020-0626.

Bauer, A.P., Schauer, F.R., Kemnitz, R.A., Bohan, B.T., Walker, G., Gillaugh, D.L., Holley, A.T., Hoke, J.L., "Design, Analysis, and Testing of a Low-Cost, Additively-Manufactured, Single-Use Compressor." *AIAA SciTech 2020 Forum*, Orlando, FL, AIAA 2020-0125, Jan 2020, doi.org/10.2514/6.2020-0125.

Touma J.A., Clark, N.A., Bohan, B.T., Schauer, F., Sell, B.C., "Spaceflight Propulsion and Power Using a Radioisotope Heat Exchanger". *Conference Proceedings of JANNAF*, Virtual Conference, September 2020, Distribution C.

Patent Applications

Bohan, BT, Polanka, MD, Staton, BM. "Disc Engine with Circumferential Swirl Radial Combustor," 5 May 2019. Patent Pending.

Other Significant Research Productivity

Holobeny, D., Polanka, M.D., Bohan, B.T., "Analysis of a Compact Combustor for Use in a JetCat P90 RXi" Dayton-Cincinnati Aerospace Science Symposium (DCASS), 3 Mar 2020, Dayton OH.

Staton, B.M., Polanka, M.D., Bohan, B.T., "Design and Analysis of a Disk-Oriented Engine Combustor" Dayton-Cincinnati Aerospace Science Symposium (DCASS), 3 Mar 2020, Dayton OH.

Bauer, A., Schauer, F.R., Kemnitz, R.A., Bohan, B.T., Walker, G.R., Gillaugh, D.L., Holley, A.T., Hoke, J.L., "Design, Analysis, and Testing of a Low-Cost, Additively-Manufactured, Single-Use Compressor" Dayton-Cincinnati Aerospace Science Symposium (DCASS), 3 Mar 2020, Dayton OH.

COBB, RICHARD G.

Professor of Aerospace Engineering, Department of Aeronautics and Astronautics, AFIT Appointment Date: 2001 (AFIT/ENY); BS, Pennsylvania State University, 1988; MS, Air Force Institute of Technology, 1992; PhD, Air Force Institute of Technology, 1996. While at AFIT, Dr. Cobb has taught graduate level courses in satellite design, optimal control, trajectory optimization, system identification and spacecraft control systems. His research focuses on dynamics and control of aerospace systems, including control of aircraft, spacecraft, large flexible structures, and optical systems. Recent work includes developing optimal trajectory plans for Global Strike missions, optimal aircraft air and ground collision avoidance algorithms for manned and unmanned systems, active buffet alleviation using piezoelectric actuators for F-16 aircraft, maneuver planning for satellite proximity operations, dynamics and control techniques for lightweight space optics and optimal/novel sensor systems and architectures for enhancing Space Situational Awareness. While on active duty, Dr. Cobb served as the technical advisor for AFRL's Space Vehicles Technology Branch, and led several space flight experiment programs, including the Vibration Isolation and Suppression System sponsored by BMDO and the Satellite Ultra-quiet Isolation Technology Experiment. Dr. Cobb also served as a launch operations officer at Cape Canaveral AFS on the Global Positioning System program, responsible for the integration and launch of the GPS Block II satellite constellation. He is an Associate Fellow of AIAA. AFIT research center affiliation(s): [ANT], [CDE], [CSRA] and [CTISR.] Tel. (937) 255-3636 x4559, email: Richard.Cobb@afit.edu

Sponsor Funded Research Projects

"Space Domain Modeling & Simulation via High Performance Computing." Sponsor: Undisclosed. Funding: $230,000 - Cobb 50%, Meyer 50%. [CSRA]

"Satellite Attitude Control Testbed Upgrades (Continuation)." Sponsor: SAF/FMBIB. Funding: $65,366 - Cobb 34%, Hess 33%, Zagaris 33%. [CSRA]

"AFIT Support for Operations in Contested Space." Sponsor: SAF/FMBIB. Funding: $300,000 - Cobb 20%, Hess 20%, Zagaris 20%, Meyer 20%, Johnson 20%. [CSRA]

"Swarm Rendezvous and Proximity Operations via Visual-Serving." Sponsor: AFRL/RV. Funding: $43,100 - Cobb 50%, Zagaris 50%. [CSRA]

"Artificial Intelligence Opponent for Contested Space (AIOCS): Game Development." Sponsor: AFRL/RV. Funding: $57,500 - Cobb 50%, Hess 50%. [CSRA]

"Rapid CubeSat Build and Test." Sponsor: AFRL/RV. Funding: $8,567 - Cobb 50%, Hartsfield 50%. [CSRA]

"“Timely Path Optimization for Enhanced Autonomy." Sponsor: AFRL/RQ. Funding: $25,000 - Cobb 50%, Jacques 50%. [ANT]

Refereed Journal Publications

Thomas*, G., Cobb, R., Fiorino, S. and Hawks, M., “Daytime Cloudless Sky Radiance Quantification with Ground-based Aerosol and Meteorological Observations in the Short-Wave Infrared,” *Journal of Atmospheric and Oceanic Technology*, 37(5) March 2020, DOI: 10.1175/JTECH-D-19-0157.1.

Spendel, D., Hess, J., Johnson, K., and Cobb, R., “Evaluating Orbital Defender Performance Trades Using Differential Game Theory” *Journal of Defense Research & Engineering*, Vol 3, Issue 1, March 2020, AD1092565.

Thomas, G., Cobb, R., Fiorino, S. and Hawks, M., “NIR and SWIR Observations for Daytime Satellite Custody,” *Journal of Defense Research & Engineering*, Vol 3, Issue 1, March 2020, AD1093125.

Smith, N.E., Cobb, R.G., and W.P. Baker, “Incorporating Stochastics into Optimal Collision Avoidance Problems using Superquadrics,” *AIAA Journal of Air Transportation*, February 2020, DOI: 10.2514/1.D0170.

Spendel, D.S., Hess, J.A., Cobb, R.G., Johnson, K. J., “Developing and Analyzing Strategies Using Pursuer-Evader-Defender Differential Game Theory for Orbital Engagements,” Journal of DOD Research and Engineering, July 2020.

Refereed Conference Papers Accepted on basis of Full Paper Review

Harris, W., Cobb R., and Taylor, C., "Visual Servoing for Final Approach Phase of Spacecraft Proximity Operations with Unknown Targets," 2020 IEEE/ION Position, Location and Navigation Symposium (PLANS), Portland, OR, USA, 2020, pp. 1606-1617, doi: 10.1109/PLANS46316.2020.9110218.

Harris, W., Linville, D., Hess J., and. Cobb, R., "Development of GNC for Optimal Relative Spacecraft Trajectories," 2020 IEEE/ION Position, Location and Navigation Symposium (PLANS), Portland, OR, USA, 2020, pp. 1476-1487, doi: 10.1109/PLANS46316.2020.9110153.

Weintraub, I., Cobb, R., Baker, W. and Pachter, M., “Direct Methods Comparison for the Active Target Defense Scenario,” AIAA SciTech 2020 Forum, January 2020, DOI: 10.2514/6.2020-0612.

Other Significant Research Productivity

Harris, W., Cobb R., and Taylor, C., “Visual Servoing for Final Approach Phase of Spacecraft Proximity Operations with Unknown Targets,” presented virtually to the AFRL/RVSW “RANGERS” symposium, 16 April, 2020.

Matissek, K., Cobb, R. Jacques, D., Grymin, D., and Zollars, M., “A Near-Real-Time Near-Optimal Shortest Path Solution for an Unmanned Aerial System (UAS) in a Highly Constrained Environment,” AIAA 45th Dayton-Cincinnati Aerospace Science Symposium, 3 March 2020.

Matissek, K., Cobb, R. Jacques, D., Grymin, D., and Zollars, M., “A Near-Real-Time Near-Optimal Shortest Path Solution for an Unmanned Aerial System (UAS) in a Highly Constrained Environment,” ASME 15th Dayton Engineering Sciences Symposium, 29 October 2019.

GRANDHI, RAMANA V.
Professor of Aerospace Engineering, Department of Aeronautics and Astronautics, AFIT Appointment Date: 2018 (AFIT/ENY); Previously he was a Distinguished Professor at Wright State University, Dayton, OH, and also served as the Director of Engineering Ph.D. program for 15 years and Executive Director of International Collaborations and Graduate Programs for 4 years. His research interests are in multidisciplinary analysis and optimization, aircraft structures, risk-based design, and advanced manufacturing processes. He is a Fellow of the American Society of Mechanical Engineering, and a Fellow of the American Institute of Aeronautics and Astronautics. Tel. (937) 255-3636 x4723, email: ramana.grandhi@afit.edu

Sponsor Funded Research Projects

"High-Fidelity Multi-Physics for Revolutionary Aerospace Vehicles Design." Sponsor: AFOSR. Funding: $40,000- Grandhi 100%.

"Computational Tools for Hypersonic Vehicle Design." Sponsor: AFRL/RQ. Funding: $48,000 - Grandhi 100%.

"Computational Tools for Hypersonic Vehicle Design." Sponsor: AFRL/RQ. Funding: $24,500 - Grandhi 100%.

"Computational Tools for Hypersonic Vehicle." Sponsor: AFRL/RQ. Funding: $27,500 - Grandhi 100%.

Editorships in Professional Journals

Editorial Board, *International Journal of Peening Science and Technology,* 2018 - present.

Editorial Board, *ASCE-ASME Journal of Risk and Uncertainty in Engineering Systems*, 2014 - present.

Editorial Board, *Journal of Manufacturing Review,* 2013 - present.

Editorial Board, *International Journal of Vehicle Structures & Systems,* 2009 - present.

Editorial Board*, International Journal of Reliability and Safety,* 2005 - present.

Associate Editor, *Journal of Structural and Multidisciplinary Optimization*, 1999 - present

Editorial Board, *Journal for Finite Elements in Analysis and Design,* 1999 – present

GREENDYKE, ROBERT B.
Associate Professor of Aeronautics and Astronautics and Director, AFIT Scientist and Engineer Education Programs at Kirtland AFB, Department of Aeronautics and Astronautics, Appointment Date: 2005 (AFIT/ENY); BBA, Economics, Baylor University, 1979; BS, Aerospace Engineering, Texas A&M University, 1986; MS, Aerospace Engineering, Texas A&M University, 1988; PhD, Interdisciplinary Engineering, Texas A&M University, 1998. Dr. Greendyke's research interests include computational fluid dynamics, Direct Simulation Monte Carlo methods, hypersonic and reacting flows, radiation simulation, thermophysics, and plasma simulation. He was a Research Scientist at NASA-Langley Research Center studying re-entry and aero braking flows, and an Associate Professor in the University of Texas at Tyler establishing a start-up Mechanical Engineering Program from concept through accreditation. Dr. Greendyke has published over 30 journal articles, technical reports and conference publications in multiple fields. He is an Associate Fellow of the American Institute of Aeronautics and Astronautics. Tel. (937) 255-3636 x4567, email: Robert.Greendyke@afit.edu

Sponsor Funded Research Projects

"Hypersonic Flow field Phenomenology." Sponsor: NASIC. Funding: $60,464 - Greendyke 0%, Reeder 100%.

HARTSFIELD, CARL R.

Assistant Professor of Aerospace Engineering, Department of Aeronautics and Astronautics, AFIT Appointment Date: 2015 (AFIT/ENY); B. Aerospace Engineering, Georgia Institute of Technology, 1991; MS, Aeronautical Engineering, Air Force Institute of Technology, 2001; PhD, Astronautical Engineering, Naval Postgraduate School, 2006. Dr. Hartsfield is a former faculty member of The Ohio State University, former space sensor payload program manager, and retired USAF Lt Col. His research interests include space and rocket propulsion and optimal design of spacecraft, including integration and testing of spacecraft. Dr. Hartsfield's research focuses on experimental evaluation and diagnostics for space propulsion, analytic evaluation of spacecraft design, and applications of additive manufacturing for optimal spacecraft structures. He served as an invited space propulsion session co-chair at a 2011 NASA GRC HBCUOMI Outreach Symposium, as a session chair at the 2011 and 2012 Dayton/Cincinnati Aerospace Sciences Symposia, as chair for the technical program and session chair at the 2017 Dayton/Cincinnati Aerospace Sciences Symposium and Executive Chair for the 2018 Dayton/Cincinnati Aerospace Sciences Symposium. Dr. Hartsfield is a member of AIAA, the AIAA Small Satellites Technical Committee, Sigma Gamma Tau, and the American Society for Engineering Education. AFIT research center affiliation(s): [CSRA.] Tel. (937) 255-3636 x4667, email: Carl.Hartsfield@afit.edu

Sponsor Funded Research Projects

"Material Characterization of CNT Textiles (Continuation)." Sponsor: Undisclosed. Funding: $64,844 - Hartsfield 50%, Kemnitz 50%. [CSRA]

"Satellite Structures Built in Space (Continuation)." Sponsor: Undisclosed. Funding: $68,874 - Hartsfield 50%, Kemnitz 50%. [CSRA]

"Additively Manufactured Microsatellite Propulsion." Sponsor: Undisclosed. Funding: $69,029 - Hartsfield 100%. [CSRA]

"Material Characterization of CNT Textiles (Continuation)." Sponsor: Undisclosed. Funding: $43,229 - Hartsfield 50%, Kemnitz 50%. [CSRA]

"Satellite Structures Built in Space (Continuation)." Sponsor: Undisclosed. Funding: $45,916 - Hartsfield 50%, Kemnitz 50%. [CSRA]

"Additively Manufactured Microsatellite Propulsion." Sponsor: Undisclosed. Funding: $46,019 - Hartsfield 50%, Kemnitz 50%. [CSRA]

"Developing Cargo Compartments through Additive Manufacturing." Sponsor: AFRL/RQ. Funding: $21,700 - Hartsfield 100%.

Refereed Journal Publications

Crouch, S.*, Hartsfield, C., 2020, "*Triggered Lightning Threat Prediction Based on Launch Vehicle Parameters*," Journal of Defense Research and Engineering, Volume 3, Issue 2, pp 39-50. (FOUO) (DTIC Accession number for issue: AD1101059).

Wilson, P.*, Hartsfield, C., 2020, "*Effects of Discontinuities on Single and Multi-Wire Solid Propellant Grains*," Journal of Defense Research and Engineering, Volume 3, Issue 2, pp 94-108. (FOUO) (DTIC Accession number for issue: AD1101059).

Anderson, W.*, Heister, S., Kan, B., Hartsfield, C., 2020, "*Experimental Study of a Hyperbolically Ignited Liquid Bipropellant Rotating Detonation Rocket Engine*," AIAA Journal of Propulsion and Power, Published online 28 June 2020, DOI: https://doi.org/10.2514/1B37666.

Hartsfield, C., Shelton, T., Palmer, B.*, O'Hara, R., 2020, "*All Metallic Phase Change Thermal Management Systems for Transient Spacecraft Loads*," ASCE Journal of Aerospace Engineering, Volume 33, Issue 4. DOI: (10.1061/(ASCE)AS.1943-5525.0001150).

Doane, B., Truster, N., Cobb, G., Shelton, T., Kemnitz, R., Hartsfield, C., 2020, "*Parameter development of selective laser melted nickel alloy 718 for thin-walled applications*," Journal of Defense Research and Engineering, Volume 3 Issue 1 (FOUO).

Shelton, T., Willburn, Z.*, Hartsfield, C., Cobb, G., Cerri, J.*, Kemnitz, R., 2019, "*Effects of Thermal Process Parameters on Mechanical Interlayer Strength for Additively Manufactured Ultem 9085*," Journal of Polymer Testing, No 81. DOI: (j.polymertesting.2019.106255).

Shelton, T., Stelzer, D.*, Hartsfield, C., O'Hara, R., 2019. "*Understanding Surface Roughness of Additively Manufactured Nickel Superalloy for Space Applications*," Rapid Prototyping, Vol 26, No 3. DOI (10.1108/RPJ-02-2019-0049).

Kemnitz, R.*, Cobb, G., Singh, A., Hartsfield, C., 2019, "*Characterization of simulated low earth orbit space environment effects on acid-spun carbon nanotube yarns*," Materials & Design, Vol 184. DOI: (j.matdes.2019.108178).

Refereed Conference Papers Accepted on the Basis of Abstract Review

Gallagher, W.*, T. Shelton, R. Kemnitz, C. Hartsfield, 2020, *Accelerated Testing of Ultraviolet and Atomic Oxygen Effects on 3-D Printed Polyetherimide Plastic*, 58th AIAA Aerospace Sciences Meeting.

HESS, JOSHUAH, A., Maj
Assistant Professor of Aerospace Engineering, Department of Aeronautics and Astronautics, AFIT Appointment Date: 2016 (AFIT/ENY); BS, Aerospace Engineering, Virginia Polytechnic and State University, 2009; MS, Astronautical Engineering, Air Force Institute of Technology, 2011; PhD, Aeronautical Engineering, Air Force Institute of Technology, 2016. Major Hess's research interests include relative satellite motion and spacecraft proximity operations, spacecraft attitude determination, optimal control, differential pursuit/evasion games, and estimation theory. He has investigated adaptive estimation of nonlinear spacecraft attitude dynamics as well as the relative navigation between satellites conducting proximity operations. Previously, Major Hess worked as a space system engineer at the National Air and Space Intelligence Center (NASIC), and has deployed to Southwest Asia in support of Operation Enduring Freedom. He is a member of Tau Beta Pi, Sigma Gamma Tau, and AIAA. AFIT research center affiliation(s): [CSRA.] Tel. (937) 255-3636 x4713, email: Joshuah.Hess@afit.edu

Refereed Journal Publications

Spendel, D.S., Hess, J.A., Cobb, R.G., Johnson, K. J., "Evaluating Orbital Defender Performance Trades Using Differential Game Theory," Journal of DOD Research and Engineering, Mar 2020, AD1092565.

Spendel, D.S., Hess, J.A., Cobb, R.G., Johnson, K. J., "Developing and Analyzing Strategies Using Pursuer-Evader-Defender Differential Game Theory for Orbital Engagements," Journal of DOD Research and Engineering, July 2020.

Nesmith, A., Lingenfelter, A., Hess, J.A., and Liu, D., "Applications of Second-Order Linear Differential Equations to Model a Hydrodynamic Ram Cavity," Journal of Aircraft Survivability, Fall 2019.

Refereed Conference Papers Accepted on the Basis of Abstract Review

Stephens, S., Casbeer, D., Kunz, D., Baker, W., and Hess, J.A., "A Control Algorithm Framework for Time-of-Arrival and Arrival Airspeed Control," ASME 2020 Dynamic Systems and Control Conference, Oct 5-7 2020, DSCC2020-3126.

Enders, N., Hess, J.A., and Cobb, R.G., "Spacecraft Moment of Inertia Estimation via Recurrent Neural Networks," 2020 AAS/AIAA Astrodynamics Specialist Conference, AAS 20-483.

Zagaris, C., and Hess, J.A., " Rapid Reachability Analysis of Single Impulse Spacecraft Relative Motion Maneuvers," 2020 AAS/AIAA Astrodynamics Specialist Conference, AAS 20-468.

Saunders, D., Zagaris, C., Hess, J.A., and Cobb, R.G., "Autonomous Cooperative Optimal Control of Multi-Agent Satellite Formations," 2020 AAS/AIAA Astrodynamics Specialist Conference, AAS 20-492.

Henderson, T., Hack, Y., Sunkin, S., Lovell, T.A., and Hess, J.A., "Initial Relative Orbit Determination of Space Objects via Radio Frequency Signal Localization," 2020 AAS/AIAA Astrodynamics Specialist Conference, AAS 20-696.

W. Harris, D. Linville, J. Hess and R. Cobb, "Development of GNC for Optimal Relative Spacecraft Trajectories," *2020 IEEE/ION Position, Location and Navigation Symposium (PLANS)*, Portland, OR, USA, 2020, pp. 1476-1487, doi: 10.1109/PLANS46316.2020.9110153.

Linville, D., Hess, J.A., "Linear Regression Models Applied to Spacecraft Imperfect Information Pursuit-Evasion Differential Games," AIAA SciTech 2020 Forum, AIAA 2020-0952.

Stephens, S., Kunz, D., and Hess, J.A., "Optimal Control Approach to Terrain Following Trajectory Generation," AIAA SciTech 2020 Forum, AIAA 2020-0859.

Bettinger, R., Hess, J.A., "Hypervelocity Impact Vulnerability Assessment for a 6U CubeSat Bus," AIAA SciTech 2020 Forum, AIAA 2020-0729.

Collins, A., Johnson, K.W., and Hess, J.A., "Development of Cislunar Space Logistics Networks for Satellite Constellation Support," AIAA SciTech 2020 Forum, AIAA 2020-2135.

Bettinger, R., Hess, J.A., "Fractionated Spacecraft Survivability following a Catastrophic Explosion," AIAA SciTech 2020 Forum, AIAA 2020-0729.

Lee, C., Komives, J., and Hess J.A., "Reinforcement Learning Applied to High-Speed Systems," Accepted to 2020 AIAA Defense Forum (to be presented in 2021 due to COVID-19).

Other Significant Research Productivity

Hess, J.A., and Zagaris, C., "Limitations of Relative Satellite Motion State Transition Matrix Impulsive Maneuvering Algorithms," 45th Dayton-Cincinnati Aerospace Sciences Symposium, Sinclair Community College, Dayton, OH, 3 Mar, 2020.

Linville, D., and Hess, J.A., "Linear Regression Models Applied to Spacecraft Imperfect Information Pursuit-Evasion Differential Games," 45th Dayton-Cincinnati Aerospace Sciences Symposium, Sinclair Community College, Dayton, OH, 3 Mar, 2020.

JOHNSON, KIRK, W., Lt Col

Assistant Professor of Aerospace Engineering, Department of Aeronautics and Astronautics, AFIT Appointment Date: 2016 (AFIT/ENY); BS, Mechanical Engineering, Worcester Polytechnic Institute, 2000; MS, Astronautical Engineering, Air Force Institute of Technology, 2010; PhD, Aerospace Engineering, Texas A&M University, 2016. Lt Col Johnson's research interests include orbital mechanics and astrodynamics, focusing on satellite relative motion, formation flying, general perturbation methods, and space navigation. He has led engineering teams performing analysis and modeling and simulation for the National Air and Space Intelligence Center and for the Missile Defense Agency. He is a member of Tau Beta Pi, Sigma Gamma Tau, and the American Astronautical Society. AFIT research center affiliation(s): [CSRA.] Tel. (937) 255-3636 x4285, email: Kirk.Johnson@afit.edu

Sponsor Funded Research Projects

"Noise Radar CubeSat 6u CubeSat Flight Model-Phase 1." Sponsor: SAF/FMBIB. Funding: $300,000 - Johnson 35%, Collins 35%, Hartsfield 10%, Albrecht 10%, Cobb 10%. [CSRA]

Refereed Journal Publications

Spendel, D.S., Hess, J.A., Cobb, R.G., Johnson, K. J., "Evaluating Orbital Defender Performance Trades Using Differential Game Theory," Journal of DOD Research and Engineering, Mar 2020, AD1092565.

Spendel, D.S., Hess, J.A., Cobb, R.G., Johnson, K. J., "Developing and Analyzing Strategies Using Pursuer-Evader-Defender Differential Game Theory for Orbital Engagements," Journal of DOD Research and Engineering, July 2020.

Refereed Conference Papers Accepted on the Basis of Abstract Review

Hall, Z., Johnson, K.W., and Singla, P., "A Particle Filtering Approach to Space-based Maneuvering Satellite Location and Estimation," AAS 20-569, Astrodynamics Specialist Conference, August 2020.

Collins, A.R., and Johnson, K.W., "Development of Cislunar Space Logistics Networks for Satellite Constellation Support," AIAA 2020-2135, AIAA 2020 SciTech Forum, Orlando, FL, January 2020.

KEMNITZ, RYAN A., Maj
Assistant Professor of Aerospace Engineering, Department of Aeronautics and Astronautics, AFIT Appointment Date: 15 September 2018 (AFIT/ENY); BS, Mechanical Engineering, United Stated Air Force Academy, 2008; MS, Mechanical Engineering, University of Utah, 2012; PhD, Materials Science, Air Force Institute of Technology, 2018. Major Kemnitz' research interests include process parameter and laser scanning strategy development for additive manufacturing of metal alloys, mechanical and microstructural characterization of additively manufactured materials, and the use of finite element analysis to predict the impact of defects on the mechanical behavior of additively manufactured materials. He is a member of Tau Beta Pi and AIAA. Tel. (937) 255-3636 x4775, email: Ryan.Kemnitz@afit.edu

Sponsor Funded Research Projects

"Material Characterization of CNT Textiles." Sponsor: Undisclosed. Funding: $24,000 - Kemnitz 50%, O'Hara 50%. [CSRA]

"FASTBALL: Frugal Atmospheric Sounder Test Bed Auto-pointing Luneburg Lens (Continuation)." Sponsor: Undisclosed. Funding: $64,746 - Kemnitz 50%, Collins 50%. [CSRA]

"Additively Manufactured Thin-Walled Tungsten (W) Structures for Space Shielding Applications." Sponsor: Undisclosed. Funding: $56,578 - Kemnitz 50%, Hartsfield 50%. [CSRA]

"Process Development for Additive Manufacturing of Refractory Metals." Sponsor: AFRL/RX. Funding: $75,000 - Kemnitz 100%.

"Design Study of Additively Manufactured Heat-Exchangers." Sponsor: AFRL/RQFS. Funding: $50,000 - Kemnitz 100%.

"High Energy Laser (HEL) Hardening of Aircraft." Sponsor: DOT&E. Funding: $20,000 - Kemnitz 100%.

"Material Characterization of CNT Textiles." Sponsor: Undisclosed. Funding: $16,000 - Kemnitz 50%, Hartsfield 50%. [CSRA]

"FASTBALL: Frugal Atmospheric Sounder Test Bed Auto-pointing Luneburg Lens (Continuation)." Sponsor: Undisclosed. Funding: $43,164 - Kemnitz 50%, Collins 50%. [CSRA]

"Additively Manufactured Thin-Walled Tungsten (W) Structures for Space Shielding Applications." Sponsor: Undisclosed. Funding: $37,719 - Kemnitz 50%, Hartsfield 50%. [CSRA]

"Assessment of Alternative High-Temp Additively Manufactured Structures for Next-Gen Scramjet Engines." Sponsor: AFRL/RQ. Funding: $50,000 - Kemnitz 100%.

"Inherent Damping Study of Additive Manufacturing (AM) Compressor Airfoils." Sponsor: AFRL/RQ. Funding: $50,000 - Kemnitz 100%.

"Ultra-high temperature advanced heat exchangers." Sponsor: AFRL/RQ. Funding: $10,000 - Kemnitz 100%.

"Novel Hypersonic Structural Design Using AM." Sponsor: AFRL/RQ. Funding: $50,500 - Kemnitz 50%, Hartsfield 50%.

Refereed Journal Publications

Kemnitz, R. A., Cobb, G. R., Singh, A. K., & Hartsfield, C. R. "Characterization of simulated low earth orbit space environment effects on acid-spun carbon nanotube yarns." *Materials & Design*, *184*, 108178, 2019.

Sabelkin, V. P., Cobb, G. R., Shelton, T. E., Hartsfield, M. N., Newell, D. J., O'Hara, R. P., & Kemnitz, R. A. "Mitigation of anisotropic fatigue in nickel alloy 718 manufactured via selective laser melting." *Materials & Design*, *182*, 108095, 2019.

Singleton, J. W., Cobb, G. R., Misak, H. E., & Kemnitz, R. A. "Quantifying the effects of hyper thermal atomic oxygen and thermal fatigue environments on carbon nanotube sheets for space-based applications." *Results in Materials*, *3*, 100034, 2019.

Sabelkin, V.P., Cobb, G.R., Doane, B.M., Kemnitz, R.A., and O'Hara, R P., "Torsional behavior of additively manufactured nickel alloy 718 under monomatic loading and low cycle fatigue," *Materials Today Communications*, Vol. 24, Sept 2020

Singleton, J.W., Cobb, G.R., Misak, H.E., and Kemnitz, R.A., "Quantifying the electrical behavior of carbon nanotube sheet enhanced with acid functionalization and polymer intercalation," *Results in Materials*, Vol. 5, March 2020.

Shelton, T.E., Willburn, Z.A., Hartsfield, C.R., Cobb, G.R., Cerri, J.T., and Kemnitz, R.A., "Effects of thermal process parameters on mechanical interlayer strength for additively manufactured Ultem 9085/" *Polymer Testing*, Vol. 81, Jan 2020.

KEYS, ANDREW S.

Associate Professor of Aerospace Engineering, Department of Aeronautics and Astronautics, AFIT Appointment Date: 2019 (AFIT/ENY); Dr. Keys earned his bachelor's and master's degrees in electrical engineering from Auburn University in 1988 and 1990, respectively, and earned his doctorate of philosophy in electrical engineering from the University of Alabama in Huntsville in 2002. Prior to joining the AFIT faculty in February of 2019, Dr. Keys was employed for over 27 years with the National Aeronautics and Space Administration's (NASA's) Marshall Space Flight Center (MSFC) where he served in multiple leadership and technology management positions. His research interests include the development of sensors and detectors for the purpose of space-based remote sensing, electro-optics and photonic technologies, optical and laser systems, radiation hardening of avionics and electronics, and the advancement of related space technologies. Dr. Keys is a member of AIAA. Tel. (937) 255-3636 x4747, email: Andrew.Keys@afit.edu

Sponsor Funded Research Projects

"Charge Dissipation and Power in Novel Heat Exchangers." Sponsor: AFRL/RQ. Funding: $5,000 - Keys 100%.

Refereed Conference Papers Accepted on the Basis of Abstract Review

Keys, A. S., Bettinger, R. A., Miller, S. K., Sheffield, C. A., Lomanno, C. P., "Balancing Project Management, Risk, and Educational Opportunities on the Grissom CubeSat Project," 2020 Small Satellite Conference, Logan, UT, August 2020.

Other Significant Research Productivity

Keys, A. S., Bettinger, R. A., Miller, S. K., Sheffield, C. A., "Development of the Grissom CubeSat Project," 44th AIAA Dayton-Cincinnati Aerospace Sciences Symposium (DCASS), Dayton, OH, March 2020.

KOMIVES, JEFFREY R., Lt Col
Assistant Professor of Aerospace Engineering, Department of Aeronautics and Astronautics, AFIT Appointment Date: 2016 (AFIT/ENY); BS, Aeronautical & Astronautical Engineering, Purdue University, 2003; MS, Aeronautical Engineering, Air Force Institute of Technology, 2009; PhD, Aerospace Engineering & Mechanics, University of Minnesota, 2016. Lt Col Komives' research interests include aerodynamics, hypersonics, and computational fluid dynamics. He is a developmental engineer with experience in simulation, test and evaluation, and electronic warfare. In his deployment to Operation Enduring Freedom he was responsible for Counter Remote Controlled-IED Electronic Warfare training across most of Afghanistan. Lt Col Komives is a member of Sigma Gamma Tau, AIAA, and Association of Old Crows. AFIT research center affiliation(s): [CSRA] and [CTISR.] Tel. (937) 255-3636 x4744, email: Jeffrey.Komives@afit.edu

Sponsor Funded Research Projects
"PACAF/PACOM Training, Consultation and Modeling & Simulation for Hypersonics." Sponsor: DRE. Funding: $75,000 - Komives 100%.

Refereed Journal Publications

Reinert, J. D., Candler, G. V., & Komives, J. R. (2020). *Simulations of unsteady three-dimensional hypersonic double-wedge flow experiments.* AIAA journal, 58(9).

Reinert, J.D., Candler, G.V., and Komives, J.R., "Simulations of Unsteady Three-Dimensional Hypersonic Double-Wedge Flow Experiments," *AIAAJ*, Vol. 58. Number 9, Sept 2020.

Refereed Conference Papers Accepted on the Basis of Abstract Review

Thompson, R. J., & Komives, J. R. (2019). Compressible Flow Through a Diffusing Serpentine Inlet Duct Assessed with Wall-Modeled Large Eddy Simulation. In *AIAA Aviation 2019 Forum* (p. 3702).

Elliott, O. S., Greendyke, R., Jewell, J. S., & Komives, J. R. (2019). Effect of CO2 Concentration in the Hypersonic Boundary Layer on Second Mode Disturbances. In *AIAA Aviation 2019 Forum* (p. 2851).

Elliott, O. S., Greendyke, R., Jewell, J. S., & Komives, J. R. (2019). Effect of Carbon-based Ablation Products on Boundary Layer Stability. In *AIAA Scitech 2019 Forum* (p. 0625).

Other Significant Research Productivity

Komives, J. R. (2019). Hypersonics in the Indo-Pacific. Invited Presentation, *1st NDIA Hypersonics Capabilities Conference.*

Crouch, T. E. & Komives, J. R. (2019) Direct Numerical Simulation of Roughness Induced Boundary Layer Transition on a 7° Half-Angle Cone at Mach 10. In *AIAA Defense 2019 Conference.*

KUNZ, DONALD L.
Professor of Aerospace Engineering, Department of Aeronautics and Astronautics, AFIT Appointment Date: 2003 (AFIT/ENY); BS, Syracuse University, 1971; MS, Georgia Institute of Technology, 1972; PhD, Georgia Institute of Technology, 1976; Dr. Kunz's research interests include rotorcraft dynamics, vibrations, and loads, structural dynamics, aero elasticity, flying qualities of UAVs, multibody dynamics, and computational structural mechanics. He has published more than 100 journal articles, conference papers, and technical reports. Prior to coming to AFIT, Dr. Kunz worked at the US Army Aero flight dynamics Directorate, McDonnell Douglas Helicopter Company, Old Dominion University, and the US Army Aviation and Missile Command. He is an Associate Fellow of AIAA, a member of AHS, and a licensed professional engineer in the Commonwealth of Virginia. Tel. (937) 255-3636 x4548, email: Donald.Kunz@afit.edu

Sponsor Funded Research Projects

"Research Support for Joint AFIT/TPS Test Management Projects." Sponsor: USAF Test Pilot School. Funding: $15,000 - Kunz 100%.

"Autonomous Flight Planning in Constrained Environments." Sponsor: AFRL/RQ. Funding: $15,000 - Kunz 100%.

"Autonomous Relational Maneuvering." Sponsor: AFRL/RQ. Funding: $30,000 - Kunz 50%, Pachter 50%.

"Basic Research with Integrated Flight Test." Sponsor: AFOSR. Funding: $95,769 - Kunz 50%, Reeder 20%, Cobb 20%, Crowe 10%.

Refereed Journal Publications

Callaghan, P.M. and Kunz, D.L., "Evaluation of Unmanned Aircraft Flying/Handling Qualities Using a Stitched Learjet Model," *Journal of Guidance, Control and Dynamics*, Open Access, November 2020. doi: http://arc.aiaa.org/doi/abs/10.2514/1.G004748.

Hope, D.N., and Kunz, D.L., "Investigation of Shock Motion in Transonic Flow Using an Oscillating, Straked, Delta Wing," *AIAA Journal*, Vol. 57, No. 10, October 2019. doi: http://arc.aiaa.org/doi/abs/10.2514/1.J057456.

Refereed Conference Papers Accepted on the Basis of Abstract Review

Stephens, S.S., Hess, J.A., and Kunz, D.L., "Optimal Control Approach to Terrain Following Trajectory Generation," AIAA 2020-0859, Guidance, Navigation and Control Conference, AIAA SciTech Forum, Orlando, Florida, January 2020, doi: 10.2514/6.2020-0859.

Stephens, S.S., Grandhi, R.V., and Kunz, D.L., "Modified Traveling Salesman Problem with Delivery Time Windows and Item Constraints," AIAA 2020-1088, Guidance, Navigation and Control Conference, AIAA SciTech Forum, Orlando, Florida, January 2020, doi: 10.2514/6.2020-1088.

Other Significant Research Productivity

Stephens, S.S., Casbeer, D.W., Kunz, D.L., Baker, W.P., and Hess, J.A. "Racetrack Pattern Autopilot with Arrival Time and Arrival Velocity Control," Dayton-Cincinnati Aerospace Sciences Symposium, Dayton, Ohio, March 2020.

LIEBST, BRADLEY S.
Professor of Aerospace Engineering and Head, Department of Aeronautics and Astronautics, AFIT Appointment Date: 1989 (AFIT/ENY); BS, Wichita State University, 1978; MS, Massachusetts Institute of Technology, 1979; PhD, Massachusetts Institute of Technology, 1981. Dr. Liebst's research interests include Eigen structure assignment and control, stability and control of aerospace vehicles, passive and active control of large flexible structures, and aircraft handling qualities. He has published over 30 articles and reports and chaired over 40 theses and dissertations. Prior to teaching at AFIT, Dr. Liebst was Assistant Professor of Aerospace Engineering for six years at the University of Minnesota where he was voted the 1987 Best Institute of Technology (U of M) Professor. Tel. (937) 255-3636 x4636, email: Bradley.Liebst@afit.edu

LINGENFELTER, ANDREW J., Maj
Assistant Professor of Aerospace Engineering, Department of Aeronautics and Astronautics, AFIT Appointment Date: 2016 (AFIT/ENY); BS, Mechanical Engineering, University of Nebraska – Lincoln, 2008; MEng, Industrial and Systems Engineering, University of Florida, 2011; PhD, Aeronautical Engineering, Air Force Institute of Technology, 2016. Maj Lingenfelter's research interests include aircraft survivability, weapons, weapons testing, and additive manufacturing. His previous research has focused on flow visualization and ballistically induced failure of aircraft fuel tanks. Maj Lingenfelter is a member of AIAA, Tau Beta Pi, and Sigma Gamma Tau. AFIT research center affiliation(s): [CSRA.] Tel. (937) 255-3636 x4282, email: Andrew.Lingenfelter@afit.edu

LITTLE, BRYAN D., Lt Col

Assistant Professor of Astronautical Engineering, Department of Aeronautics and Astronautics, AFIT Appointment Date: 2019 (AFIT/ENY); BS, Aerospace Engineering, University of Washington, 2004; MS, Astronautical Engineering, Air Force Institute of Technology, 2009; PhD, Astronautic Engineering, Purdue University, 2019. Lt Col Little's research interests include space domain awareness, astrodynamics, cis-lunar orbits, and satellite systems. Lt Col Little is a member of the American Astronautical Society and AIAA. AFIT research center affiliation(s): [CSRA.] Tel. (937) 255-3636 x4901, email: Bryan.Little@afit.edu

Refereed Journal Publications

Little, B. D., & Frueh, C. E. (2020). Space situational awareness sensor tasking: Comparison of machine learning with classical optimization methods. Journal of Guidance, Control, and Dynamics, 43(2), 262–273. https://doi.org/10.2514/1.G004279.

Little, B.D., Frueh, C.E. Multiple Heterogeneous Sensor Tasking Optimization in the Absence of Measurement Feedback. J Astronaut Science (2020). https://doi.org/10.1007/s40295-020-00232-1.

Little, B.D., and Frueh, C.E., "Space Situational Awareness Sensor Tasking: Comparison of Machine Learning with Classical Optimization Methods," *Journal of Guidance, Control, and Dynamics*, Vol. 43, Number 2, Feb 2020.

Little, B, and Jugroot, M., "Bimodal Propulsion System for Small Spacecraft: Design, Fabrication, and Performance Characterization," *Journal of Spacecraft and Rockets*, Vol. 57. Number 4, July 2020.

Refereed Conference Papers Accepted on the Basis of Abstract Review

Vasso, A. R., Cobb, R. G., Colombi, J. M., Little, B. D., Meyer, D. W., "Optimal Incorporation of Non-Traditional Sensors into the Space Domain Awareness Architecture," AMOS Technical Conference 202, Maui, HI, 17 Sep 20.

MEYER, DAVID W.
Adjunct Instructor of Aerospace Engineering, Department of Aeronautics and Astronautics, AFIT Appointment Date: 2015 (AFIT ENV), 2019 (AFIT ENY); BS, Mechanical Engineering, the Ohio State University, 1987; MS, Mechanical Engineering, Naval Postgraduate School, 1994; MS Operations Research, Naval Postgraduate School, 2007. Mr. Meyer's research interests include space domain awareness, model based systems engineering, space warfighting and strategy, modeling and simulation, combat modeling and high performance computing. AFIT research center affiliation: [CSRA.] Tel. (937) 255-3636 x4512, E-mail: David.Meyer@afit.edu

Refereed Conference Papers Accepted on the Basis of Abstract Review

Vasso, A. R., Cobb, R. G., Colombi, J. M., Little, B. D., Meyer, D. W., "Optimal Incorporation of Non-Traditional Sensors into the Space Domain Awareness Architecture," AMOS Technical Conference 202, Maui, HI, 17 Sep 20.

PALAZOTTO, ANTHONY N.
Distinguished Professor of Aerospace Engineering, Department of Aeronautics and Astronautics, AFIT Appointment Date: 1975 (AFIT/ENY); BS, New York University, 1955; MS, Brooklyn Polytechnic Institute, 1961; PhD, New York University, 1968. Dr. Palazotto's interests include nonlinear mechanics, shell analysis, finite elements, composite materials, viscoplasticity, and nonlinear dynamics. Dr. Palazotto is the co-author of a textbook, "The Nonlinear Analysis of Shell Structures," published in 1992 by the AIAA. In addition, he has authored 262 archival technical publications and more than 650 technical presentations and manuscripts. Dr. Palazotto received the Hetanyi Award in 1982 from the Society of Experimental Mechanics, the Cleary Award in 1981 from the Air Force Materials Lab, the Structures and Materials Award from the ASCE in 1986, and the AIAA Sustained Service Award in 2004. Dr. Palazotto is a Fellow of the ASCE, a Fellow of the AIAA, a Fellow of the American Academy of Mechanics, and a Fellow of the Engineering Mechanics Institute. He has advised over 185 MS theses, 37 Doctoral dissertations and 21 Post Docs. He is a registered Professional Engineer in the State of Ohio. He has been nominated for Honorary Fellow AIAA and NAE. Has one Patent granted. Tel. (937) 255-3636 x4599, email: Anthony.Palazotto@afit.edu.

Sponsor Funded Research Projects

"Nano Engineered Lightweight Composites for Improved Mechanical and EMI Shielding Properties: Experimental and Analytical Approaches (New)." Sponsor: Undisclosed. Funding: $64,440 - Palazotto 50%, Weeks 50%.

"Release of Lighter-Than-Air-Vehicles." Sponsor: AFRL/RQ. Funding: $35,992 - Palazotto 100%.

"Predictive Model for Behavior of Bolted Composite/Metallic Laminate Joint." Sponsor: AFRL/RQ. Funding: $23,507 - Palazotto 100%.

"Nano Engineered Lightweight Composites for Improved Mechanical and EMI Shielding Properties." Sponsor: Undisclosed. Funding: $42,960 - Palazotto 50%, Weeks 50%.

"Investigation of Blunt and Ogive-Nose Projectiles Impact at High Velocity." Sponsor: AFOSR. Funding: $48,134 - Palazotto 100%.

"Design and Analysis of a Lighter than Air Vehicle with an Internal Vacuum." Sponsor: AFOSR. Funding: $52,320 - Palazotto 100%.

"High Strain Rate Wear Model (Continuation)." Sponsor: AFRL/RQ. Funding: $25,000 - Palazotto 100%.

Refereed Journal Publications

Liu, B.C., Palazotto, A., Vivek, A., Daehn, G.S., "Impact Welding Of Ultra-High-Strength Stainless Steel in Wrought Vs. Additively Manufactured Forms," *International Journal of Advanced Manufacturing Technology*, Vol. 104, Issue 9-12, pp. 4593-4604, Oct 2019.

Abu Al-Rub, R.K., Lee, D., Khan, K.A., and Palazotto, A.N., "Effective Anisotropic Elastic and Plastic Yield Properties of Periodic Foams Derived from Triply Periodic Schoen's I-WP Minimal Surface," *Journal of Engineering Mechanics*, Vol. 146, Issue 5, May 2020.

Wonnell, L.B., Palazotto, A., and Sritharan, S, "Incorporation of Morphing Theory to Aerodynamic Flows," *Journal of Engineering Mechanics*, Volume 146, Issue 8, Aug 2020.

POLANKA, MARC D.

Professor of Aerospace Engineering, Department of Aeronautics and Astronautics, AFIT Appointment Date: 2009 (AFIT/ENY); BS, Mechanical Engineering, University of Dayton, 1992; MS, Mechanical Engineering, Stanford University, 1993; PhD, Mechanical Engineering, University of Texas, 1999. Prior to accepting a position with AFIT, Dr. Polanka served 17 years in Turbine Engine Division of the Air Force Research Laboratory's Propulsion Directorate. His research interests include aspects of heat transfer, combustion, and fluid mechanics focusing on experimental applications involving turbine and combustor aerodynamics and cooling techniques. He has been published in a variety of journals including the AIAA Journal of Propulsion and Power, the ASME Journal of Turbomachinery and the Journal of Engineering for Gas Turbines and Power. Dr. Polanka also has two patents to his credit. He is an Associate Fellow of the AIAA, the past Section Chair of the Dayton-Cincinnati Section of the AIAA, and the Honors and Awards Chair for the same section. Dr. Polanka serves as the Chair of the AIAA Associate Fellows Selection Committee and is the Faculty representative for the AFIT Student Section branch of AIAA. He is also a Fellow of the ASME and serves as the Chair of the K-14 Heat Transfer Committee of the International Gas Turbine Institute where he is also a past Point Contact for the annual Turbo Expo conference. He is currently serving as an Associate Editor of the ASME Journal of Engineering for Gas Turbines and Power. Tel. (937) 255-3636 x4714, email: Marc.Polanka@afit.edu

Sponsor Funded Research Projects

"AFIT Combustion Laboratory Program Concerning UCC, RDE, Small Engines, and Film Cooling Phenomenon." Sponsor: AFRL/RQ. Funding: $25,000 - Polanka 100%.

Refereed Journal Publications

DeMarco K.J.; Bohan B.T.; Polanka M.D.; Rutledge J.L.; Akbari P.J., "Analysis of an Additively Manufactured Cooled Ultra Compact Combustor Vane," *Journal of Thermal Science and Engineering Applications,* vol. 11 (10) pg. 051021 1-9. Oct 2019.

Bohan, B.T., Polanka, M.D., and Rutledge, J.L., "Fluidic Oscillators Injecting From Backward-Facing Steps," *Journal of Fluids Engineering,* Vol 141, No. 12, 2019, pg. 121201 1-17.

Huff, R., Polanka, M.D., McClearn, M.J., Schauer, F.R, Fotia, M.L., Hoke, J.L., "Design and Operation of a Radial Rotating Detonation Engine," *Journal of Propulsion and Power*. Vol 35, No. 6, 2019, pp. 1143-1150.

Bohan, B.T. and Polanka, M.D., "Experimental Analysis of an Ultra-Compact Combustor Powered Turbine Engine," *Journal of Engineering for Gas Turbines and Power*, vol. 142 (5) pg. 051014 1-10, May 2020.

Bohan, B.T., and Polanka, M.D., "The Effect of Scale and Working Fluid on Sweeping Jet Frequency and Oscillation Angle," *Journal of Fluids Engineering,* Vol 142, No. 6, June 2020, pg. 061206 1-9.

Ausserer, J.K., Polanka, M.D., Deutsch, M.J., Baranski, J.R., and Rein, K.D., "In-Cylinder Temperature Measurements in a 55 cm^3 Two-Stroke Engine via Tunable Laser Absorption Spectroscopy," *Journal of Engineering for Gas Turbines and Power*, vol. 142 (9) pg. 091011 1-8, Sept 2020.

Fischer, J.P, McNamara, L.J., Rutledge, J.L., Polanka, M.D., "Scaling Flat Plate, Low Temperature Adiabatic Effectiveness Results Using the Advective Capacity Ratio," *Journal of Turbomachinery,* Published Online: March 3, 2020.

Refereed Conference Papers Accepted on the Basis of Full Paper Review

Bohan, B.T., Polanka, M.D., and Goss, L.P., "Circumferential Combustor Cavity Flow Fields With Decreasing Core Flow," ASME Turbo Expo, GT2020-14151, London, England, June 22-26, 2020.

Akbari, P.J., Brady, G.M., Polanka, M.D., and Sell, B.C., "Experimental Investigation of a Radial Wave Engine Utilizing a Rotary Valve Pressure Gain Combustor" ASME Turbo Expo, GT2020-14428, London, England, June 22-26, 2020.

McNamara, L.J., Fischer, J.P., Rutledge, J.L., and Polanka, M.D., "Scaling Considerations for Thermal and Pressure Sensitive Paint Methods Used to Determine Adiabatic Effectiveness" ASME Turbo Expo, GT2020-16129, London, England, June 22-26, 2020.

Refereed Conference Papers Accepted on the Basis of Abstract Review

Akbari, P.J., Tait, C.J., Brady, G.M., Polanka, M.D., and Sell, B.C., "Enhancement of the Radial Wave Engine" 55th AIAA/SAE/ASEE Joint Propulsion Conference, AIAA 2019-4037, Aug 19-22, 2019.

Dechert, J.R., Polanka, M.D., Schauer, F.R., Schumaker, S.A., Sell, B.C., and Fotia, M.L., "Development of a Small Scale Rotating Detonation Engine," AIAA Scitech 2020 Forum, AIAA-2020-0127, 6-10 January 2020.

Muraleetharan, K., Polanka, M.D., Schauer F.R., and Huff, R., "Detonation Confinement using a Flat Channel Plate in a Radial Rotating Detonation Engine," AIAA Scitech 2020 Forum, AIAA-2020-0200, 6-10 January 2020.

Holobeny, D., Polanka, M.D., and Bohan, B.T., "Analysis of a Compact Combustor for Use in a JetCat P90 RXi," AIAA Scitech 2020 Forum, AIAA-2020-0625, 6-10 January 2020.

Staton, B.M., Bohan, B.T., and Polanka, M.D., "Flow Characterization and Combustion Analysis for a Disk-Oriented Engine," AIAA Scitech 2020 Forum, AIAA-2020-0626, 6-10 January 2020.

Macias, R.A., Polanka, M. D., and Rutledge, J.L., "Effects of High Freestream Turbulence on Film Cooling Effectiveness of Shaped Holes" AIAA Scitech 2020 Forum, AIAA-2020-0636, 6-10 January 2020.

DePaola, R. Schauer, F.R., Polanka, M.D., and Grannan, N.D., "Micro-Turbine Performance Study," AIAA Scitech 2020 Forum, AIAA-2020-0869, 6-10 January 2020.

Editorships in Professional Journals

Associate Editor of the ASME Journal of Engineering for Gas Turbines and Power

Associate Editor for JANNAF Journal

Patents Awarded

Pickl, C.W., Rutledge, J.L., Polanka, M.D., Harkless, C., Crabtree, M., "Wind Tunnel Wake Generator," 12 May 2020, US Patent 10,648,882 B2.

Patent Applications

Tait, C.J., Akbari, P.J., Polanka, M.D., Sell, B.C., Filed 13 Mar, 2019,"Seal For A Wave Rotor Disk Engine," Application AFD 1878P.

Bohan, B.T., Polanka, M.D., Staton, B.M., Filed 5 Jun, 2019, "Disk Engine with Circumferential Swirl Radial Combustor," Application AFD 1976P.

Other Significant Research Productivity

Dechert, J.R., Schauer, F.R., Polanka, M.D., Schumaker, S.A., and Sell, B.C., "Development of a Small Scale RDE," 45DCASS-014, Sinclair Community College, Dayton, OH, 3 Mar, 2020.

Holobeny, D., Bohan, B.T., Polanka, M.D., "Analysis of a Compact Combustor for Use in a JetCat P90 RXi," 45DCASS-021, Sinclair Community College, Dayton, OH, 3 Mar, 2020

Muraleetharan, K., Polanka, M.D., Schauer, F.R., Huff, R., "Detonation Confinement in a Radial Rotating Detonation Engine," 45DCASS-022, Sinclair Community College, Dayton, OH, 3 Mar, 2020.

Macias, R.A., Polanka, M.D., Rutledge, J.L., "Effects of High Freestream Turbulence on Film Cooling Effectiveness of Shaped Holes," 45DCASS-031, Sinclair Community College, Dayton, OH, 3 Mar, 2020

Staton, B.M., Bohan, B.T., Polanka, M.D., "Design and Analysis of a Disk-Oriented Engine Combustor," 45DCASS-086, Sinclair Community College, Dayton, OH, 3 Mar, 2020.

REEDER, MARK F.
Professor of Aerospace Engineering, Department of Aeronautics and Astronautics, AFIT Appointment Date: 2002 (AFIT/ENY); BS, Mechanical Engineering, West Virginia University, 1989; MS, Mechanical Engineering, The Ohio State University, 1991; PhD, Mechanical Engineering, The Ohio State University, 1994. Prior to accepting a position with AFIT, Dr. Reeder served as an NRC Research Associate at NASA Glenn and subsequently as the manager of Research and Development for a manufacturer of industrial mixing equipment. His research interests include all aspects of fluid mechanics with an emphasis on experimental applications involving external aerodynamics, mixing enhancement, hypersonics, and propulsion. Publications include characterizations of store separation from a cavity using pressure sensitive paint and measurements relating to several types of aircraft using 6-DOF balances, particle image velocimetry, filtered Rayleigh scattering, and other diagnostic tools. Dr. Reeder has also recently published in the area of low temperature ablation in a supersonic flow as applied to thermal management systems for space access vehicles. He has been published in a variety of journals including Experiments in Fluids, Journal of Fluid Mechanics, The AIAA Journal, The AIAA Journal of Propulsion and Power, AIAA Journal of Aircraft, the AIAA Journal of Spacecraft and Rockets, Physics of Fluids, NASA Tech Briefs, the AIChE Journal, and Chemical Engineering

Progress. Dr. Reeder also has four patents to his credit, is a licensed Professional Engineer in the State of Ohio, and is an elected member of the Academy of Distinguished Alumni, Department of Mechanical and Aerospace Engineering, West Virginia University. He currently serves on the editorial board of the International Journal of Micro Air Vehicles. Dr. Reeder is an Associate Fellow of the AIAA and a member of ASME. Tel. (937) 255-3636 x4530, email: Mark.Reeder@afit.edu

Sponsor Funded Research Projects

"Force and Moment Coefficients for Miniature Self-Defense Munition (MSDM) Geometry." Sponsor: Lockheed Martin. Funding: $40,000 - Reeder 100%.

"Drop Testing in the AFIT Small Supersonic Tunnel with Ejection Mechanism (Revised)." Sponsor: AFRL/RQ. Funding: $19,200 - Reeder 40%, Freeman 30%, Walker 30%.

"Turbulence Modeling in Hypersonic Flows." Sponsor: USAFA. Fusafng: $50,000 - Reeder 66%, Komives 34%. [CTISR]

"Support of High Speed Strike Weapon Technology Maturation Activities." Sponsor: AFRL/RW. Funding: $30,386 - Reeder 50%, Komives 50%.

"Support of High Speed Strike Weapon Technology Maturation Activities." Sponsor: AFRL/RW. Funding: $19,614 - Reeder 50%, Komives 50%.

Refereed Journal Publications

Semmelmayer, Frank*, Reeder, Mark F., and Seymour, Richard, "Determination of a Probability Distribution for Pressure Scanner Noise and Digitization Uncertainty Reporting," *Measurement Science and Technology*, Vol. 30, No. 11, November 2019, Paper 115011, 11 pages.

Paxton, J.C.*, Reeder, M.F.**,** Dean, E.F.*, Cahill, D.A.*, Rutledge, J.L., Petrosky, J.C., "Effect of Upstream Heating Examined Via the Wind-Tunnel Enhanced Experimental Irradiation Test System," *Journal of Radiation Effects, Research and Engineering*, Vol. 38, No. 1, Mar 2020, pp. 280-290 (Dist. C).

Chin, D., Granlund, K., Maatz, I. , Schmit, R.F., and Reeder, M.F., "Stochastic Store Trajectory of Ice Models from a Cavity into Supersonic Flow," *Journal of Aircraft*, Volume 56, Number 4, July 2019.

Conference Papers Accepted on the Basis of Abstract Review

Demoret, A.C., Walker, M.M., Reeder, M.F., "The Effect of Passive Boundary-Layer Fences on Delta Wing Performance at Low Reynolds Number," *AIAA Paper 2020-0785*, AIAA Scitech 2020 Forum, Orlando, FL, January 2020.

LaBuda, D., Komives, J., Reeder, M.F., Borg, M.P., Jewell, J.S., "High-Speed Schlieren Visualization of Mach 6 Flow Past a Cone with Varied Parameters," *AIAA Paper 2020-2968*, AIAA Aviation 2020 Forum, June 2020.

RUGGLES-WRENN, MARINA B.
Professor of Aerospace Engineering, Department of Aeronautics and Astronautics, AFIT Appointment Date: 2003 (AFIT/ENY); BS, Polytechnic Institute of New York, 1981; MS, Rensselaer Polytechnic Institute, 1983; PhD, Rensselaer Polytechnic Institute, 1987. Dr. Ruggles-Wrenn's interests center on mechanics of materials and structures, including experimental investigation of material behavior in extreme environments, advanced structural materials, high-temperature structural design methods, and viscoplasticity. She has published over 170 peer reviewed scientific publications. Dr. Ruggles-Wrenn received several research and best paper awards; Stinson Trophy of the National Aeronautic Association, Col Gage H. Crocker Outstanding Professor Award, as well as the AFIT Instructor of the Quarter Award. Prior to joining AFIT, she was a research scientist at the Oak Ridge National Laboratory (1987-2003). Dr. Ruggles-Wrenn is a member of the Editorial Board of Applied Composite Materials and an Associate Technical Editor of the ASME Journal of Pressure Vessel Technology. She is a Fellow of the American Society of Mechanical

Engineers (ASME) and a member of the American Ceramic Society. Tel. (937) 255-3636 x4641, email: Marina.Ruggles-Wrenn@afit.edu

Sponsor Funded Research Projects

"Properties and Performance of Novel Nano-Engineered Unitized Composites for Aerospace Systems." Sponsor: Undisclosed. Funding: $43,510 - Ruggles-Wrenn 100%.

"Creep of polycrystalline YAG and LuAG at elevated temperature in air and steam." Sponsor: AFRL/RX. Funding: $20,000 - Ruggles-Wrenn 100%.

"Properties and Performance of Novel Nano-Engineered Unitized Composites for Aerospace Systems." Sponsor: Undisclosed. Funding: $29,006 - Ruggles-Wrenn 100%.

"Properties and Performance of Novel Nano-Engineered Unitized Composites for Aerospace Systems." Sponsor: AFOSR. Funding: $55,000 - Ruggles-Wrenn 100%.

Refereed Journal Publications

M. B. Ruggles-Wrenn and T. M. Williams, "Fatigue of a SiC/SiC ceramic composite with an ytterbium-disilicate environmental barrier coating at elevated temperature," International Journal of Applied Ceramic Technology, Vol. 17, 2020, pp. 2074-2082.

S. J. Robertson, M. B. Ruggles-Wrenn, R. S. Hay, T. Shillig, R. Mitchell, B. Kroeger, L. Gumucio, "Static fatigue of Hi-Nicalon™-S fiber at elevated temperature in air, steam and silicic-acid-saturated steam," Journal of the American Ceramic Society, Vol. 103, 2020, pp. 1358-1371.

M. B. Ruggles-Wrenn and T. A. Wallis, "Creep in interlaminar shear of an Hi-Nicalon™/SiC-B_4C composite at 1300°C in air and in steam," Journal of Composite Materials, Vol. 54(14), 2020, pp. 1819-1829.

M. B. Ruggles-Wrenn, S. N. Minor, C. P. Przybyla, and E. L. Jones, "Creep of a Nextel™720/alumina ceramic composite containing an array of small holes at 1200°C in air and in steam," International Journal of Applied Ceramic Technology, Vol. 16, 2019, pp. 3-13.

Refereed Conference Papers Accepted on the Basis of Full Paper Review

T. M. Williams and M. B. Ruggles-Wrenn, "Fatigue of an advanced SiC/SiC ceramic matrix composite with an environmental barrier coating at elevated temperature in air and in steam," GT2020-15604, Proceedings of ASME Turbo Expo 2020, London, England, June 22-26, 2020.

T. A. Wallis and M. B. Ruggles-Wrenn, "Creep in interlaminar shear of an advanced SiC/SiC composite with an oxidation-inhibited matrix at 1300°C in air and in steam," GT2020-14124, Proceedings of ASME Turbo Expo 2020, London, England, June 22-26, 2020.

S. J. Robertson, M. B. Ruggles-Wrenn, R. S. Hay, T. Shillig, R. Mitchell, B. Kroeger, L. Gumucio, "Static Fatigue of Hi-Nicalon™-S Fiber at Elevated Temperature in Air, Steam and Silicic-Acid-Saturated Steam," ICACC-S1-005-2020, Proceedings of the 44th International Conference & Exposition on Advanced Ceramics & Composites, Daytona Beach FL, January 26-31, 2020.

M. B. Ruggles-Wrenn and T. A. Wallis, "Creep in interlaminar shear of a Hi-Nicalon™/SiC-B_4C composite at 1300°C in air and in steam," ICACC-S1-002-2020, Proceedings of the 44th International Conference & Exposition on Advanced Ceramics & Composites, Daytona Beach FL, January 26-31, 2020.

Editorships in Professional Journals

Assistant Editor-in-Chief, Applied Composite Materials – International Journal for the Science and Application of Composite Materials.

Member of the Editorial Board, Applied Composite Materials – International Journal for the Science and Application of Composite Material.

Associate Technical Editor, ASME Journal of Pressure Vessel Technology.

RUTLEDGE, JAMES L., Lt Col
Associate Professor of Aerospace Engineering; Department of Aeronautics and Astronautics, AFIT Appointment Date: 2011 (AFIT/ENY); BS, Mechanical Engineering, University of Texas at Austin, 2002; MS, Mechanical Engineering, University of Texas at Austin, 2004; PhD, Aeronautical Engineering, Air Force Institute of Technology, 2009. Lt Col Rutledge's research interests include experimental and computational investigations of gas turbine heat transfer, unsteady fluid mechanics, inverse heat transfer and aerothermodynamics. He holds two patents, has published 33 archival journal articles and was awarded the Rohsenow Prize in 2008 by ASME and ASME Best Paper awards in 2017 and 2019. Lt Col Rutledge is a fellow of ASME and a member of the ASME K-14 Gas Turbine Heat Transfer Committee, AIAA, and Tau Beta Pi. He is an associate editor for the ASME Journal of Turbomachinery, a registered professional engineer in the State of Texas and has deployed to Afghanistan in support of Operation Enduring Freedom. AFIT research center affiliation(s): [CSRA.] Tel. (937) 255-3636 x4734, email: James.Rutledge@afit.edu

Sponsor Funded Research Projects
"Advanced Film Cooling Development." Sponsor: AFRL/RQ. Funding: $11,160 - Rutledge 100%.

Refereed Journal Publications

Fischer, J.P., McNamara, L.J., Rutledge, J.L., Polanka, M.D., 2020, "Scaling Flat-Plate, Low-Temperature Adiabatic Effectiveness Results Using the Advective Capacity Ratio," *Journal of Turbomachinery*, Vol. 142, No. 8, August 2020.

Bryant, C.E. and Rutledge, J.L., 2020, "A Computational Technique to Evaluate the Relative Influence of Internal and External Cooling on Overall Effectiveness," *Journal of Turbomachinery*, Vol. 142, No. 5, May 2020.

Paxton, J.C., Reeder, M.F., Dean, E.F., Cahill, D.A., Rutledge, J.L., Petrosky, J.C., 2020, "Effect of Upstream Heating Examined Via the Wind-Tunnel Enhanced Experimental Irradiation Test System," *Journal of Radiation Effects, Research and Engineering*, Vol. 38, No. 1, Mar 2020, pp. 280-290.

Bohan, B.T., Polanka, M.D., Rutledge, J.L., 2019, "Sweeping Jets Issuing From the Face of a Backward-Facing Step," *Journal of Fluids Engineering*, Vol. 141, No. 12, December 2019.

DeMarco, K.J., Bohan, B.T., Polanka, M.D., Rutledge, J.L., Akbari, P., 2019, "Analysis of an Additively Manufactured Cooled Ultra Compact Combustor Vane," *Journal of Thermal Science and Engineering Applications*, Vol. 11, No. 5, October 2019.

Refereed Conference Papers Accepted on the Basis of Full Paper Review

Wiese, C.J., Rutledge, J.L., 2020, "The Effects of Specific Heat and Viscosity on Film Cooling Behavior," *ASME Turbo Expo 2020*, Paper No. GT2020-15253.

Fuqua, M.N., Rutledge, J.L., 2020, "Film Cooling Superposition Theory for Multiple Rows of Cooling Holes with Multiple Coolant Temperatures," *ASME Turbo Expo 2020*, Paper No. GT2020-15252.

McNamara, L.J., Fischer, J.P., Rutledge, J.L., Polanka, M.D., 2020, "Scaling Considerations for Thermal and Pressure Sensitive Paint Methods Used to Determine Adiabatic Effectiveness," *ASME Turbo Expo 2020*, Paper No. GT2020-16129.

Refereed Conference Papers Accepted on the Basis of Abstract Review

Macias, R., Polanka, M.D., Rutledge, J.L., 2020, "Effects of High Freestream Turbulence on Film Cooling Effectiveness of Shaped Holes," AIAA Aerospace Sciences Meeting, AIAA SciTech Forum.

Editorships in Professional Journals

Associate Editor, *ASME Journal of Turbomachinery*

Patents Awarded

Pickl, C.W., Rutledge, J.L., Polanka, M.D., Harkless, C., Crabtree, B., 12 May 2020, "Wind Tunnel Wake Generator," U.S. Patent No. 10,648,882 B2.

Patent Applications

Rutledge, J.L., Fuqua, M.N., Bryant, C.E., "Energy Separation Turbine Cooling Method, application filed May 2020.

SCHAUER, FRED

Associate Professor of Aerospace Engineering, Department of Aeronautics and Astronautics, AFIT Appointment Date: Jan 2019 (AFIT/ENY); BS, Mechanical Engineering, University of Dayton, 1993; Ph.D., Mechanical Engineering, University of Illinois at Urbana-Champaign, 1998; Air War College 2008. Dr. Schauer's research interests include energy, propulsion, and power - in particular, he is active in developing novel cycles. From 1997-2019, he served as the principal investigator for AFRL's in-house detonation propulsion research program. Starting from AF sponsored dissertation research on laser diagnostics and modeling flame/turbulence interactions, he eventually led the Propulsion and Power Advanced Concepts Group, which includes of the Detonation Engine Research Facility and the Small Engine Research Laboratory. Prior to joining AFIT fulltime, Dr. Schauer served as a research advisor for numerous M.S. and Ph.D. students and maintains collaborations with other research institutions including AFRL, NASA, DOE, and academia. His research group has published extensively and been recognized by AIAA, ASME, AFOSR, and AFRL including the AFRL Commander's Cup and Innovation Award, two time winners of the AFRL Science & Technology Achievement Award, the ASME Air breathing Propulsion Award and finalists for both the Collier Trophy and Aviation Laureate. Dr. Schauer is an AFRL Fellow and was named Air Force Scientist of the Year and AIAA Engineer of the Year. Tel. (937) 255-3636 x4204, email: Fred.Schauer@afit.edu

Sponsor Funded Research Projects

"Combustion and Energy Conversion for Novel Cycles." Sponsor: AFRL/RQ. Funding: $20,000 - Schauer 100%.

Refereed Journal Publications

"Experimental Inlet Diffuser/Rotating Detonation Engine Coupling: Part II - Impact of Operating Mode on Pressure Recovery, "M. L. Fotia, J. Hoke, A. Knisely, M. McClearn, F. Schauer, JANNAF Journal, Vol. 10, No. 1, 2019, Paper No. 2020-0001C.

"Experimental Investigation of Inlet Diffuser/Rotating Detonation Engine Coupling: Part I," A. Knisely, M. L. Fotia, J. Hoke, M. McClearn, F. Schauer, JANNAF Journal, Vol. 10, No. 1, 2019, Paper No. 2020-0001B.

"Experimental Study of the Ignition of Liquid Fuels in Rotating Detonation Engines," M. L. Fotia, J. Hoke, F. Schauer, JANNAF Journal, Vol. 10, No. 1, 2019.

Refereed Conference Papers Accepted on the Basis of Abstract Review

"Detonation Confinement using a Flat Channel Plate in a Radial Rotating Detonation Engine," Kavi Muraleetharan, Marc D. Polanka, Frederick R. Schauer and Riley Huff, 6-10 January 2020AIAA Scitech 2020 Forum, https://doi.org/10.2514/6.2020-0200.

"Micro-Turbine Performance Study," Richard DePaola, Frederick R. Schauer, Marc D. Polanka and Nicholas D. Grannan, 6-10 January 2020AIAA Scitech 2020 Forum, https://doi.org/10.2514/6.2020-0869.

"Quantification of the Loss Mechanisms of a Ram Rotating Detonation Engine," Thomas A. Kaemming, Matthew L. Fotia, John Hoke, Stephen A. Schumaker and Frederick R. Schauer, 6-10 January 2020AIAA Scitech 2020 Forum, https://doi.org/10.2514/6.2020-0927.

"Development of a Small Scale Rotating Detonation Engine," Joseph R. Dechert, Marc D. Polanka, Frederick R. Schauer, Stephen A. Schumaker, Brian Sell and Matthew L. Fotia, 6-10 January 2020AIAA Scitech 2020 Forum, https://doi.org/10.2514/6.2020-0127.

"Design, Analysis, and Testing of a Low-Cost, Additively-Manufactured, Single-Use Compressor," Aaron Bauer, Frederick R. Schauer, Gabriel Walker, Daniel Gillaugh, Ryan Kemnitz, Brian T. Bohan, Adam T. Holley and John Hoke, 6-10 January 2020AIAA SciTech 2020 Forum, https://doi.org/10.2514/6.2020-0125.

THOMAS, LEVI M., Maj

Associate Professor of Aerospace Engineering, Department of Aeronautics and Astronautics, AFIT Appointment Date: 2017 (AFIT/ENY); BS, Aeronautical Engineering, United States Air Force Academy, 2006; MS, Aeronautical Engineering Air Force Institute of Technology, 2009; AA, Foreign Language, Defense Language Institute, 2011; PhD, Mechanical Engineering, Purdue University, 2017. Maj Thomas deployed to Iraq in 2018 in support of Operation Inherent Resolve. Research interests include optical diagnostics, high-speed measurement techniques, and combustion. He has experience as an intelligence analyst (air-to-air weapons), as a combustion research engineer (detonation combustion), and as an exchange officer working with the German Aerospace Center (combustion physics). Previous research includes detonation measurements as well as laser-based velocity and temperature measurements. Professional memberships include AIAA, ASME, and the Combustion Institute, and Maj Thomas is a registered professional engineer in the state of Colorado. Tel. (937) 255-3636 x4500, email: Levi.Thomas@afit.edu

Sponsor Funded Research Projects

"Ballistic Properties of Additively Manufactured Structures." Sponsor: DOT&E. Funding: $83,000 - Thomas 100%.

"Optical investigation of liquid fuel injection in a detonation combustor." Sponsor: AFRL/RQ. Funding: $5,000 - Thomas 100%.

WALKER, MICHAEL, M., Lt Col

Assistant Professor of Aerospace Engineering, Department of Aeronautics and Astronautics, AFIT Appointment Date: 2018 (AFIT/ENY); BS, Aeronautical Engineering, United States Air Force Academy, 2003; MS, Aeronautical Engineering, Air Force Institute of Technology, 2007; MBA, Amberton University, 2008; PhD, Aerospace Engineering, The Ohio State University, 2018. Lt Col Walker's research interests include low-speed aerodynamics, swept-wing performance, active flow control, experimental fluid mechanics, aircraft combat survivability, and composite armor testing. He is a developmental engineer with experience at the Air Force Research Laboratory (AFRL), Hanscom AFB; the National Air and Space Intelligence Center (NASIC), Wright-Patterson AFB; the Launch and Range Systems Directorate (LRS), Los Angeles AFB; and deployed to Kandahar Airfield, Afghanistan in support of Operation Enduring Freedom. Lt Col Walker is a member of Sigma Gamma Tau and AIAA. Tel. (937) 255-3636 x4745, email: Michael.Walker@afit.edu

Sponsor Funded Research Projects

"Aircraft Combat Survivability Education and Research." Sponsor: DOT&E. Funding: $24,000 - Walker 100%.

Refereed Conference Papers Accepted on the Basis of Abstract Review

Demoret, A. C., Walker, M. M., Reeder, M. F. "The Effect of Passive Boundary-Layer Fences on Delta Wing Performance at Low Reynolds Number." AIAA SciTech, Orlando FL, AIAA 2020-1218, 5 Jan 2020. https://doi.org/10.2514/6.2020-0785.

Keane, M. P., Lingenfelter, A. J., Walker, M. M., Hill, R. R., "Ballistic Limit Shot Dependency Testing in Composite Materials." AIAA SciTech, Orlando FL, AIAA 2020-0785, 5 Jan 2020. https://doi.org/10.2514/6.2020-1218.

WIESEL, WILLIAM E., Jr.
Professor of Astronautical Engineering, Department of Aeronautics and Astronautics, AFIT Appointment Date: 1977 (AFIT/ENY); BS, University of Massachusetts, 1970; MS, Harvard University, 1972; PhD, Harvard University, 1974. Dr. Wiesel's research interests include applications of dynamical systems theory to orbital mechanics and astrodynamics, especially KAM theory; estimation and control, planetary astronomy, stability theory, and optimal control. He is the author of Spaceflight Dynamics, a leading introductory text on astronautical engineering. Dr. Wiesel has authored over 50 technical papers and has been a member of the department for 40 years. AFIT research center affiliation(s): [CSRA.] Tel. (937) 255-3636 x4312, email: William.Wiesel@afit.edu

Wiesel, W. E. "Onboard Satellite Cluster Navigation," in PA review.

Wiesel, W.E. "Hill's Lunar Theory Revisited," presented at the AAS/AIAA Astrodynamics Conference, (Virtual), July 2020.

Craft, C.T., and Wiesel, W.E., "Impulsive Control of Earth Satellites on Low-Eccentricity Kolmogorov-Arnold-Moser Tori," *Journal of Guidance, Control, and Dynamics*, Volume 42, Number 10, Oct 2019.

ZAGARIS, COSTANTINOS, Maj
Assistant Professor of Astronautical Engineering, Department of Aeronautics and Astronautics, AFIT Appointment Date: 2018 (AFIT/ENY); B.S. Aerospace Engineering, Virginia Tech (2007); M.S. Astronautical Engineering, Air Force Institute of Technology (2012); Ph.D. Astronautical Engineering, Naval Postgraduate School (2018). His research interests include autonomous spacecraft guidance, spacecraft relative motion dynamics, optimal control, and reachability. Maj Zagaris has previous experience in flight test (Edwards AFB), acquisition and launch of ground-based launch vehicles (Kirtland AFB), and managing research in spacecraft autonomy, control, and navigation technologies (Kirtland AFB). He is a member of AIAA and IEEE. Tel. (937) 255-3636 x4774, email: Costantinos.Zagaris@afit.edu

Sponsor Funded Research Projects

"Autonomous Mission Planning of Multi-Agent Systems." Sponsor: AFRL/RY. Funding: $40,020 - Zagaris 50%, Leishman 50%. [ANT]

"Autonomous Swarm Resilience in the Presence of Subsystem Failure (Unreliable Swarm)." Sponsor: AFRL/RV. Funding: $20,200 - Zagaris 100%. [CSRA]

Refereed Journal Publications

Zagaris, C., and Romano, M., "Autonomous Spacecraft Rendezvous with a Tumbling Object via Model Predictive Control," submitted to *AIAA Journal of Guidance Control and Dynamics*, Sep 2020 (under review).

Refereed Conference Papers Accepted on the Basis of Abstract Review

Zagaris, C., and Hess, J.A., " Rapid Reachability Analysis of Single Impulse Spacecraft Relative Motion Maneuevers," 2020 AAS/AIAA Astrodynamics Specialist Conference, AAS 20-468.

Saunders, D., Zagaris, C., Hess, J.A., and Cobb, R.G., "Autonomous Cooperative Optimal Control of Multi-Agent Satellite Formations," 2020 AAS/AIAA Astrodynamics Specialist Conference, AAS 20-492.

Bishop, B., Cobb, R.G., Zagaris, C., "Optimal Trajectory Generation for Multi-Body, Flexible Systems with Vibration Compensation via Pseudo spectral Methods," 2020 AAS/AIAA Astrodynamics Specialist Conference, AAS 20-692.

Harris, W., Cobb, R.G., Zagaris, C., "A method of Visual Servo Control Using Estimated Surface Normal Vectors for Final Approach with Unknown Target Spacecraft," 2020 AAS/AIAA Astrodynamics Specialist Conference, AAS 20-667.

Other Significant Research Productivity

Becker, J. and Zagaris, C., "Autonomous Constrained Spacecraft Inspection via Model Predictive Control," 45th Dayton-Cincinnati Aerospace Sciences Symposium, Sinclair Community College, Dayton, OH, 3 Mar, 2020.

Hess, J.A., and Zagaris, C., "Limitations of Relative Satellite Motion State Transition Matrix Impulsive Maneuvering Algorithms," 45th Dayton-Cincinnati Aerospace Sciences Symposium, Sinclair Community College, Dayton, OH, 3 Mar, 2020.

Zagaris, C., "Constrained Spacecraft Attitude Reorientation via Model Predictive Control," invited seminar presented at AFRL/RVSW Tech Talk series, Oct 2020.

5.2. DEPARTMENT OF ENGINEERING PHYSICS

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Fax: (937) 656-6000, DSN 786-6000
Homepage: https://www.afit.edu/ENP/

5.2.1. DOCTORAL DISSERTATIONS

CAMPBELL, BRITTANY, D., Evaluation of Multifunctional Composites Designed for Directed Energy and Ionizing Radiation Threats. AFIT-ENP-MS-20-M-087. Faculty advisor: Dr. John W. McClory. Sponsor: AFRL/RV.

OLESEN, ROBERT, J., Low-Information Radiation Imaging using Rotating Scatter Mask Systems and Neural Network Algorithms. AFIT-ENP-DS-20-S-028. Faculty Advisor: Maj. James E. Bevins. Sponsor: DTRA. [NEAT]

5.2.2. MASTER'S THESES

BAILEY, BRANDON, M., Next-Generation Air Force Weather Metrics Via Bayes Cost Analysis. AFIT-ENP-MS-M-077. Faculty Advisor: Lt. Col. Andrew J. Geyer. Sponsor: N/A.

BATE, TIMOTHY, J., The Design of a Continuous Wave Molecular Nitrogen Stimulated Raman Laser in the Visible Spectrum. AFIT-ENP-MS-20-M-078. Faculty Advisor: Dr. Christopher A. Rice. Sponsor: AFRL/RW.

BAXTER, ADAM, L., Modulation of Lightning Occurrence by the Solar Wind. AFIT-ENP-MS-20-M-079. Faculty Advisor: Lt. Col. Anthony L. Franz. Sponsor: AFOSR/RTB. [CSRA]

BAXTER, CHANCE, M., Conduction Mapping for Quality Control of Laser Powder Bed Fusion Additive Manufacturing. AFIT-ENP-MS-20-M-080. Faculty Advisor: Maj. Nicholas C. Herr. Sponsor: N/A.

BISHOP, MICHAEL, W., Enhanced BRDF Modeling Using Directional Volume Scatter Terms. AFIT-ENP-MS-20-M-081. Faculty Advisor: Lt. Col. Samuel D. Butler. Sponsor: AFOSR. [CDE]

BOECKENSTEDT, ALEXANDER, S., Validation of HTS Optical Turbulence Profiling via Sonic Anemometry. AFIT-ENP-MS-20-M-082. Faculty Advisor: Dr. Jack E. McCrae Jr. Sponsor: DEJTO. [CDE]

BURG, KEVIN, S., Validation Technique for Modeled Bottom side Ionosphere Via Ray Tracing. AFIT-ENP-MS-20-M-085. Faculty Advisor: Maj. Daniel J. Emmons. Sponsor: AFRL/RV. [CSRA]

BURKHARDT, AARON, W., An Assessment of the Spatial Variation of Isotopic Ratios in a CANDU-6 Reactor For Nuclear Treaty Monitoring. AFIT-ENP-MS-20-M-086. Faculty Advisor: Maj. James E. Bevins. Sponsor: AFTAC. [NEAT]

CHAPMAN, RYAN, K., Measurement of the 160GD(p,n)160 Tb Excitation Function From 4-18 MeV Using a Stacked Foil Technique. AFIT-ENP-MS-20-M-088. Faculty Advisor: Maj. James W. Bevins. Sponsor: AFTAC. [NEAT]

FIORETTI, JOHN, L., Characterizing Regime-Based Flow Uncertainty. AFIT-ENP-MS-20-M-093. Faculty Advisor: Lt. Col. Edward L. Hobbs. Sponsor: AFTAC.

FREEMAN, TRENTON, L., Effects of Water Entrainment on Shock Propagation from a Nuclear Detonation. AFIT-ENP-MS-20-M-091. Faculty Advisor: Lt. Col. Michael L. Dexter. Sponsor: DTRA. [NEAT]

GALE, NATHAN, J., Neutron Displacement Damage in Germanium-Tin Photodiodes. AFIT-ENP-MS-20-M-096. Faculty Advisor: Dr. John W. McClory. Sponsor: AFOSR/RTA. [NEAT]

GROSSNICKLE, JULIE, Determining Bulk Aerosol Absorption from Off-Axis Backscattering using Rayleigh Beacon Laster Pulses. AFIT-ENP-MS-20-M-097. Faculty Advisor: Dr. Steven T. Fiorino. Sponsor: DEJTO. [CDE]

GUERRERO, NICHOLAS, J., Solving Combinatorial Optimization Problems Using the Quantum Approximation Optimization Algorithm. AFIT-ENP-MS-20-M-098. Faculty Advisor: Dr. David E. Weeks. Sponsor: AFRL/RI. [CDE]

GUM, DANIEL, A., A Machine Learning Approach to Characterizing Particle Morphology in Nuclear Forensics. AFIT-ENP-MS-20-M-099. Faculty Advisor: Dr. Abigail A. Bickley. Sponsor: N/A. [NEAT]

HORAN, LANSING, S., Neutron Energy Effects on Asteroid Deflection. AFIT-ENP-MS-20-M-101. Faculty Advisor: Dr. Darren E. Holland. Sponsor: NNSA. [NEAT]

JAGODA, DANIEL, B., A Method for Routine PM2.5 Observation and Incorporation into Numerical Weather Prediction. AFIT-MS-20-M-102. Faculty Advisor: Dr. Steven T. Fiorino. Sponsor: DEJTO. [CDE]

KANIPE, MICHELLE, K., Middle Atmosphere Response to Two Surface Teleconnections Using the Whole Atmosphere Community Climate Model-Extended. AFIT-ENP-MS-20-M-103. Faculty Advisor: Lt. Col. Rose H. Tseng. Sponsor: DARPA.

KEY, JOSHUA, A., Laser Induced Thermal Degradation of Carbon Fiber-Carbon Nanotube Hybrid Laminates. AFIT-ENP-MS-20-M-104. Faculty Advisor: Maj. Nicholas C. Herr. Sponsor: N/A.

KLEIN, ADAM, W., Characterizing Over-the-Horizon Radar Noise Directionality Using a High-Resolution Lightning Detection Network. AFIT-ENP-MS-20-M-105. Faculty Advisor: Maj. Omar A. Nava. Sponsor: AFRL/RV. [CSRA]

MIHAL, CHRISTOPHER, J., Analysis of the Correlation Between Re Filament Surface Features and Tims Performance. AFIT-ENP-MS-20-M-107. Faculty Advisor: Dr. Abigail A. Bickley. Sponsor: N/A. [NEAT]

NARANJO, TRISTAN, R., Multi-Spectral Imaging of Vegetation with a Diffractive Plenoptic Camera. AFIT-ENP-MS-20-M-108. Faculty Advisor: Lt. Col. Anthony L. Franz. Sponsor: N/A. [CSRA] [CTISR]

NICHOLS, TAYLOR, M., Determination and Simulation of the Neutron Spectrum of Nuclear Detonations and Surrogate Sources. AFIT-ENP-MS-20-M-109. Faculty Advisor: Dr. John W. McClory. Sponsor: DTRA/RD. [NEAT]

OWENS, ANDREW, J., The Effect of Aeration Rate and Free-Floating Carrier Media on the Emission of Bacillus globigii in Bioaerosols. AFIT-ENP-MS-20-M-110. Faculty Advisor: Dr. Larry W. Burggraf. Sponsor: EPA.

PIERCE, BRANDON, A., CN and C2 Spectroscopy on the Pulsed Ablation of Graphite in the Visible Spectrum. AFIT-ENP-MS-20-M-111. Faculty Advisor: Dr. Kevin C. Gross. Sponsor: AFRL/RQ.

POWELL, AMBER, S., Effect of Ink Composition on the Physical Characteristics and Performance of Aerosol Jet Printed Lithium Cobalt Oxide Cathodes. AFIT-ENP-MS-20-M-114. Faculty Advisor: Maj. Nicholas C. Herr. Sponsor: AFRL/RQ.

RAO, ASHWIN, P., Rapid Analysis of Plutonium Surrogate Material via Hand-held Laser-induced Breakdown Spectroscopy. AFIT-ENP-MS-20-M-115. Faculty Advisor: Lt. Col. Michael B. Shattan. Sponsor: AFTAC; DTRA; DHS; LANL. [NEAT]

STAMBOVSKY, DANIEL, W., Simulation of Sporadic-E Parameters Using Phase Screen Method. AFIT-ENP-MS-20-M-117. Faculty Advisor: Maj. Daniel J. Emmons. Sponsor: AFRL/RV. [CSRA]

URBANCIC, BRIAN, R., Relating Polar Climate Oscillations to Stratospheric and Mesospheric Conditions. AFIT-ENP-MS-20-M-118. Faculty Advisor: Lt. Col. Rose H. Tseng. Sponsor: DARPA.

WHITNEY, TAYLOR, R., Detection of Reconnection Signatures in Solar Flares. AFIT-ENP-MS-20-M-121. Faculty Advisor: Dr. Robert D. Loper. Sponsor: AFOSR/RT. [CSRA]

WILLIAMS, JOANNA, E.S., Localized Effects of Hurricane Michael (2018) in Total Electron Content. AFIT-ENP-MS-20-M-122. Faculty Advisor: Maj. Omar. A. Nava. Sponsor: N/A.

WOLFGANG, RACHEL, L., Comparison of the Accuracy of Rayleigh-Rice Polarization Factors to Improve Micro facet BRDF Models. AFIT-ENP-MS-20-M-123. Faculty Advisor: Lt. Col. Samuel D. Butler. Sponsor: AFOSR. [CDE]

WOOD, JASON, C., Determination of Lithium Isotope Concentration by Laser Induced Breakdown Spectroscopy Using Chemometrics. AFIT-ENP-MS-20-M-124. Faculty Advisor: Lt. Col. Michael B. Shattan. Sponsor: AFTAC; AFOSR. [NEAT]

ZUCKER, ADAM, B., Detection of Damage on Charge Coupled Device by Optical Cross Section Analysis. AFIT-ENP-MS-20-M-125. Faculty Advisor: Dr. Michael A. Marciniak. Sponsor: AFRL/RX. [CDE]

5.2.3. FACULTY BIOGRAPHIES & RESEARCH OUTPUT

Notes: Research Center affiliations are listed in [ ] if applicable.

BAILEY, WILLIAM F.
Associate Professor Emeritus of Physics, Department of Engineering Physics, AFIT Appointment Date: 1978 (AFIT/ENP); BS, United States Military Academy, 1964; MS, The Ohio State University, 1966; PhD, Air Force Institute of Technology, 1978. Dr. Bailey's research interests center on weakly ionized gases and reactive kinetics with special applications to semiconductor processing in gas discharges, shock characterization in ionized flows, and solutions of the inhomogeneous electron kinetic equation. Dr. Bailey has published over 20 papers in refereed conference proceedings and international journals and chaired over 25 theses and dissertations. He is a member of Tau Beta Pi, Sigma Pi Sigma, and Sigma Xi. Tel. (937) 255-3636 x4501, email: William.Bailey@afit.edu

BEVINS, JAMES E., Maj
Assistant Professor of Nuclear Engineering, Department of Engineering Physics, AFIT Appointment Date: 2017 (AFIT/ENP); BS, Nuclear Engineering, University of Tennessee, 2009; MS, Nuclear Engineering, Air Force Institute of Technology, 2011; PhD, Nuclear Engineering, University of California – Berkeley, 2017. Maj Bevins' research interests include experimental and modeling research in the areas of nuclear forensics, nuclear detection, nuclear data, radiation transport, and applied optimization design of nuclear systems. Maj Bevins has authored 19 refereed archival journal publications and 31 refereed conference proceedings. He holds two notices of invention and two provisional patents. He has successfully advised five Master's students and is currently advising two MS students and four PhD students. Tel. (937) 255-3636 x4767, email: James.Bevins@afit.edu

Sponsor Funded Research Projects

"Nuclear Survivability Experimentation, Modeling and Data Verification." Sponsor: NNSA. Funding: $12,200 - Bevins 100%. [NEAT]

"Nuclear Survivability Experimentation, Modeling and Data Verification." Sponsor: NNSA. Funding: $125,000 - Bevins 55%, Hobbs 20%, Dexter 15%, McClory 10%. [NEAT]

"MOA - Support of the Development of Civilian Technical Expertise in Key Nuclear Competencies." Sponsor: AFNWC. Funding: $10,000 - Bevins 40%, Holland 20%, Reeder 20%, Petrosky 20%. [NEAT]

"MOA - AFTAC Endowed Term Chairs." Sponsor: AFTAC/XPB. Funding: $30,000 - Bevins 100%. [NEAT]

"MOA - AFTAC Endowed Term Chairs." Sponsor: AFTAC/XPB. Funding: $22,000 - Bevins 100%. [NEAT]

"MOA - AFTAC Endowed Term Chairs." Sponsor: AFTAC/XPB. Funding: $38,000 - Bevins 100%. [NEAT]

Refereed Journal Publications

Robert J. Olesen*, Darren E. Holland, Erik M. Brubaker, and James E. Bevins, "Maximum Likelihood Reconstructions for Rotating Scatter Mask Imaging," *Radiation Measurements*, vol. 137, September 2020, DOI: 10.1016/j.radmeas.2020.106441.

Amy Hall*, Daniel A. Gum*, Richard Ferrieri, John Brockman, and James E. Bevins, "Development of an Experimentally-Validated MCNP6 Model for 11C Production via the 14N (p,n) Reaction Using a GE PETTrace Cyclotron," *Nuclear Technologies*, May 2020, DOI: 10.1080/00295450.2020.1740561.

N. J. Quartemont*, J. E. Bevins, R. Slaybaugh, and L. Bernstein, “Analysis of an Energy Tuning Assembly for Simulating Nuclear Weapon Environments at the National Ignition Facility," *Journal of Radiation Effects Research and Engineering*, vol. 38, no. 1, Mar. 2020.

W. D. Johnston*, M. L. Dexter, J. W. McClory, and J. E. Bevins, “Simulating Surface-interacting nuclear Detonations using RECIPE and SHAMRC," *Journal of Radiation Effects Research and Engineering*, vol. 38, no. 1, pp. 14-23, Mar. 2020.

N. J. Quartemont*, A. A. Bickley, and J. E. Bevins, “Nuclear Data Covariance Analysis in Radiation Transport Simulations Utilizing SCALE Sampler and the IRDFF Nuclear Data Library," *IEEE Transactions on Nuclear Science*, vol. 67, no. 3, pp. 482-491, Mar. 2020, DOI:10.1109/TNS.2020.2970700

R. Olesen*, B. E. O'Day, D. E. Holland, L. W. Burggraf, and J. E. Bevins, “Characterization of Novel Rotating Scatter Mask Designs for Gamma Direction Identification," *Nuclear Instruments and Methods Phys. Res. A*, vol. 954, no. 21, Feb. 2020, DOI: 10.1016/j.nima.2018.09.067.

Refereed Conference Papers Accepted on the Basis of Full Paper Review

Robert J. Robert J. Olesen*, James B. Cole, Erik M. Brubaker, Darren E. Holland, James E. Bevins, “Design and gTesting a Regenerative Neural Network for Radiation Imaging," in *IEEE Nuclear Science and Security Symposium*, November 1st, 2020.

Bryan V. Egner*, Michael T. Febbraro, James E. Bevins, “Development of a Boron-Loaded Deuterated Liquid Scintillator for Neutron Spectroscopy," in *IEEE Nuclear Science and Security Symposium*, November 1st, 2020.

Nicholas J. Quartemont*, Narek Gharibyan, Ken Moody, James E. Bevins, “Simulating Nuclear Weapon Neutron Environments at the National Ignition Facility," in *Hardened Electronics and Radiation Technology Conference*, August 17th, 2020.

Robert J. Olesen*, Darren E. Holland, James E. Bevins, “Imaging Fast Burst Reactor with Rotating Scatter Mask Imaging System," in Hardened Electronics and Radiation Technology Conference, August 17th, 2020.

Bryan V. Egner*, Michael T. Febbraro, James E. Bevins, “Characterization of a Boron-Loaded Deuterated Liquid Scintillator for Neutron Spectroscopy," in *Hardened Electronics and Radiation Technology Conference*, August 17th, 2020.

Aaron W. Burkhardt*, Stephen H. Baxter*, James E. Bevins, “An Assessment of the Spatial Variation of Isotopic Ratios in a CANDU Reactor for Nuclear Monitoring,” in *Physics of Reactors*, Cambridge, UK, March 29th, 2020.

Lansing Horan*, Darren E. Holland, Megan Syal, Joe Wasem, Michael Dexter, James E. Bevins, “Neutron Energy Effects on Asteroid Deflection." in *IEEE Aerospace Conference*, Big Sky, MT, March 2020.

Jason Seik*, Darren E. Holland, James E. Bevins, “Rotating Scatter Mask Single Voxel Characterization," in *ANS Student Conference*, Raleigh, NC, April 5th, 2020.

Sean Fitzpatrick*, Ryan S. Chapman*, Darren E. Holland, James E. Bevins, “Evaluation of the 154-Gd(p,2n)153-Tb Cross Section," in *ANS Student*

Patents Awarded

Holland, D., Olesen, R.*, Burggraf, L., O’Day, B., Bevins, J. 2019. “Rotating Scatter Mask Design Classes for Directional Radiation Detection and Imaging.” U.S. Patent Application 16/812,844, filed September 17, 2020.

BICKLEY, ABIGAIL, A.

Assistant Professor of Nuclear Engineering, Department of Engineering Physics, AFIT Appointment Date: 2017 (AFIT/ENP); BA, Dartmouth College, 2000; PhD, University of Maryland, 2004. Dr. Bickley’s expertise is in nuclear

forensics and radiation transport. Her current research focuses on the characterization of radiological and nuclear samples for nuclear forensics signature identification and software development of pattern recognition tools for nuclear forensics applications. In addition, Dr. Bickley is examining neutral particle transport in the space environment. Before joining AFIT, she was on the faculty of Michigan State University and worked in nuclear treaty monitoring at the Air Force Technical Applications Center. Dr. Bickley has successfully chaired two Master's students and is currently advising two MS students. Dr. Bickley is a member of the American Physical Society (APS) and American Chemical Society (ACS). Tel. (937) 255-3636 x4555, email: Abigail.Bickley@afit.edu

Refereed Journal Publications

N.J. Quartemont*, A.A. Bickley, J.E. Bevins, "Nuclear Data Covariance Analysis in Radiation Transport Simulations Utilizing SCALE Sampler and the IRDFF Nuclear Data Library," IEEE Transactions on Nuclear Science, Vol. 67, No. 3, 482 (2020).

J. Cezeaux*, A.A. Bickley, G. Varshney, J.C. Petrosky, "Morphological Classification and Analysis of Fuel Bearing Debris from a Non-Critical Event," Journal of Radiation Effects Research and Engineering, Vol. 38, Issue 1, (2020). (S//RD).

BOSE-PILLAI, SANTASRI R.
Research Assistant Professor of Physics, Department of Engineering Physics, AFIT Appointment Date: 2011 (AFIT/ENP); BE, Electrical Engineering, Jadavpur University (India), 2000; MS, Electrical Engineering, New Mexico State University, 2005; PhD, Electrical Engineering (with emphasis on Optics), New Mexico State University, 2008. Dr. Bose-Pillai's research interests are in propagation and imaging through the atmosphere, generation of partially coherent sources, telescope pointing and tracking and laser communications through free space. At AFIT, she has been working on remote characterization of atmospheric turbulence using imaging and other optical techniques. She has also been investigating methods for generation of different types of partially coherent sources. Dr. Bose-Pillai has more than fifty journal and conference publications to her credit. Prior to joining AFIT, she was a Visiting Assistant Professor in the Physics and Optical Engineering Department at Rose-Hulman Institute of Technology, Terre Haute, IN. She is a senior member of SPIE and a regular member of OSA and DEPS. AFIT research center affiliation(s): [CDE.] Tel. (937) 255-3636 x4903, email: Santasri.Bosepillai@afit.edu

Refereed Journal Publications

Steven T. Fiorino, Santasri R. Bose-Pillai, Jaclyn Schmidt, Brannon Elmore and Kevin Keefer, "Implications of four-dimensional weather cubes for improved cloud-free line-of-sight assessments of free-space optical communications link performance," *Optical Engineering*, vol. 59, no. 8, 081808 (18 pp.), Jul 2020, doi: 10.1117/1.OE.59.8.081808.

Jack E. McCrae, Santasri R. Bose-Pillai, Steven T. Fiorino, Aaron J. Archibald, Joel Meoak, Brannon J. Elmore, Thomas Kesler, Christopher A. Rice, "Measurements of optical turbulence over 149-km path," *Optical Engineering*, vol. 59, no. 8, 081808 (18 pp.), Jun 2020, doi: 10.1117/1.OE.59.8.081806.

Refereed Conference Papers Accepted on the Basis of Full Paper Review

Jack E. McCrae, Christopher A. Rice, Steven T. Fiorino, Santasri R. Bose-Pillai and Aaron J. Archibald, "Wave optics simulations of a dual beacon Hartmann Turbulence Sensor," 2020 IEEE Aerospace Conference, Big Sky, MT, 8-15 Mar 2020.

Benjamin Wilson, Santasri Bose-Pillai, Jack McCrae, and Steven Fiorino, "Profiling of atmospheric turbulence using time-lapse imagery of noncooperative targets from multiple cameras," in *Optical Sensors and Sensing Congress, OSA Technical Digest* (Optical Society of America, 2020), paper PTu4F.3.

Santasri Bose-Pillai, Benjamin Wilson, Jack McCrae, Alexander Boeckenstedt, Aaron Archibald, Kevin Keefer, and Steven Fiorino, "Profiling of atmospheric turbulence from dual-camera time-lapse imagery of a LED array," in *Optical Sensors and Sensing Congress*, *OSA Technical Digest* (Optical Society of America, 2020), paper PTu4F.2.

Refereed Conference Papers Accepted on the Basis of Abstract Review

Alexander S. Boeckenstedt, Jack E. McCrae, Santasri R. Bose-Pillai, Benjamin G. Wilson and Steven T. Fiorino, "Validation of HTS optical turbulence profiling via sonic anemometry," Proc. SPIE 11508, Unconventional Imaging and Adaptive Optics 2020, 1150805 (Sep 2020).

Jack E. McCrae Jr., Santasri Bose-Pillai, Alexander Boeckenstedt, Ben Wilson, Kevin Keefer and Steven T. Fiorino, "Turbulence profiling with a dual beacon Hartmann turbulence sensor using simulation derived weighting function," Proc. SPIE 11508, Unconventional Imaging and Adaptive Optics 2020, 1150805 (Sep 2020).

Santasri Bose-Pillai, Benjamin Wilson, Jonathan Krone, Aaron Archibald, Brannon Elmore, Jack McCrae and Steven Fiorino, "Profiling atmospheric turbulence using dual-camera imagery of non-cooperative targets," Proc. SPIE 11506, Laser Communication and Propagation through the Atmosphere and Oceans IX, 115060J (Aug 2020).

Patent Applications

Santasri Bose-Pillai, Jack McCrae, Steven Fiorino and Christopher Rice, "Estimation of atmospheric turbulence parameters using differential motion of extended features in time-lapse": provisional patent application filed, application number: 62/924,745, filing date: Oct 23, 2019.

Other Significant Research Productivity

Gave an invited talk in June, 2020 at the Optical Society of America's Propagation through and Characterization of Atmospheric and Oceanic Phenomena (pcAOP): "Profiling of atmospheric turbulence from dual-camera time-lapse imagery of a LED array".

Gave an invited talk in August, 2020 at SPIE Optics and Photonics, *Laser Communication and Propagation through the Atmosphere and Oceans IX*: ""Profiling atmospheric turbulence using dual-camera imagery of non-cooperative targets".

Gave a talk at DEPS Annual S+T Symposium in March, 2020: "Atmospheric Turbulence Profiling with Dual- Camera Time-Lapse Imagery and Validation with Sonic Anemometers".

Contributed to DEPS talk: "Validation of Hartmann Turbulence Sensor Optical Turbulence Profiling via Sonic Anemometry" by 2nd Lt. Alex Boeckenstedt.

Submitted proposal for Phase II of a Naval Undersea Warfare Center funded STTR: Marine Atmospheric Modeling, Data Collection, Visualization & Metrological Toolset for Submarine Electromagnetic (EM) Maneuverability.

Submitted proposal to AFRL/ RDLE: Extension of HELEEOS' Capabilities to Include Guide star Compensation Effects and Different Focusing Ranges.

Submitted a proposal to AFOSR under the AFRL/ AFIT MOA Small Grant Program: Profiling of Atmospheric Turbulence using Time-Lapse Imagery of Non-Cooperative Targets from Multiple Spatially Separated Cameras

Served as a reviewer for OSA and SPIE Optical Engineering journals.

BURGGRAF, LARRY W.

Professor of Engineering Physics and Chemical Physics, Department of Engineering Physics, AFIT Appointment Date: 1994 (AFIT/ENP); BA, Chemistry, Olivet Nazarene University, 1968; MS, Chemistry, The Ohio State University, 1971; MA, Applied Mathematics, University of West Florida, 1977; PhD, Chemistry, University of Denver, 1981; Post-doctoral Associate, Computational Chemistry, Iowa State University, 1993. Dr. Burggraf conducts experimental and theoretical research in physical chemistry and materials chemistry including radiation biophysics, exotic atom chemistry, positron spectroscopy, surface and cluster spectroscopy, excitonic nanomaterials, gamma spectroscopy and gamma imaging to solve DOD, DHS and DOE problems in WMD non-proliferation. Theoretical research to model surfaces, clusters, nanomaterials and positronic molecules applies quantum mechanics modeling to

interpret experimental results. Dr. Burggraf has authored more than 55 refereed archival publications. He holds one patent; two pending. He has successfully advised 45 Master's students, eight PhD students, and is currently advising one MS and one PhD student. Tel. (937) 255-3636 x4507, email: Larry.Burggraf@afit.edu

Refereed Journal Publications

Olesen R., O'Day B., Holland D., Burggraf L., and Bevins J., "Characterization of novel rotating scatter mask designs for gamma direction identification". Nuclear Instruments and Methods in Physics Research Section A: Accelerators, Spectrometers, Detectors and Associated Equipment. 954, 161232 21 February 2020 https://doi.org/10.1016/j.nima.2018.09.067.

Logan, J., Holland, D., Burggraf, L., Clinton, J., O'Day, B. 2019. "Monte Carlo and Experimental Analysis of a Novel Directional Rotating Scatter Mask Gamma Detection System." *Nuclear Instruments and Methods in Physics Research Section A: Accelerators, Spectrometers, Detectors and Associated Equipment*. **947**, pp. 162698. https://doi.org/10.1016/j.nima.2019.162698.

Refereed Conference Papers Accepted on the Basis of Full Paper Review

Horan, L., Holland, D., Syal, M., Wasem, J., Dexter, M., Bevins, J., "Neutron Energy Effects on Asteroid Deflection." 2020 IEEE Aerospace Conference, Big Sky, MT, presented March 2020.

Olesen, R., Holland, D., Bevins, J., "Imaging Fast Burst Reactor with a Rotating Scatter Mask Imaging System," Hardened Electronics and Radiation Technology Conference, to be presented August 2020.

Patents Awarded

Holland, D., Olesen, R.*, Burggraf, L., O'Day, B., Bevins, J. 2019. "Rotating Scatter Mask Design Classes for Directional Radiation Detection and Imaging." U.S. Patent Application 16/812,844, filed September 17, 2020.

Patent Applications

Holland, D., Olesen, R., Burggraf, L., O'Day, B., Bevins, J. 2019. "Rotating Scatter Mask Design Classes for Directional Radiation Detection and Imaging." U.S. Patent Application 62,986,892, Additional provisional filed April 2, 2020.

Egner, B., Olesen, R., Holland, D., Martin, V., O'Day, B., Burggraf, B., Bevins, J. 2019. "An Efficient, Dual-particle Directional Detection System using a Rotating Scatter Mask." U.S. Patent Application 16,812,844, Non-provisional filed March 11, 2020.

BURGI, KENNETH, W., Lt Col

Assistant Professor of Optical Engineering, Department of Engineering Physics, AFIT Appointment Date: 2016 (AFIT/ENP); BS, Michigan Technological University, 2002; MS, Michigan Technological University, 2010; PhD, Air Force Institute of Technology, 2016. Lt Col Burgi's research focus is primarily the development of methods to control reflectively scattered light from rough surfaces. These methods could be used to reconstruct images of objects without direct line-of-sight using scattered light. As a former instructor pilot, Lt Col Burgi has deployed three times in support of Operation Enduring Freedom and Operation Iraqi Freedom. He has flown 1,295 combat flight hours in 363 combat sorties in the C-17 and MC-12 aircraft. He has published two referred journal articles and four conference publications. Lt Col Burgi is a member of SPIE and the current Engineering Physics Interim Department Head. AFIT research center affiliation(s): [CDE.] Tel. (937) 255-3636 x4696, email: Kenneth.Burgi@afit.edu

Sponsor Funded Research Projects

"Dynamic Data Driven Phase Optimization for Controlling Light Scattered by a Rough Surface." Sponsor: AFOSR. Funding: $151,881 - Burgi 75%, Marciniak 15%, Oxley 10%. [CDE] [CTISR]

BUTLER, SAMUEL D., Lt Col

Assistant Professor of Physics, Department of Engineering Physics, AFIT Appointment Date: 2015 (AFIT/ENP); BS, Applied Physics (Computer Science Emphasis), Brigham Young University, 2004; MS, Physics, Air Force Institute of Technology, 2010; PhD, Physics, Air Force Institute of Technology, 2015. Lt Col Butler's research is primarily focused on development of optical scatter models for use in remote sensing applications, particularly in the IR. He has also previously been involved in munitions development, quantum mechanical scattering, cryptography, and quantum information. Lt Col Butler has published four refereed journal articles, 12 conference papers and four conference presentations. His works have been cited over 90 times. He has also deployed to Afghanistan as a deputy IG in support of Operation Enduring Freedom in 2011, and to Southwest Asia in 2016. Lt Col Butler is a member of SPIE and the AFIT chapter co-advisor of SPIE. AFIT research center affiliation(s): [CDE] and [CTISR.] Tel. (937) 255-3636 x4385, email: Samuel.Butler@afit.edu

Sponsor Funded Research Projects

"Analysis of Modified Micro facet BRDF Models for Polarimetric Optical Scatter." Sponsor: AFOSR. Funding: $147,262 - Butler 75%, Marciniak 25%. [CDE] [CTISR]

Refereed Conference Papers Accepted on the Basis of Abstract Review

Todd V. Small, Samuel D. Butler, and Michael A. Marciniak "Augmenting CASI® BRDF measurement device to measure out-of-plane scatter with CCD pixel array," Proc. SPIE 11485, Reflection, Scattering, and Diffraction from Surfaces VII, 114850B (31 August 2020); https://doi.org/10.1117/12.2568050.

Michael W. Bishop, Samuel D. Butler, and Michael A. Marciniak "Analysis of hybrid directional volumetric scatter terms for enhanced micro facet BRDF modeling," Proc. SPIE 11485, Reflection, Scattering, and Diffraction from Surfaces VII, 114850I (20 August 2020); https://doi.org/10.1117/12.2568046.

Rachel L. Wolfgang, Samuel D. Butler, and Michael A. Marciniak "Comparison of the accuracy of Rayleigh-Rice polarization factors to improve micro facet pBRDF models," Proc. SPIE 11485, Reflection, Scattering, and Diffraction from Surfaces VII, 114850H (20 August 2020); https://doi.org/10.1117/12.2568042.

CAYLOR, MICHAEL, J.
Associate Director, Center for Technical Intelligence Studies & Research, and Research Assistant Professor of Physics, Department of Engineering Physics, AFIT Appointment Date: 2017 (AFIT/ENP); BS, Aerospace Engineering, University of Notre Dame, 1981; MS, Aerospace Engineering, University of Notre Dame, 1983; MS, Engineering Management, Florida Institute of Technology, 1985; PhD, Aerospace Engineering, University of Notre Dame, 1993. AFIT research center affiliation(s): [CTISR] and [CSRA.] Tel. (937) 255-3636 x4565, email: Michael.Caylor@afit.edu

CLINTON, JUSTIN A.
Assistant Professor of Nuclear Engineering, Department of Engineering Physics, AFIT Appointment Date: 2013 (AFIT/ENP); BS, Nuclear Engineering, Rensselaer Polytechnic Institute, 2004; PhD, Nuclear Engineering, Rensselaer Polytechnic Institute, 2011. Dr. Clinton's research interests are in the area of radiation detection, both experimental and theoretical modeling, as it applies to nuclear forensics. His expertise includes particle transport, Monte Carlo methods, analog and digital data acquisition and analysis, and detector development. Dr. Clinton is a member of the American Nuclear Society (ANS) as well as the Institute of Electrical and Electronics Engineers (IEEE). AFIT research center affiliation(s): [ANT.] Tel. (937) 255-6565 x4586, email: Justin.Clinton@afit.edu

Refereed Journal Publications

Logan, J., Holland, D., Burggraf, L., Clinton, J., O'Day, B. 2019. "Monte Carlo and Experimental Analysis of a Novel Directional Rotating Scatter Mask Gamma Detection System." *Nuclear Instruments and Methods in Physics Research Section A: Accelerators, Spectrometers, Detectors and Associated Equipment*. **947**, pp. 162698. https://doi.org/10.1016/j.nima.2019.162698

DEXTER, MICHAEL L., Lt Col

Director, Center for Technical Intelligence Studies and Research, and Assistant Professor of Nuclear Engineering, Department of Engineering Physics, AFIT Appointment Date: 2017 (AFIT/ENP); BS, Applied Physics, University of Nebraska at Omaha, 2004; MS, Applied Physics, Air Force Institute of Technology, 2009; PhD, Nuclear Physics, Air Force Institute of Technology, 2015. Lt Col Dexter's research interests include physics of high-density plasmas, intense light physics, nuclear forensics, nuclear effects modelling and simulation, laser effects on materials, digital image processing, and advanced technology development. Lt Col Dexter is also the Deputy Department Head. Tel. (937) 255-3636 x4742, email: Michael.Dexter@afit.edu

Sponsor Funded Research Projects

"Electro-Optics and Algorithms Research." Sponsor: Ball Aerospace. Funding: $50,000 - Dexter 100%. [CTISR]

"Research Support to Sponsored Students (CTISR portion)." Sponsor: SAF/FBIB. Funding: $100,000 - Dexter 50%, Caylor 50%. [CTISR]

"Sustainment of a Master of Science (MS) Degree in Scientific and Technical Intelligence." Sponsor: NASIC CC. Funding: $30,000 - Dexter 100%.

"Spectro-Polarimetric Imaging of Disturbed Earth (SIDE), Phase IV." Sponsor: CEERD-EEC. Funding: $138,000 - Dexter 50%, Hawks 50%. [CTISR]

"Research Support to Sponsored Students (CTISR portion)." Sponsor: SAF/FMBIB. Funding: $250,000 - Dexter 50%, Caylor 50%. [CTISR]

"Efficient and Automated Measurement System and Methodology for Characterizing Event-Based Cameras." Sponsor: AFRL/RV. Funding: $50,000 - Dexter 100%. [CTISR]

Refereed Journal Publications

W.D. Johnston, M.L. Dexter, J.W. McClory, and J.E. Bevins, "Simulating Surface-Interacting Nuclear Detonations using RECIPE and SHAMRC," Journal of Radiation Effects, Research and Engineering, vol. 38, no. 1, pp. 14-23, March 2020.

R.S. Torzilli, W.L. Harrell, J.C. Petrosky, M.L. Dexter, and S.T. Fiorino, "Developing and Testing of a Simulated NUDET Optical Detection Model Using Realistic Weather Conditions" Journal of Radiation Effects, Research and Engineering, vol. 38, no. 1, pp. 248-256, March 2020.

Refereed Conference Papers Accepted on the Basis of Full Paper Review

Horan, L.*#, Holland, D., Syal, M., Wasem, J., Dexter, M., Bevins, J. "Neutron Energy Effects on Asteroid Deflection." *2020 IEEE Aerospace Conference*, Big Sky, MT, presented March 2020.

EMMONS, DANIEL J, Maj
Assistant Professor of Physics, Department of Engineering Physics, AFIT, Appointment Date: 2017 (AFIT/ENP); BS, Physics, San Diego State University, 2007; MS, Applied Physics, Air Force Institute of Technology, 2012; PhD, Applied Physics, Air Force Institute of Technology, 2017. Maj Emmons' research interests center on computational gas discharge modeling, plasma kinetics, and the effects of ionospheric disturbances on high frequency radio wave propagation. AFIT research center affiliation(s): [CSRA.] Tel. (937) 255-3636 x4571, email: Daniel.Emmons@afit.edu

Sponsor Funded Research Projects

"Using GPS Radio Occultation to Monitor Sporadic-E." Sponsor: AFOSR. Funding: $30,240 - Emmons 50%, Nava 25%, Tseng 25%.

"Investigating Channel Scattering in GPS Radio Occultation Measurements." Sponsor: AFRL/RV. Funding: $16,100 - Emmons 100%. [CSRA]

Refereed Journal Publications

Aegerter, T. R. W., D. J. Emmons, and R. D. Loper. "Detection of reconnection signatures in solar flares." Journal of Atmospheric and Solar-Terrestrial Physics 208 (2020): 105375.

Emmons, D. J., E. V. Dao, K. K. Knippling, L. F. McNamara, O. A. Nava, K. S. Obenberger, and J. J. Colman. "Estimating horizontal phase speeds of a traveling ionospheric disturbance from Digisonde single site vertical ionograms." Radio Science 55, no. 8 (2020): e2020RS007089.

Emmons, D. J., and D. E. Weeks. "Steady-State Model of an Argon-Helium High-Pressure Radio Frequency Dielectric Barrier Discharge." IEEE Transactions on Plasma Science 48, no. 8 (2020): 2715-2722.

Gooch, J. Y., J. J. Colman, O. A. Nava, and D. J. Emmons. "Global ionosonde and GPS radio occultation sporadic-E intensity and height comparison." Journal of Atmospheric and Solar-Terrestrial Physics 199 (2020): 105200.

Emmons, D. J., and D. E. Weeks. "Effect of Ar ($3p^5 4p$; 2p) +M → Ar ($3p^5 4s$; 1s) +M branching ratio on optically pumped rare gas laser performance." Optics Express 27, no. 24 (2019): 35689-35699.

Refereed Conference Papers Accepted on the Basis of Abstract Review

Williams, J., Nava, O., Emmons, D. J., & Tseng, H. L. R. (2019). Influence of Lightning on Total Electron Content during Hurricane Michael (2018). AGUFM, 2019, NH31B-08.

Burg, K. S., Emmons, D. J., Nava, O., & Dao, E. V. (2019). Numerical Validation of Ionospheric Models Via Ray Tracing. AGUFM, 2019, NH33C-0931.

Urbancic, B., Tseng, R., Tournay, R., Nava, O., & Emmons, D. J. (2019). Whole Atmosphere Characterization based on Arctic Oscillation Index. AGUFM, 2019, A31S-2835.

Kanipe, M., Tseng, R., Tournay, R., Nava, O., & Emmons, D. J. (2019). Middle Atmosphere Response to the El Nino Southern Oscillation Using the Whole Atmosphere Community Climate Model-Extended. AGUFM, 2019, A31S-2833.

FEE, JAMES R. Jr., Col
Section Commander, AU Det 1; Assistant Professor of Nuclear Engineering, Department of Engineering Physics, AFIT Appointment Date: 2015 (AFIT/ENP); BS, Purdue University, 1997; MS, Air Force Institute of Technology, 2002; PhD, Air Force Institute of Technology, 2015. Col Fee's research is primarily focused on computational simulation of nuclear weapon effects with a focus in electromagnetic pulse. He has also previously managed radiation hardened microelectronics programs for satellite and missile systems. Col Fee has published one refereed journal article and one conference presentation. He also deployed to Iraq as an Intelligence Advisor in support of Operation New Dawn. Col Fee holds a Master of Military Operational Art and Science from Air University (2012). Tel. (937) 255-3636 x4438, email: James.Fee@afit.edu

FERDINANDUS, MANUEL R.
Research Assistant Professor of Optical Sciences, Department of Engineering Physics, AFIT Appointment Date: 2019 (AFIT/ENP); BS, Seattle University, 1999; MS, Rochester Institute of Technology, 2007; PhD, University of Central Florida, 2014. Dr. Ferdinandus performs research into nonlinear optics, optical limiting, infrared laser sources and hyperspectral target detection. Previously, he has worked in space operations and satellite system acquisition. He has published two refereed journal articles and seven conference presentations. Dr. Ferdinandus is a member of the Optical Society of America. AFIT research center affiliation(s): [CDE] and [CSRA.] Tel. (937) 255-6565 x4339, email: Manuel.Ferdinandus@afit.edu

Sponsor Funded Research Projects

"Mid-IR Nonlinear Measurements of Optical Materials." Sponsor: AFRL/RX. Funding: $60,000 - Ferdinandus 100%.

Refereed Journal Publications

Ferdinandus, M. R., et al. (2020). “Nonlinear optical measurements of CdSiP2 at near and mid-infrared wavelengths.” Optical Materials Express **10**(9): 2066.

Refereed Conference Papers Accepted on the Basis of Abstract Review

Barrette, A. G., et al. (2020). Super continuum generation in single-crystal YAG fibers. Photonic Fiber and Crystal Devices: Advances in Materials and Innovations, Online only, SPIE.

Ferdinandus, M.R. et. al. (2020). Z-Scan Measurements of CdSiP2 at OPA Pumping Wavelengths. Conference on Lasers and Electro-Optics, San Jose, California, Optical Society of America.

FIORINO, STEVEN T.
Director, Center for Directed Energy, and Professor of Atmospheric Physics, Department of Engineering Physics, AFIT Appointment Date: 2003 (AFIT/ENP); BS, Geography (Climatology), The Ohio State University, 1987; BS, Meteorology, Florida State University, 1989; MS, Atmospheric Dynamics, The Ohio State University, 1993; PhD, Physical Meteorology, Florida State University, 2002. Dr. Fiorino’s research interests include retrieving environmental parameters via microwave remote sensing; developing signal processing algorithms to fuse meteorological data collection with non-weather ISR platforms; evaluating uncertainty in high-energy laser engagement due to atmospheric effects; and improving microphysical characterizations for nuclear fallout, transport, and dispersion. He has published broadly in meteorological, optics, directed energy, and military journals. Dr. Fiorino is a member of the American Meteorological Society (AMS), American Institute of Aeronautics and Astronautics (AIAA), the Directed Energy Professional Society (DEPS), Society of Photo-Instrumentation Engineers (SPIE), the Optical Society (OSA), and additionally holds a Master of Military Operational Art and Science from Air University (2003). AFIT research center affiliation(s): [CDE], [CSRA], and [CTISR.] Tel. (937) 255-3636 x4506, email: Steven.Fiorino@afit.edu

Sponsor Funded Research Projects

"Atmospheric Effects Inputs for HELJWS and JLaSE." Sponsor: JTCG/ME. Funding: $110,000 - Fiorino 100%. [CDE]

"AFIT Research in Support of ONR’s US-India OSD-DRDO Collaborations." Sponsor: ONR. Funding: $25,000 - Fiorino 100%. [CDE]

"AFIT CDE Support to the DEPS Directed Energy Education Initiative." Sponsor: AFRL/RD. Funding: $110,000 - Fiorino 40%, Marciniak 15%, Perram 15%, McCrae 15%, Rice 15%. [CDE]

"AFIT CDE Support to NATO SCI 316." Sponsor: ONR. Funding: $60,000 - Fiorino 100%. [CDE]

"Free Space Optical Communications Planning Tool Phase II SBIR with Guide star Optical Systems." Sponsor: AFRL/SBRK. Funding: $150,000 - Fiorino 100%. [CDE]

"2020 AFIT Center for Directed Energy DOD HPCMP HPC Internship Program (HIP)." Sponsor: CEERD-IZP. Funding: $25,000 - Fiorino 80%, Akers 20%. [CDE]

"Extension of HELEEOS' Capabilities to Include Guide star Compensation Effects." Sponsor: SAF/FMBIB. Funding: $100,000 - Fiorino 100%. [CDE]

"CY2020 DE JTO AP TAWG Research and Analysis." Sponsor: AFRL/RD. Funding: $400,000 - Fiorino 100%. [CDE]

"CY2020 DE JTO M&S TAWG Research Analysis." Sponsor: AFRL/RD. Funding: $400,000 - Fiorino 100%. [CDE]

"SDPE Field Test Support & Predictive / Post-Test Diagnostic HEL Performance Analyses." Sponsor: AFRL/SDPE. Funding: $134,000 - Fiorino 100%. [CDE]

"CY2020 DE JTO AP TAWG Research and Analysis." Sponsor: AFRL/RD. Funding: $25,000 - Fiorino 100%. [CDE]

Refereed Journal Publications

Fiorino, S.T., S.R. Bose-Pillai, J.E. Schmidt, B.J. Elmore, K.J. Keefer, 2020: "Implications of 4D weather cubes for improved cloud free line of sight assessments of free space optical communications link performance," *Opt. Eng*. 59(8), 081808, doi: 10.1117/1.OE.59.8.081808.

McCrae, J.E., S.R. Bose-Pillai, S.T. Fiorino, A. Archibald, J. Meoak, B. Elmore, T. Kesler, and C. Rice, 2020, "Measurements of Optical Turbulence over 149 km Path," *Opt. Eng*. 59(8), 081806, doi: 10.1117/1.OE.59.8.081806.

Zuraski, S.M., E. Beecher, J.E. McCrae, and S.T. Fiorino, 2020, "Turbulence profiling using pupil plane wave front data derived Fried parameter values for a dynamically ranged Rayleigh beacon," *Opt. Eng.* 59(8), 081807, doi: 10.1117/1.OE.59.8.081807.

Thomas, G., R. Cobb, S. Fiorino, and M. Hawks, 2020: "Daytime Cloudless Sky Radiance Quantification with Ground-Based Aerosol and Meteorological Observations in the Shortwave Infrared," *J. Atmos. Oceanic Technol*., **37**, 777–788, doi.org/10.1175/JTECH-D-19-0157.1.

Refereed Conference Papers Accepted on the Basis of Full Paper Review

Boeckenstedt, A., J. McCrae, S. Bose-Pillai, B. Wilson, and S. Fiorino, "Validation of HTS optical turbulence profiling via sonic anemometry," Proc. SPIE. 11508, Unconventional Imaging and Adaptive Optics 2020 (8 September 2020).

Bose-Pillai, S., B. Wilson*, J. Krone*, A. Archibald, B. Elmore, J. McCrae, and S. Fiorino, "Profiling atmospheric turbulence using dual-camera imagery of non-cooperative targets," Proc. SPIE. 11506, Laser Communication and Propagation through the Atmosphere and Oceans IX (22 August 2020).

Zuraski, S., J. McCrae, and S.T. Fiorino, "Focal anisoplanatism influence on dynamically ranged Rayleigh beacon measurements," Proc. SPIE. 11508, Unconventional Imaging and Adaptive Optics 2020 (20 August 2020).

#McCrae, J., S. Bose-Pillai, A. Boeckenstedt*, B. Wilson*, K.J. Keefer, and S.T. Fiorino, "Turbulence profiling with a dual beacon Hartmann turbulence sensor using simulation derived weighting functions," Proc. SPIE. 11508, Unconventional Imaging and Adaptive Optics 2020 (20 August 2020).

Fiorino, S.T., K.J. Keefer, and J.C. Grossnickle*, "Comparison of NOAA's CLAP Measurements to Aerosol Absorption from Number Concentration," in Propagation through and Characterization of Atmospheric and Oceanic Phenomena (pcAOP), (JTu5F.2), OSA Optical Sensors and Sensing Congress, Virtual Event, 23 June 2020.

Bose-Pillai, S., B. Wilson*, J. McCrae, A. Boeckenstedt*, A. Archibald, K. Keefer, and S. Fiorino, "Profiling of atmospheric turbulence from dual-camera time-lapse imagery of a LED array," in Propagation through and Characterization of Atmospheric and Oceanic Phenomena (pcAOP), (PTu4F.2), OSA Optical Sensors and Sensing Congress, Virtual Event, 23 June 2020.

Wilson, B., S. Bose-Pillai, J. McCrae, and S. Fiorino, "Profiling of atmospheric turbulence using time-lapse imagery of noncooperative targets from multiple cameras," in Propagation through and Characterization of Atmospheric and Oceanic Phenomena (pcAOP), (PTu4F.3), OSA Optical Sensors and Sensing Congress, Virtual Event, 23 June 2020.

McCrae, J.E., S.R. Bose-Pillai, C.A. Rice, A. Archibald, and S.T. Fiorino, “Wave Optics Simulations of a Dual Beacon Hartmann Turbulence Sensor,” 2020 IEEE Aerospace Conference, Big Sky, MT, 7-14 Mar 2020.

Refereed Conference Papers Accepted on the Basis of Abstract Review

Fiorino, S.T., D. Narcisse, and J.E. Schmidt, "Development of a 3-Category Weather Effects Assessment Tool for DEW Test and/or Employment," 2020 Annual DEPS S&T Symposium, West Point, NY, 9-13 March 2020.

Bose-Pillai, S., B. Wilson*, J.E. McCrae, A. Boeckenstedt*, A. Archibald, C. Rice, K.J. Keefer, and S.T. Fiorino, "Atmospheric Turbulence Profiling with Dual- Camera Time-Lapse Imagery and Validation with Sonic Anemometers," 2020 Annual DEPS S&T Symposium, West Point, NY, 9-13 March 2020.

Grossnickle, J., S.T. Fiorino# , K.J. Keefer, H.R. Tseng, and R.C. Tournay, "Determining Bulk Aerosol Absorption from Off-Axis Backscattering using Rayleigh Beacon Laser Pulses," 2020 Annual DEPS S&T Symposium, West Point, NY, 9-13 March 2020.

Jagoda, D., S.T. Fiorino, S. Peckham, K.J. Keefer, R. Tournay, and J.E. Schmidt, "A Method for Routine PM2.5 Observation and Incorporation into Numerical Weather Prediction," 2020 Annual DEPS S&T Symposium, West Point, NY, 9-13 March 2020.

Boeckenstedt, A., J.E. McCrae, S.R. Bose-Pillai, and S.T. Fiorino, "Validation of Hartmann Turbulence Sensor Optical Turbulence Profiling via Sonic Anemometry," 2020 Annual DEPS S&T Symposium, West Point, NY, 9-13 March 2020.

Schmidt, J.E., J. Burley, B. Fourman*, and S.T. Fiorino, "Global Cloud Free Line of Sight (CFLOS) Characterizations Using Numerical Weather Prediction Data," 2020 Annual DEPS S&T Symposium, West Point, NY, 9-13 March 2020.

Grossnickle, J., S.T. Fiorino , K.J. Keefer, H.R. Tseng, and R.C. Tournay, "Determining Bulk Aerosol Absorption from Off-Axis Backscattering using Rayleigh Beacon Laser Pulses," 24th Conference on Integrated Observing and Assimilation Systems for the Atmosphere, Oceans, and Land Surface (IOAS-AOLS), 100th Annual American Meteorological Society Meeting, Boston, MA, Jan 2020. (Poster and web posting: https://ams.confex.com/ams/2020Annual/meetingapp.cgi/Paper/370190.

Jagoda, D., S.T. Fiorino, S. Peckham, K.J. Keefer, and J.E. Schmidt, "Assessment of Improved WRF-Chem PM2.5 Characterization via Implementation of an Aerosol Measurement Network," 12th Symposium on Aerosol - Cloud - Climate Interactions, 100th Annual American Meteorological Society Meeting, Boston, MA, Jan 2020. (Poster and web posting: https://ams.confex.com/ams/2020Annual/meetingapp.cgi/Paper/370208.

Schmidt, J.E., J. Burley, B. Fourman*, and S.T. Fiorino, "Global Cloud Free Line of Sight (CFLOS) Characterizations Using Numerical Weather Prediction Data," 20th Conference on Aviation, Range, and Aerospace Meteorology, 100th Annual American Meteorological Society Meeting, Boston, MA, Jan 2020. (Poster and web posting: https://ams.confex.com/ams/2020Annual/meetingapp.cgi/Paper/369796.

Fiorino, S.T., J. Schmidt, B. Elmore, and B. Fourman*, "Global Cloud Free Line of Sight (CFLOS) Characterizations for Air Force SDPE Sites," 14th Annual Directed Energy Systems Symposium, San Diego, CA, 20 November 2019.

Schmidt, J., S.T. Fiorino, B. Elmore, and K.J. Keefer, "Expected HEL Performance Quantification for Air Force SDPE Sites and Systems using Weather Cubes," 14th Annual Directed Energy Systems Symposium, San Diego, CA, 20 November 2019.

Editorships in Professional Journals

Guest Editor, Atmospheric Propagation Special Section of *Optical Engineering* (Vol 59, Issue 8).

Editor, *Journal of Directed Energy* (2020)

Patent Applications

Zuraski, S.M., E.A. Beecher, S.T. Fiorino, J.D. Schmidt, J.E. McCrae, N.M. Figlewski, "Design for an electro-optic testbed utilizing a dynamic range gated Rayleigh beacon for atmospheric turbulence profiling," AFD-1721. Application filed on 31 January 2020, with the U.S. Patent and Trademark Office. The application was accorded U.S. Serial No. 16/778,424.

Bose-Pillai, S.R., J.E. McCrae, C.A. Rice, and S.T. Fiorino, "Estimation of Atmospheric Turbulence Parameters using Differential Motion of Extended Features in Time-lapse Imagery," AFD-1920. Filed as an application for Letters Patent of the United States (Application Serial Number 62/924,745, filed 23-October-2019 and Application Serial Number 17/077,323, filed 22-October-2020).

Other Significant Research Productivity

Ward, D. J. Bowers*, S. Sanyal, T. Vo, S. Fiorino and N. Flores, 2020: "Empirical Derivation of Power Measurement Scaling Factor for Beam Irradiance on Target System (BITS) utilizing Novel in-situ Primary Standard," accepted *Journal of Directed Energy*.

Fiorino, S, A. van Eijk, S. Hammel, and A. Berk, 2020: "Special Section Guest Editorial: Atmospheric Propagation," *Opt. Eng*. **59**(8).

FRANZ, ANTHONY L., Lt Col

Assistant Professor of Physics, Department of Engineering Physics, AFIT Appointment Date: 2012 (AFIT/ENP); BS, United States Air Force Academy, 1992; MS, Air Force Institute of Technology, 1997; PhD, University of Maryland, 2007. Lt Col Franz's research focuses on lasers and optics. His recent work has focused on developing light weight diffractive optics for use on satellites and novel approaches for imaging and hyperspectral imaging systems. Before joining AFIT, he was a physics faculty member at the Air Force Academy for eight years and deployed to Iraq and Afghanistan. He has also worked in nuclear treaty monitoring and infrared missile engagement modeling and simulation. Lt Col Franz is a member of the American Association of Physics Teachers (AAPT), the American Physical Society (APS), the International Society for Optics and Photonics (SPIE), and the Optical Society of America (OSA). AFIT research center affiliation(s): [CTISR.] Tel. (937) 255-3636 x4429, email: Anthony.Franz@afit.edu

Sponsor Funded Research Projects

"Performance Analysis and Sensor Toolkit for ASSET (PASTA), Phase II." Sponsor: SAF/FMBIB. Funding: $79,684 - Franz 50%, Hawks 25%, Dexter 25%. [CTISR]

Refereed Conference Papers Accepted on the Basis of Abstract Review

Tristan R. Naranjo and Anthony L. Franz, "Experimental demonstration of multi-spectral imaging of vegetation with a diffractive plenoptic camera," Proc. SPIE 11396, Computational Imaging V, 113960R (21 April 2020). [CTISR]

GILES, NANCY C.

Professor of Physics, Department of Engineering Physics, AFIT Appointment Date: 2009 (AFIT/ENP); BS, University of North Carolina at Chapel Hill, 1981; PhD, North Carolina State University, 1987. Dr. Giles' research focuses on solid-state physics: photoluminescence (PL), absorption, Raman, and magnetic resonance (EPR) spectroscopy leading to identification of point defects in semiconducting and optical materials; PL excitation and time-resolved PL spectroscopies; nonlinear optical materials; laser-host materials; and scintillators. She is the author of 203 archival publications in refereed journals and two book chapters. Before joining AFIT, she was a physics faculty member at West Virginia University for 19 years. She has more than 5600 total career citations of her papers; her h-index is 38. Current work includes studies of dosimeter materials for improved detection of nuclear radiation, wide band-gap semiconductors for photorefractive and electronic device applications, and infrared non-linear optical materials for

infrared countermeasures. Dr. Giles is a member of the Optical Society of America, American Physical Society, and Materials Research Society. Tel. (937) 255-3636 x4601, email: Nancy.Giles@afit.edu

Sponsor Funded Research Projects

"Optical and EPR characterization of CdSiP2 crystals." Sponsor: AFRL/RX. Funding: $30,000 - Giles 100%.

"Optical and EPR characterization of CdSiP2 crystals." Sponsor: AFRL/RX. Funding: $8,000 - Giles 100%.

Refereed Journal Publications

Lenyk, C.A., Gustafson, T.D. Basun, S.A., Halliburton, L.E. and Giles, N.C., "Experimental determination of the (0/-) level for Mg acceptors in β-Ga2O3 crystals," Applied Physics Letters, Vol. 116, article no. 142101 (5 pages), April 2020.

Shumelyik, O., Voldov, A., Skrypka, Y., Halliburton, L. E., Giles, N. C., Lenyk, C. A., Basun, S., Grabar, A., Vysochanskii, Y., Odoulov, S., and Evans, D., "Near-infrared-sensitive photorefractive Sn2P2S6 crystals grown by the Bridgman method," Journal of Applied Physics, Vol. 127, article no. 103103 (8 pages), Mar 2020.

Lenyk, C.A., Gustafson, T.D., Halliburton, L.E. and Giles, N.C., "Deep donors and acceptors in β-Ga2O3 crystals: Determination of the Fe2+/3+ level by a noncontact method," Journal of Applied Physics, Vol. 126, article no. 245701 (9 pages), Dec 2019.

HAWKS, MICHAEL R.
Research Assistant Professor of Optical Engineering (through Perduco), Department of Engineering Physics, AFIT Appointment Date: 2008 (AFIT/ENP); BS, Astrophysics, Michigan State University, 1991; MS, Engineering Physics, AFIT, 1993; PhD, Optical Sciences, AFIT, 2006. Dr. Hawks' main research interests include electro-optic and infrared (EO/IR) remote sensing. Specific application areas include monocular passive ranging, hyperspectral and polarimetric imaging, and computational imaging. He previously taught at the United States Air Force Academy and has conducted research in chemical lasers, space object identification, chem/bio agent detection, infrared countermeasures, nuclear detonation detection, and other remote sensing applications at the Air Force Research Laboratory and other assignments. He has, chaired eleven MS committees and published 38 technical papers and reports. He is a member of the Optical Society of America and SPIE and is a retired USAF Lt Col. AFIT research center affiliation(s): [CTISR], [CDE], and [CSRA.] Tel. (937) 255-3636 x4828, email: Michael.Hawks.ctr@afit.edu

Refereed Journal Publications

Thomas, G., R. Cobb, S. Fiorino, and M. Hawks, 2020: "Daytime Cloudless Sky Radiance Quantification with Ground-Based Aerosol and Meteorological Observations in the Shortwave Infrared," *J. Atmos. Oceanic Technol*., **37**, 777–788, doi.org/10.1175/JTECH-D-19-0157.1

HENGEHOLD, ROBERT L.
Professor Emeritus of Physics, Department of Engineering Physics, AFIT Appointment Date: 1961 (AFIT/ENP); AB, Thomas More College, 1956; MS, University of Cincinnati, 1961; PhD, University of Cincinnati, 1965. Dr. Hengehold's research areas center on experimental solid state physics, semiconductor physics, optical diagnostics, and electron and laser spectroscopy. He is the author of over 100 archival publications and over 215 presentations at technical meetings. He has served as advisor on over 17 doctoral dissertations and 80 master's theses. He is currently carrying out studies of (1) depth resolved cathodoluminescent spectroscopy of materials suitable for neutron absorbing semiconductor solid state detectors and (2) optical characterization of compound semiconductor materials and super lattice structures for mid-infrared diode lasers and detectors. This work involves collaborative efforts with the Directed Energy and Sensors Directorates at AFRL and DTRA. Dr. Hengehold received the Air University Commander's Award for Faculty Achievement in 1982, the Gage H. Crocker Outstanding Professor Award in 1996, the Outstanding Professional Achievement Award from the Affiliate Society Council of the Engineering and Science Foundation of Dayton in 1997, and the General Bernard A. Schriever Award in 1999. He was elected a Fellow of the American Physical Society in 2008. Tel. (937) 255-3636 x4502, email: Robert.Hengehold@afit.edu

HERR, NICHOLAS, C., Maj
Assistant Professor of Materials Science, Department of Engineering Physics, AFIT, Appointment Date: 2016 (AFIT/ENP); BS, United States Air Force Academy, 2008; MS, Air Force Institute of Technology, 2010; PhD, Air Force, 2016. Maj Herr's research focuses on high-power laser damage of carbon composites, remote sensing, and atomic force microscopy.

HOBBS, EDWARD L., LTC
Assistant Professor of Nuclear Engineering, Department of Engineering Physics, AFIT Appointment Date: 2018 (AFIT/ENP); LTC Hobbs' research interests are primarily focused on deterministic neutron transport. Most recently he developed methods to address the difficulties of the non-linear characteristics associated with the time-eigenvalue diffusion and even-parity transport equations. His calculations currently provide the time-eigenvalue used to model the burst characteristics associated with a Fast Burst Reactor (FBR). Additional research interests include non-proliferation, counter-proliferation, and consequence management, specifically as they relate to the military and Nuclear and Counter-Proliferation Officer (NCP/52) missions. LTC Hobbs is also interested in improved methods to determine accurate nuclear data (material), stochastic transport methods, and health physics (radiation safety). Tel. (937) 255-3636 x4609, email: Edward.Hobbs@afit.edu

Books and Chapters in Books

Chapter 9: Nuclear Weapons Physics in Guide to Nuclear Deterrence in the Age of Great-Power Competition. Louisiana Technical Research Institute.

HOLLAND, DARREN, E.
Research Assistant Professor of Nuclear Engineering, Department of Engineering Physics, AFIT Appointment Date: 2018 (AFIT/ENP); BA, Cedarville University, 2006; MS, University of Michigan, 2008; PhD, University of Michigan, 2012. Dr. Holland's expertise is in modeling and simulation, which he performs for the Nuclear Expertise for Advancing Technologies center. His current research focuses on optimizing the design of complex radiation imagers and developing models and simulations to analyze radiative and thermal weapon effects in space or ground. Before joining AFIT, he was on the faculty of Cedarville University. AFIT research center affiliation(s): [NEAT.] Tel. (937) 255-3636 x4697, email: Darren.Holland.@afit.edu

Refereed Journal Publications

Logan, J., Holland, D., Burggraf, L., Clinton, J., O'Day, B. 2019. "Monte Carlo and Experimental Analysis of a Novel Directional Rotating Scatter Mask Gamma Detection System." *Nuclear Instruments and Methods in Physics Research Section A: Accelerators, Spectrometers, Detectors and Associated Equipment*. 947, pp. 162698. https://doi.org/10.1016/j.nima.2019.162698

Olesen R., O'Day B., Holland D., Burggraf L., and Bevins J., 2020. "Characterization of novel rotating scatter mask designs for gamma direction identification". *Nuclear Instruments and Methods in Physics Research Section A: Accelerators, Spectrometers, Detectors and Associated Equipment*. 954, pp. 161232. https://doi.org/10.1016/j.nima.2018.09.067

Refereed Conference Papers Accepted on the Basis of Full Paper Review

Horan, L., Holland, D., Syal, M., Wasem, J., Dexter, M., Bevins, J., "Neutron Energy Effects on Asteroid Deflection." *2020 IEEE Aerospace Conference*, Big Sky, MT, presented March 2020.

Olesen, R., Holland, D., Bevins, J., "Imaging Fast Burst Reactor with a Rotating Scatter Mask Imaging System," *Hardened Electronics and Radiation Technology Conference*, to be presented August 2020.

Seik, J., Holland, D., Bevins, J., "Rotating Scatter Mask Single Voxel Characterization," 2021 ANS Student Conference, Raleigh, NC, to be presented April 2021.

Fitzpatrick, S., Chapman, R., Holland, D., Bevins, J., "Evaluation of the 154-Gd (p,2n)153-Tb Cross Section," 2021 ANS Student Conference, Raleigh, NC, to be presented April 2021.

Patents Awarded

Holland, D., Olesen, R.*, Burggraf, L., O'Day, B., Bevins, J. 2019. "Rotating Scatter Mask Design Classes for Directional Radiation Detection and Imaging." U.S. Patent Application 16/812,844, filed September 17, 2020.

Patent Applications

Holland, D., Olesen, R., Burggraf, L., O'Day, B., Bevins, J. 2019. "Rotating Scatter Mask Design Classes for Directional Radiation Detection and Imaging." U.S. Patent Application 62,986,892, Additional provisional filed April 2, 2020.

Egner, B., Olesen, R., Holland, D., Martin, V., O'Day, B., Burggraf, B., Bevins, J. 2019. "An Efficient, Dual-particle Directional Detection System using a Rotating Scatter Mask." U.S. Patent Application 16,812,844, Non-provisional filed March 11, 2020.

HYDE, MILO W., Lt Col

Associate Professor of Optical Physics, Department of Engineering Physics, AFIT Appointment Date: 28 Aug 2020 (AFIT/ENP); Associate Professor of Electrical Engineering, Department of Electrical and Computer Engineering, AFIT Appointment Dates: 19 Oct 2014 – 15 Sep 2017 (AFIT/ENG); BS, Georgia Institute of Technology, 2001; MS, Air Force Institute of Technology, 2006; PhD, Air Force Institute of Technology 2010. Dr. Hyde has over 150 journal and conference publications in electromagnetic material characterization, guided-wave theory, and statistical optics. He is a senior member of OSA, SPIE, and IEEE, and a member of the Tau Beta Pi and Eta Kappa Nu honor societies. AFIT research center affiliation(s): [CDE.] Tel. (937) 255-3636 x4508, email: milo.hyde@afit.edu

Refereed Journal Publications

Yongtao Zhang, Chaoliang Ding, Milo W. Hyde IV, and Olga Korotkova, "Non-stationary pulses with complex-valued temporal degree of coherence," *Journal of Optics*, vol. 22, 105607 (10 pp.), Sep 2020, doi: 10.1088/2040-8986/abb3a5.

Milo W. Hyde IV, "Twisted space-frequency and space-time partially coherent beams," *Scientific Reports*, vol. 10, 12443 (12 pp.), Jul 2020, doi: 10.1038/s41598-020-68705-9.

Neil Rogers, Michael Havrilla, Milo Hyde, and Alexander Knisely, "Nondestructive electromagnetic characterization of uniaxial sheet media using a two-flanged rectangular waveguide probe," *IEEE Transactions on Instrumentation and Measurement*, vol. 69, no. 6, pp. 2938-2947, Jun 2020, doi: 10.1109/TIM.2019.2925408.

Milo W. Hyde IV, "Comment on 'Modified Bessel-correlated vortex beams and their propagation properties'," *Optics and Laser Technology*, vol. 127, 106191 (1 p.), Mar 2020, doi: 10.1016/j.optlastec.2020.106191.

Milo W. Hyde IV, "Synthesizing general electromagnetic partially coherent sources from random, correlated complex screens," *Optics*, vol. 1, no. 1, pp. 97-113, Mar 2020, doi: 10.3390/opt1010008.

Milo W. Hyde IV, "Stochastic complex transmittance screens for synthesizing general partially coherent sources," *Journal of the Optical Society of America A*, vol. 37, no. 2, pp. 257-264, Feb 2020, doi: 10.1364/JOSAA.381772.

Milo W. Hyde IV, "Generating electromagnetic dark and antidark partially coherent sources," *Journal of Physics Communications*, vol. 4, no. 1, 015025 (8 pp.), Jan 2020, doi: 10.1088/2399-6528/ab6ed3.

Milo W. Hyde IV, Xifeng Xiao, and David G. Voelz, "Generating electromagnetic nonuniformly correlated beams," *Optics Letters*, vol. 44, no. 23, pp. 5719-5722, Dec 2019, doi: 10.1364/OL.44.005719.

Milo W. Hyde IV, "Generating electromagnetic Schell-model sources using complex screens with spatially varying auto- and cross-correlation functions," *Results in Physics*, vol. 15, 102663 (9 pp.), Dec 2019, doi: 10.1016/j.rinp.2019.102663.

Svetlana Avramov-Zamurovic, Charles Nelson, and Milo Hyde, "Scintillation experiments with non-uniformly and uniformly correlated spatially partially coherent laser beams propagating underwater," *Journal of Modern Optics*, vol. 66, no. 20, pp. 1998-2007, Nov 2019, doi: 10.1080/09500340.2019.1686547.

Refereed Conference Papers Accepted on the Basis of Full Paper Review

Milo W. Hyde IV, "Generating genuine partially coherent sources using complex transmittance screens," OSA Imaging and Applied Optics Congress: Propagation Through and Characterization of Atmospheric and Oceanic Phenomena, PM2D.3 (2 pp.), Virtual Conference (Vancouver, British Columbia, Canada), Jun 2020. Invited.

JAMES, ROYCE W., CDR, US Coast Guard

Visiting Professor of Physics, Department of Engineering Physics, AFIT Appointment Date: 2019, (AFIT/ENP); CG Academy Appointment Date: 2004, (CGA/dsp); BS, New Mexico State University, 1999; MS, Columbia University, 2003; Ph.D., Stephens Institute of Technology, 2009. CDR James' research focus is primarily in laboratory and space based magnetized plasmas, plasma interactions with electromagnetic radiation (with emphasis on high energy lasers), fusion energy, and plasma water treatment. CDR James recently served as the Head of Physics at the Coast Guard Academy, is a co-founder of the New London Freedom School, a Science Technology and Mathematics Magnet School Board Member, and Member of the Nuclear Energy Advisory Council for the state of CT. CDR James has published three referred journal articles and twenty conference publications. CDR James is a member of APS-DPP. AFIT research center affiliation(s): [CDE.] Tel. (937) 255-3636 x4696, email: Royce.James@afit.edu, Royce.W.James@uscga.edu

Sponsor Funded Research Projects

"2020 STEM coding / AFIT Summer Teacher Fellowship." Sponsor: CEERD-IZP. Funding: $25,000 - James 100%. [CDE]

Refereed Conference Papers Accepted on the Basis of Full Paper Review

K. Young-McLear, S. Zelmanowitz, R. W. James, D. Brunswick, T. DeNucci, "Beyond Buzzwords and Bystanders: A Framework for Systematically Developing a Diverse, Mission Ready, and Innovative Coast Guard Workforce," ASEE's 2020 Collaborative Network for Engineering and Computing Diversity 3rd Annual Meeting, Washington, DC (Crystal City); (2020).

Refereed Conference Papers Accepted on the Basis of Abstract Review

B. Kay, R. W. James, R. W. Freeman, L. A. Allen, E. Tejero, "CGA Impedance Probe and CGA VSIR Sensor," Annual Directed Energy Science and Technology Symposium, West Point NY, March 2020.

C. Baxter, J. Frey, K. Poole, R. W. James, "High Power Microwave Directed Energy Protection for USCG Vessels: Design Research," Annual Directed Energy Science and Technology Symposium, West Point NY, March 2020.

J. Moll, R. Wolfgang, R. W. James, "A Systems Approach to Stopping Non-Compliant Vessels with HPM Devices on USCGC FRC," Annual Directed Energy Science and Technology Symposium, West Point NY, March 2020.

James, R.W. "Progress on Development of Low Pressure High Density Plasmas on the Helicon Plasma Experiment (HPX)," American Physical Society's 61st Annual Meeting of the Division of Plasma Physics, Fort Lauderdale, FL; November, 5 - October, 24, (2019).

Freeman, R.W, James, R.W., Allen, L.A., Tejero, E., Daeffler, M. "CGA/NRL Impedance Probe as a ThinSat Spacecraft Payload" American Physical Society's 61st Annual Meeting of the Division of Plasma Physics, Fort Lauderdale, FL; November, 5 - October, 24, (2019).

James, R.W. "Progress on Development of Low Pressure High Density Plasmas on the Helicon Plasma Experiment (HPX)," American Physical Society's 61th Annual Meeting of the Division of Plasma Physics, Ft. Lauderdale, FL; October, 21 - October, 25, (2019).

Freeman, R. W., James, R. W., Allen, L, Tejero, E, "Impedance Probe as a ThinSat Spacecraft Payload," American Physical Society's 61th Annual Meeting of the Division of Plasma Physics, Ft. Lauderdale, FL; 21-25 October (2019).

James, R. W., Freeman, R. W., L. A. Allen, Tejero, E, Kang, J. S., B. Kay," SmallSat Platform Development for Coast Guard Academy Collaborative Space-Based Research," Small Satellite Annual Meeting, (Online); (2020).

R. W. James, L. A. Allen, R. W. Freeman, E. Tejero, B. Kay, "Building an Academic Community SmallSat Program," Small Satellite Annual Meeting, (Online); (2020).

Other Significant Research Productivity

CGAPL (AFRL, DOE): Helicon plasmas in a high-pressure regime and a discharge plasma in the standard temperature and plasma (STP) regime are being explored with typical magnetic, particle, optical, and emissive probes and other diagnostics that will be developed as learning tools and for use in experiments. We utilize a Quantel 2.5 J high energy laser for Thomson Scattering, as we continue to expand our data collection ability. These purchases are the forward along the development of invaluable diagnostics on the Helicon plasma Experiment (HPX) to yield real-time, simultaneous measurements of electron plasma temperature and density can be measured with a high degree of accuracy using a high energy laser beam pulse. We have also continued our working relationship with Princeton Plasma Physics Laboratory (PPPL), Navy Research Lab (NRL), and Air Force Institute of Technology (AFIT). These initiatives will continue to be funded by DE-JTO, PPPL, the Coast Guard, and other funding agencies. A new student will continue to follow in this progression this fiscal year to work on the new polychromator and Langmuir probes.

Schedules:

HPX (3-Phases)

Phase 1: particle & optical probes measure plasma edge & global temp & density profiles [Winter 21']

Phase 2: measure plasma's internal temp & density w/ Thomson scattering diagnostic [Fall 21']

Phase 3: energy solution investigations; develop innovative 'intelligent' diagnostics, & spacecraft propulsion design/engineering. [Ongoing]

MSIHL: Military Service Institutions of Higher Learning is launching 2 ThinSat spacecraft this winter on the NG-15 launch through our VaSpace partnership. We will explore the ionosphere and LEO space environment with a SWIR optical sensor and cutting-edge impedance probe with a never before utilized surface mounted antenna. Another CubeSat launch will follow on the NG-16 with enhanced senor capabilities and other funded research payloads. Costs for both launches are covered by VaSpace.

Thin/CubeSats

Phase 1: Polar Scout/1st ThinSat Launch & Ground Station Construction [2018/19] – Complete!

Phase 2: Visual & Impedance Probe NG-15 Launch [Fall 20']

Phase 3: CubeSat Visual Payload NG-16 Launch [Fall 21']

Pulse Laser Plasmoid (NSF): The interaction of plasma with liquid water at 1 Atm is currently being investigated for a range of technical applications ranging from environmental remediation (e.g. water purification) to healthcare (wound healing). Additionally, material processing applications such as etching, discharges to solid surfaces, plus texturing and surface functionalization are being investigated. 3-year grant (with option to renew) as Co-PI's. Total grant is ~$240,000 per year. CGA portion is ~$95,000 per year. One Ph.D. student to attend AFIT and do research at the CGA Plasma Lab (CGAPL) & Air Force Institute of Technology (AFIT) with the Air Force Research Lab (AFRL), Princeton Plasma Physics Lab (PPPL), and UMich collaborations on the sub award to CGA. Total Ph.D. student costs ~$65,000 – this is the anticipated portion of the grant that SPRI can assert overhead on at a rate of 26%. CGA/SPRI will source funds to AFIT for them to hire the civilian student as an AD21 for salary and benefits while tuition will be covered under the CGA/AFIT MOA. UMich will submit and administer the full grant with CGA as a sub award to SPRI.

KEDZIORA, GARY S.
Assistant Research Professor of Physics, Department of Engineering Physics, AFIT Appointment Date: 2020 (AFIT/ENP); BS University of Minnesota, 1987; PhD, The Ohio State University, 1994. Dr. Kedziora's research interests are in using quantum mechanics, molecular dynamics, and quantum electrodynamics to model processes in physics, chemistry and biology with emphasis on modeling mechanisms, kinetics, and spectroscopy. He has contributed to various quantum chemistry software packages and is an expert in scientific programming, method development, data analysis, and high-performance computing. He has published 34 papers in refereed journals with over 3000 citations. He has participated in 3 dissertation committees. Email: Gary.Kedziora@afit.edu

Sponsor Funded Research Projects

"Kinetics of Chain Scission in Polymeric Materials." Sponsor: AFRL/RX. Funding: $75,000 - Kedziora 100%.

Refereed Journal Publications

Yilin Ren, Rahul Rao, Shushi Bhopal, Visas Varshney, Gary Kedziora, Robert Wheeler, Youngjong Kang, Ajit Roy, Dhriti Nepal, "Hierarchical Assembly of Gold Nanoparticles on Graphene Nanoplatelets by Spontaneous Reduction: Implications for Smart Composites and Biosensing," *ACS Applied Nano Materials*, Vol. 3, No. 9, pp. 8753-8762, Aug 2020.

Belcher, Lachlan T, Lewis, Charlton D, Kedziora, Gary S, and Weeks, David S, "Analytic non-adiabatic derivative coupling terms for spin-orbit MRCI wave functions. II. Derivative coupling terms and coupling angle for KHe A2Π1/2 ⇔ KHe B2Σ1/2," The Journal of Chemical Physics, Vol. 151, No. 23, pp. 234109-1,8, Dec 2019.

Belcher, Lachlan T, Kedziora, Gary S, and Weeks, David S, "Analytic non-adiabatic derivative coupling terms for spin-orbit MRCI wave functions. I. Formalism," The Journal of Chemical Physics, Vol. 151, No. 23, pp. 234104-1,9, Dec 2019.

LENYK, CHRISTOPHER A., Lt Col
Assistant Professor of Nuclear Engineering, Department of Engineering Physics, AFIT Appointment Date: 2019 (AFIT/ENP); BS, Nuclear Engineering, Rensselaer Polytechnic Institute, 2002; MS Nuclear Engineering, Air Force Institute of Technology, 2014; PhD Nuclear Engineering, Air Force Institute of Technology, 2019. Lt Col Lenyk's research focuses on solid-state physics, radiation effects, and nuclear weapon effects using a variety of experimental techniques including photoluminescence (PL), absorption, and electron paramagnetic resonance (EPR), thermoluminescence (TL), and wavelength-dependent TL leading to identification of point defects in ultra-wide bandgap and optical materials; laser-host materials; and scintillators for radiation detection. He is the author of 4 archival publications in refereed journals. Before joining AFIT, he has held a variety of assignments and leadership positions in the areas of directed energy weapons, nuclear treaty monitoring, space intelligence, and countering weapons of mass destruction. Current research includes wide bandgap materials for power electronics, scintillator and radiation detection materials, photorefractives, and nonlinear optical materials. Lt Col Lenyk is a member of SPIE. Tel. (937) 255-3636 x4558, email: Christopher.lenyk@afit.edu

Sponsor Funded Research Projects

"Identification and Characterization of Isolated Point Defects in BaGa4S7, BaGa4Se7, and BaGa2GeSe6." Sponsor: AFOSR. Funding: $20,100 - Lenyk 100%.

Refereed Journal Publications

Lenyk, C.A., Gustafson, T.D. Basun, S.A., Halliburton, L.E. and Giles, N.C., "Experimental determination of the (0/-) level for Mg acceptors in β-Ga2O3 crystals," Applied Physics Letters, Vol. 116, article no. 142101 (5 pages), April 2020.

Shumelyik, O., Voldov, A., Skrypka, Y., Halliburton, L. E., Giles, N. C., Lenyk, C. A., Basun, S., Grabar, A., Vysochanskii, Y., Odoulov, S., and Evans, D., "Near-infrared-sensitive photorefractive Sn2P2S6 crystals grown by the Bridgman method," Journal of Applied Physics, Vol. 127, article no. 103103 (8 pages), Mar 2020.

Lenyk, C.A., Gustafson, T.D., Halliburton, L.E. and Giles, N.C., "Deep donors and acceptors in β-Ga2O3 crystals: Determination of the Fe2+/3+ level by a noncontact method," Journal of Applied Physics, Vol. 126, article no. 245701 (9 pages), Dec 2019.

LOPER, ROBERT D.
Assistant Professor of Physics, Department of Engineering Physics, AFIT Appointment Date: 2014 (AFIT/ENP); BS, University of Dayton, 1994; MS, University of Texas at Dallas, 1998; MTS, United Theological Seminary, 2011; PhD, Air Force Institute of Technology, 2013. Dr. Loper's research interests are in space physics, centering on solar astrophysics, magnetospheric physics, and the near-Earth space environment. Dr. Loper is a member of Tau Beta Pi and Sigma Pi Sigma. AFIT research center affiliation(s): [CSRA.] Tel. (937) 255-3636 x4333,
email: Robert.Loper@afit.edu

Sponsor Funded Research Projects

"Reconnection Signatures in Solar Magneto grams." Sponsor: AFOSR. Funding: $30,888 - Loper 100%.

Refereed Journal Publications

Loper, R. D., and Weeks, D. E., "A fully quantum calculation of broadening and shifting coefficients of the D1 and D2 spectral lines of alkali-metal atoms colliding with noble-gas atoms," Journal of Physics B: Atomic, Molecular and Optical Physics, Vol. 53, No. 20, p. 205403, 15 Sep 2020.

Whitney Aegerter, T. R., Emmons, D. J., and Loper, R. D., "Detection of Reconnection Signatures in Solar Flares," Journal of Atmospheric and Solar-Terrestrial Physics, Vol. 208, p. 105375, 15 Oct 2020 (available online 30 Jul 2020).

Refereed Conference Papers Accepted on the Basis of Abstract Review

Loper, R. D., "Plasma structure of the deep solar interior," AGU 2019 Fall Meeting, San Francisco, CA, 9-13 Dec 2019.

Whitney, T. R., Emmons, D. J., and Loper, R. D., "Reconnection Signatures in Solar Magneto grams," AGU 2019 Fall Meeting, San Francisco, CA, 9-13 Dec 2019.

Schwalbe, S. G., Loper, R. D., Nava, O. A., and Lewis, C. D., "Modeling the Effects of a Second Sun on Ionospheric Composition and Structure," AGU 2019 Fall Meeting, San Francisco, CA, 9-13 Dec 2019.

MARCINIAK, MICHAEL A.
Professor of Physics, Department of Engineering Physics, AFIT Appointment Date: 1999 (AFIT/ENP); BS, St. Joseph's College, 1981; BSEE, University of Missouri, 1983; MSEE, Air Force Institute of Technology, 1987; PhD, Air Force Institute of Technology, 1995. Dr. Marciniak's research interests include various aspects of light-matter interaction, including (1) polarimetry scatterometry of nanostructured materials, such as photonic crystals such as photonic crystals and infrared meta-surfaces, and bidirectional reflectance distribution functions (BRDF's) for optical signatures. He has published over 35 refereed and 80 other publications and chaired 11 PhD and over 55 MS thesis committees. He holds one patent. He is a retired Lt Col, USAF, with 22 years of service. AFIT research center affiliation(s): [CDE], [CSRA], and [CTISR.] Tel. (937) 255-3636 x4529, email: Michael.Marciniak@afit.edu

Sponsor Funded Research Projects

"2D photonic crystals from birefringent nanorod thin-films for nanophotonic component applications." Sponsor: AFOSR. Funding: $117,241 - Marciniak 100%. [CDE]

"Meta-optic microlenses for severe-axial-chromatic-aberration imaging systems." Sponsor: Undisclosed. Funding: $26,496 - Marciniak 75%, Franz 25%. [CTISR]

"Meta-optic microlenses for severe-axial-chromatic-aberration imaging systems." Sponsor: Undisclosed. Funding: $39,743 - Marciniak 75%, Franz 25%. [CTISR]

Refereed Journal Publications

C.D. Diaz,* A.L. Franz, and M.A. Marciniak, "Spatial resolution comparison of a diffractive plenoptic camera and an intermediate image diffractive plenoptic camera," Optical Engineering 58(12), 123102(1-13) (Dec 2019).

Refereed Conference Papers Accepted on the Basis of Abstract Review

C.D. Diaz,* B.M. Adomanis, D.B. Burckel and M.A. Marciniak, "Simulation and modeling of fabricated metasurface optical device measured via polarimetric scatterometer," Proc. SPIE 11467, (11467-18) (2020).

T.V. Small,* S.D. Butler and M.A. Marciniak, "Augmenting CASI® BRDF measurement device to measure out-of-plane scatter with CCD pixel array," Proc. SPIE 11485, (11485-9) (2020).

R.L. Wolfgang,* S.D. Butler and M.A. Marciniak, "Comparison of the accuracy of Rayleigh-Rice polarization factors to improve micro facet pBRDF models," Proc. SPIE 11485, (11485-15) (2020).

M.W. Bishop,* S.D. Butler and M.A. Marciniak, "Analysis of hybrid directional volumetric scatter terms for enhanced micro facet BRDF modeling," Proc. SPIE 11485, (11485-16) (2020).

Other Significant Research Productivity

C.D. Diaz,*# M.A. Marciniak, M. Miller,* A.M. Urbas, D.B. Burckel, E.B. Whiting, S.D. Campbell and D.H. Werner, "Measurement of an infrared plasmonic out-of-plane 3D thin-film meta-surface beam-steerer," presented at Metamaterials 2020 held on 28 September-1 October 2020 in New York, NY (on line).

MATHEWS, KIRK A.
Professor Emeritus of Nuclear Engineering, Department of Engineering Physics, AFIT Appointment Date: 1987 (AFIT/ENP); BS, California Institute of Technology, 1971; MS, Air Force Institute of Technology, 1982; PhD, Air Force Institute of Technology, 1983. Dr. Mathews' research interests center on computational methods for neutral particle radiation transport and modeling and analysis of nuclear phenomena and measurements, including enrichment cascade modeling, high altitude radiation transport, blast and shock, nuclear thermal radiation, deconvolution of radiation spectra, and statistical analysis of nuclear measurements. Dr. Mathews has published 20 papers in refereed journals and 21 conference proceedings and chaired 35 theses and 13 dissertations. He is a member of the American Nuclear Society and Tau Beta Pi.

MCCLORY, JOHN W.
Professor of Nuclear Engineering, Department of Engineering Physics, AFIT Appointment Date: 2008 (AFIT/ENP); BS, Physics, Rensselaer Polytechnic Institute, 1984; MS, Physics, Texas A&M University, 1993; PhD, Nuclear Engineering, Air Force Institute of Technology, 2008. Dr. McClory's expertise is in radiation effects, radiation detector development, and nuclear weapon effects. His research includes determining the effect of space and nuclear weapon radiation on electronic and structural materials, the interaction of radiation with matter, and the use of nuclear reactions to inform nuclear forensics techniques. He has advised 20 PhD students (eight current) and 36 MS students (two current), received 20 research grants, and published 91 journal articles during his time on the AFIT faculty. He is a member of the IEEE Nuclear and Plasma Sciences Society, American Nuclear Society, and Materials Research Society. AFIT research center affiliation(s): [CSRA] and [CTISR.] Tel. (937) 255-3636 x7308, email: John.McClory@afit.edu

Sponsor Funded Research Projects

"Support for the US Nuclear Detonation Detection System." Sponsor: NNSA/NA-22. Funding: $50,000 - McClory 50%, Singleton 50%.

"AFIT/ENP Research in Support of Defense Threat Reduction Agency Nuclear Technologies." Sponsor: DTRA. Funding: $200,000 - McClory 20%, Bevins 40%, Petrosky 20%, Dexter 20%. [NEAT]

"MOA - AFTAC Endowed Term Chairs." Sponsor: AFTAC/XPB. Funding: $30,000 - McClory 100%. [NEAT]

Refereed Journal Publications

K. Choe, M.R. Hogsed, N. Miguel, J.W. McClory, and J. Kouvetakis, "Displacement Damage Effects in Germanium Tin LEDs," *Journal of Radiation Effects, Research and Engineering*, vol. 38, no. 1, pp. 11-17, March 2020.

M.C. Recker and J.W. McClory, "Comparison of Clustering Algorithms for Analysis of Pulse-Shape Data from Cerium- Doped Cesium Lithium Yttrium Chloride," *Journal of Radiation Effects, Research and Engineering*, vol. 38, no. 1, pp. 14-23, March 2020.

M.E. Mace, J.W. McClory, J.C. Petrosky, E. Heller, and G. Vizkelethy, "Targeted Heavy-Ion Radiation of Aluminum Gallium Nitride/Gallium Nitride HEMTs," *Journal of Radiation Effects, Research and Engineering*, vol. 38, no. 1, pp. 52-61, March 2020.

W.D. Johnston, M.L. Dexter, J.W. McClory, and J.E. Bevins, "Simulating Surface-Interacting Nuclear Detonations using RECIPE and SHAMRC," *Journal of Radiation Effects, Research and Engineering*, vol. 38, no. 1, pp. 14-23, March 2020.

Michael A. Ford, Buckley E. O'Day, John W. McClory, Areg Danagoulian, "Development of a Neutron Spectrometer Utilizing Rubberized Eu: LiCAF Wafers," Nuclear Instruments and Methods in Physics Research A, vol. 954, 161685, February 2020. https://doi.org/10.1016/j.nima.2018.11.144.

M.C. Recker, E. Cazalas, J.W. McClory, "Pulse shape discrimination with a low-cost digitizer using commercial off-the-shelf components," Nuclear Instruments and Methods in Physics Research A, vol. 954, 161479, February 2020. https://doi.org/10.1016/j.nima.2018.10.157.

E. Cazalas, M. R. Hogsed, S. Vangala, M. R. Snure, and J. W. McClory, "Gamma-ray radiation effects in graphene-based transistors with h-BN nanometer film substrates, *Applied Physics Letters*, vol. 115, 223504 (5 pages), November 2019. https://doi.org/10.1063/1.5127895.

Nicole Benker, *Elena Echeverria, *Robert Olesen, *Brant Kananen, John McClory, Yaroslav Burak, Volodymyr Adamiv, Ihor Teslyuk, George Peterson, Ben Bradley, Ethiyal R. Wilson, James Petrosky, Bin Dong, Jeffry Kelber, Jennifer Hamblin, Jacques Doumani, Peter A. Dowben, Axel Enders, "Possible Detection of Low Energy Solar Neutrons Using Boron Based Materials," *Radiation Measurements*, vol. 129, 106190 (7 pages), October 2019. https://doi.org/10.1016/j.radmeas.2019.106190.

Refereed Conference Papers Accepted on the Basis of Abstract Review

D. Gum, G. Varshney, J.W. McClory, A.A. Bickley, and A. Holland, "A Machine Learning Approach to Characterizing Particle Morphology in Nuclear Forensics," accepted by the *Hardened Electronics and Radiation Technology Conference*, August 2020.

T.L. Freeman, M.L. Dexter, J.W. McClory, H. Happ, "The Effects of Water Entrainment on Blast Waves in Marine Environments," accepted by the *Hardened Electronics and Radiation Technology Conference*, August 2020.

N. J. Gale, J. W. McClory, M. Hogsed, and B. Wang, "Neutron Displacement Damage in Germanium-Tin Photodiodes," accepted by the *Hardened Electronics and Radiation Technology Conference*, August 2020.

MCCRAE, JACK E., Jr.
Research Associate Professor, Department of Engineering Physics, AFIT Appointment Date: 2013 (AFIT/ENP); BS, Physics, Massachusetts Institute of Technology, 1984; MS, Physics (Optics), Air Force Institute of Technology, 1993; PhD, Physics, Air Force Institute of Technology, 1997. Dr. McCrae's research interests include optics, lasers, quantum and non-linear optics, quantum computing, laser radar, atmospheric propagation, and imaging. He is a retired USAF Col with 27 years of service. AFIT research center affiliation(s): [CDE.] Tel. (937) 255-3636 x4739, email:

Jack.Mccrae@afit.edu

Refereed Journal Publications

McCrae, J.E., S.R. Bose-Pillai, S.T. Fiorino, A. Archibald, J. Meoak, B. Elmore, T. Kesler, and C. Rice, 2020, "Measurements of Optical Turbulence over 149 km Path," Opt. Eng. 59(8), 081806, doi: 10.1117/1.OE.59.8.081806.

Zuraski, S.M., E. Beecher, J.E. McCrae, and S.T. Fiorino, 2020, "Turbulence profiling using pupil plane wave front data derived Fried parameter values for a dynamically ranged Rayleigh beacon," Opt. Eng. 59(8), 081807, doi: 10.1117/1.OE.59.8.081807.

Refereed Conference Papers Accepted on the Basis of Full Paper Review

Boeckenstedt, A., J. McCrae, S. Bose-Pillai, B. Wilson, and S. Fiorino, "Validation of HTS optical turbulence profiling via sonic anemometry," Proc. SPIE. 11508, Unconventional Imaging and Adaptive Optics 2020 (8 September 2020).

McCrae, J., S. Bose-Pillai, A. Boeckenstedt*, B. Wilson*, K.J. Keefer, and S.T. Fiorino, "Turbulence profiling with a dual beacon Hartmann turbulence sensor using simulation derived weighting functions," Proc. SPIE. 11508, Unconventional Imaging and Adaptive Optics 2020 (20 August 2020).

Bose-Pillai, S., B. Wilson, J. McCrae, A. Boeckenstedt, A. Archibald, K. Keefer, and S. Fiorino, "Profiling of atmospheric turbulence from dual-camera time-lapse imagery of a LED array," in Propagation through and Characterization of Atmospheric and Oceanic Phenomena (pcAOP), (PTu4F.2), OSA Optical Sensors and Sensing Congress, Virtual Event, 23 June 2020.

Wilson, B., S. Bose-Pillai, J. McCrae, and S. Fiorino, "Profiling of atmospheric turbulence using time-lapse imagery of noncooperative targets from multiple cameras," in Propagation through and Characterization of Atmospheric and Oceanic Phenomena (pcAOP), (PTu4F.3), OSA Optical Sensors and Sensing Congress, Virtual Event, 23 June 2020.

McCrae, J.E., S.R. Bose-Pillai, C.A. Rice, Archibald, A. J., and S.T. Fiorino, "Wave Optics Simulations of a Dual Beacon Hartmann Turbulence Sensor," 2020 IEEE Aerospace Conference, Big Sky, MT, 7-14 Mar 2020.

Refereed Conference Papers Accepted on the Basis of Abstract Review

Alexander S. Boeckenstedt, Jack E. McCrae, Santasri R. Bose-Pillai, Benjamin G. Wilson, Steven T. Fiorino, "Validation of HTS optical turbulence profiling via sonic anemometry," Proc. SPIE 11508, Unconventional Imaging and Adaptive Optics 2020, 1150805 (8 September 2020); https://doi.org/10.1117/12.2568595.

Santasri Bose-Pillai, Benjamin Wilson, Jonathan Krone, Aaron Archibald, Brannon Elmore, Jack McCrae, Steven Fiorino, "Profiling atmospheric turbulence using dual-camera imagery of non-cooperative targets," Proc. SPIE 11506, Laser Communication and Propagation through the Atmosphere and Oceans IX, 115060J (22 August 2020); https://doi.org/10.1117/12.2569048.

Jack E. McCrae Jr., Santasri Bose-Pillai, Alexander Boeckenstedt, Ben Wilson, Kevin Keefer, Steven T. Fiorino, "Turbulence profiling with a dual beacon Hartmann turbulence sensor using simulation derived weighting functions," Proc. SPIE 11508, Unconventional Imaging and Adaptive Optics 2020, 1150806 (20 August 2020); https://doi.org/10.1117/12.2568822.

Steven M. Zuraski, Jack E. McCrae, Steven T. Fiorino, "Focal anisoplanatism influence on dynamically ranged Rayleigh beacon measurements," Proc. SPIE 11508, Unconventional Imaging and Adaptive Optics 2020, 1150802 (20 August 2020); https://doi.org/10.1117/12.2568831.

Patent Applications

Zuraski, S.M., E.A. Beecher, S.T. Fiorino, J.D. Schmidt, J.E. McCrae, N.M. Figlewski, "Design for an electro-optic testbed utilizing a dynamic range gated Rayleigh beacon for atmospheric turbulence profiling," AFD-1721. Application filed on 31 January 2020, with the U.S. Patent and Trademark Office. The application was accorded U.S. Serial No. 16/778,424.

Bose-Pillai, S.R., J.E. McCrae, C.A. Rice, and S.T. Fiorino, "Estimation of Atmospheric Turbulence Parameters using Differential Motion of Extended Features in Time-lapse Imagery," AFD-1920. Filed as an application for Letters Patent of the United States (Application Serial Number 62/924,745, filed 23-October-2019 and Application Serial Number 17/077,323, filed 22-October-2020).

NAVA, OMAR A., Lt Col

Assistant Professor of Atmospheric Science, Department of Engineering Physics, AFIT Appointment Date: 2016 (AFIT/ENP); BS, United States Air Force Academy, 2005; BS, Naval Postgraduate School, 2006; MS, Southern Methodist University, 2010; MS, Air Force Institute of Technology, 2011; PhD, University of California Los Angeles, 2016. Lt Col Nava's research interests cover a variety of topics in atmospheric science to include problems in numerical weather prediction, tropical meteorology, mesoscale processes, and space physics. He has advised three MS students during his time on the AFIT faculty. Before joining AFIT, he was the Chief of Weather Operations at the Joint Space Operations Center in Vandenberg AFB, CA. He has seven archival publications and presentations and a member of the American Meteorological Society and American Geophysical Union. AFIT research center affiliation(s): [CSRA.]

Sponsor Funded Research Projects

"Modulation of Lightning Occurrence by the Solar Wind." Sponsor: AFOSR. Funding: $42,196 - Nava 100%.

Refereed Journal Publications

Emmons, D. J., Dao, E. V., Knippling, K. K., McNamara, L. F., Nava, O. A., Obenberger, K. S., & Colman, J. J. (2020). Estimating horizontal phase speeds of a traveling ionospheric disturbance from Digisonde single site vertical ionograms. Radio Science, 55(8), e2020RS007089.

Gooch, J. Y., Colman, J. J., Nava, O. A., & Emmons, D. J. (2020). Global ionosonde and GPS radio occultation sporadic-E intensity and height comparison. Journal of Atmospheric and Solar-Terrestrial Physics, 199, 105200.

Refereed Conference Papers Accepted on the Basis of Abstract Review

Tournay, R. C., Nava, O. A., & Tseng, H. R. (2020, January). Influence of Tropical Cyclones on Total Electron Content. In 100th American Meteorological Society Annual Meeting. AMS.

Schwalbe, S. G., Loper Jr, R. D., Nava, O., & Lewis, C. D. (2019). Modeling the Effects of a Second Sun on Ionospheric Composition and Structure. AGUFM, 2019, SA12A-08.

Williams, J., Nava, O., Emmons, D. J., & Tseng, H. L. R. (2019). Influence of Lightning on Total Electron Content during Hurricane Michael (2018). AGUFM, 2019, NH31B-08.

Burg, K. S., Emmons, D. J., Nava, O., & Dao, E. V. (2019). Numerical Validation of Ionospheric Models via Ray Tracing. AGUFM, 2019, NH33C-0931.

Urbancic, B., Tseng, R., Tournay, R., Nava, O., & Emmons, D. J. (2019). Whole Atmosphere Characterization based on Arctic Oscillation Index. AGUFM, 2019, A31S-2835.

Kanipe, M., Tseng, R., Tournay, R., Nava, O., & Emmons, D. J. (2019). Middle Atmosphere Response to the El Nino Southern Oscillation Using the Whole Atmosphere Community Climate Model-Extended. AGUFM, 2019, A31S-2833.

PAK, MICHAEL V.
Research Assistant Professor, Department of Engineering Physics, AFIT Appointment Date: 2019 (AFIT/ENP); MS, Quantum Chemistry, St. Petersburg State University, 1992; PhD, Theoretical Physics, St. Petersburg State University, 1996; PhD, Quantum Chemistry, , Iowa State University, 2002. Dr. Pak's research interests include the theory of quantization, topological quantum computing and quantum theory of multi-component systems. Of particular interest is the development of new methods to accurately describe matter-antimatter interactions, and specifically positron annihilation in complex multi-electron environment. New research interests include modelling of Majorana states for topological quantum computation and development of theoretical methods to accurately predict temperature dependent short lifetime beta decay and electron capture decay at temperatures attained during nuclear explosions. AFIT research center affiliation(s): [CDE.] Tel. (937) 255-3636 x4501, email: Michael.Pak@afit.edu

Refereed Journal Publications

E.Ilin, M.Marchevsky, I.Burkova, M.V.Pak, A.Bezryadin "Nanometer-Scale Deformations of Berea Sandstone under Moisture-Content Variations," *Phys. Rev. Applied,* **13**, *024043*, 2020.

E.Ilin, I.Burkova, X.Song, M.V.Pak, S.Golubev, A.Bezryadin "Superconducting phase transition in inhomogeneous chains of superconducting islands," *Phys. Rev. B* **102**, 134502, 2020.

PATNAIK, ANIL K.
Associate Professor of Physics, Department of Engineering Physics, AFIT Appointment Date: 2019 (AFIT/ENP); BS, Physics, Utkal University (India), 1993; MS, Utkal University (India), 1995; PhD, Physics, Physical Research Laboratory (India), 2001; Post-doc: University of Electro-Communications (Japan), 2003. Dr. Patnaik specializes in the theory and experimentation of fundamental laser-matter interactions, both in the realm of classical and quantum regime, and their applications. He has worked on a wide range of topics in quantum optics, non-linear optics, laser-based diagnostics and state-of-art AF applications, leading to about 190 publications and presentations, including highly-cited peer-reviewed journal publications, book chapters, plenary and invited talks, seminars and conference presentations. He has authored two authoritative review articles on the optical diagnostics techniques for reacting flows and plasmas, with one of them been the top 1% cited engineering journal paper status in web of science for last few years. His theoretical work on fiber-based slow light has been in international news. Dr. Patnaik has successfully led many AFRL, AFOSR funded projects as PI or co-PI. He has held several academic and visiting positions at prestigious institutions such as Princeton University, Texas A&M, Purdue and Max-Planck Institute for Quantum Optics, Garching (Germany). He worked with Prof. Glauber (Nobel Laurate in Quantum Optics) on fundamental laser-matter interactions. He has been actively involved with professional societies such as APS, OSA and AIAA. Tel. (937) 255-3636 x4532, email: Anil.Patnaik@afit.edu

Refereed Journal Publications

Ashwin P. Rao, Mark Gragston, Anil K. Patnaik, Paul S. Hsu, and Michael B. Shattan. "Measurement of electron density and temperature from laser-induced nitrogen plasma at elevated pressure (1–6 bar)," Optics Express, 27, 33779-33788 (2019).

PERRAM, GLEN P.
Professor of Physics, Department of Engineering Physics, AFIT Appointment Date: 1989 (AFIT/ENP); BS, Cornell University, 1980; MS, Air Force Institute of Technology, 1981; PhD, Air Force Institute of Technology, 1986. Dr. Perram's research interests include high power chemical lasers, optically pumped gas phase lasers, laser-material interactions, hyperspectral imaging, reaction kinetics, atomic and molecular spectroscopy, environmental science, photochemistry, optical diagnostics, and remote sensing. He has advised 36 PhD and 51 MS students, received 58 research grants, and published over 110 journal articles during his 31 years on the AFIT faculty. Dr. Perram is a fellow of the Directed Energy Professional Society and a Registered Professional Engineer in the State of Ohio. AFIT research center affiliation(s): [CDE] and [CTISR.] Tel. (937) 255-3636 x4504, email: Glen.Perram@afit.edu

Sponsor Funded Research Projects

"High Energy Laser Analysis Tool: Advanced Kinetics." Sponsor: Creare. Funding: $42,840 - Perram 100%. [COA]

"Digital Holography: Coherence Effects." Sponsor: Undisclosed. Funding: $12,371 - Perram 50%, Rice 50%. [CTISR]

"Diode Pumped Alkali Laser Kinetics: Rb-He System Scaling." Sponsor: MDA. Funding: $260,000 - Perram 50%, Rice 50%. [CDE]

"Diode Pumped Alkali Laser Kinetics: Rb-He System Scaling." Sponsor: MDA. Funding: $97,724 - Perram 50%, Rice 50%. [CDE]

"Digital Holography: Coherence Effects." Sponsor: Undisclosed. Funding: $8,247 - Perram 50%, Rice 50%. [CTISR]

Refereed Journal Publications

N.D. Haluska, G. P. Perram, and Christopher A. Rice, "Efficient cascade lasing on over 17 wavelengths from two-photon excitation of cesium 62D" Optics Communications, 476, 126328, August 2020.

T.A. Van Woerkom, G.P. Perram, C.D. Phelps, B.D. Dolasinski, and P.A. Berry, "Picosecond laser ablation of metals and semiconductors with low transverse order gaussian beams" Opt. Eng. 60(3), 031002, Mar 2021.

Timothy True, Christopher Rice and Glen P. Perram "The cesium 6 2P3/2 to 8 2S1/2line shape broadened by He, Ar, and Kr" Journal of Quantitative Spectroscopy and Radiative Transfer, 250 107010, May 2020.

Douglas E. Thornton, Mark F. Spencer, Christopher A. Rice, and Glen P. Perram "Impacts of Laboratory Vibrations and Laser Flicker Noise on Digital Holography" IEEE Journal of Quantum Electronics, 56, 1400107, Oct 2020.

David E. Weeks, Charlton D. Lewis, L.A. (Vern) Schlie and Glen. P. Perram, "Temperature dependence of the fine structure mixing induced by 4He and 3He in K and Rb Diode Pumped Alkali Lasers," Applied Physics B, 126, 79 Apr 2020.

James Caplinger and Glen P. Perram, "The importance of cascade emission and metastable excitation in modeling strong atomic oxygen lines in laboratory plasmas" Plasma Sources Science and Technology, 29, 015011, 1-11, Jan 2020.

Douglas E. Thornton, Davin Mao, Mark F. Spencer, Christopher A. Rice, and Glen P. Perram "Digital holography experiments with degraded temporal coherence" Optical Engineering, 59 102606-1, Oct 2019.

Douglas E. Thornton, Mark F. Spencer, Christopher A. Rice, and Glen P. Perram "Digital holography efficiency measurements with excess noise" Applied Optics, 58, G19, December 2019.

Refereed Conference Papers Accepted on the Basis of Abstract Review

Davin Mao, Douglas Thornton, Christopher Rice, Mark Spencer, and Glen Perram, "Effects of sinusoidal phase modulation on the signal-to-noise ratio in a digital holographic system," Proc SPIE 111350E, Optical Engineering and Applications, Sep 2019.

Other Significant Research Productivity

Glen P. Perram, Douglas E. Thornton, Davin Mao, and Mark F. Spencer, "Digital Holography for Laser Weapons and Remote Sensing" Laser Applications to Chemical, Security and Environmental Analysis 2020, Optical Society of America, June 2020, Vancouver, Canada. (Invited).

PETROSKY, JAMES C.
Director, Nuclear Expertise for Advancing Technologies Center Professor of Nuclear Engineering, Department of Engineering Physics, AFIT Appointment Date: 2000 (AFIT/ENP); BA, Engineering Physics/Computer Science, Millersville University of Pennsylvania, 1984; MS, Engineering Physics, Rensselaer Polytechnic Institute, 1992; PhD, Engineering Physics, Rensselaer Polytechnic Institute, 1995. Dr. Petrosky has expertise in radiation effects on electronic devices, EMP, experimental design, radiation detection, and nuclear weapon effects. His research spans

narrow and wide band gap materials using combinations of electrical, optical, and absorption spectroscopy to gain information on the damaging effects of ionizing and non-ionizing radiation. Experimental techniques include I-V (T), C-V(T), photoluminescence spectroscopy, Hall Effect, x-ray and UV photo spectroscopy; applications of measurement techniques in harsh environments/in-situ measurements and obtaining real-time data. Applications include electronic switches and actuators, RF/IR sensors, force transducers, and electronics controls for use in the space and nuclear weapons environment. Dr. Petrosky has successfully chaired 12 PhD students, 57 Master's students, and mentored and supported six post-doctoral researchers. AFIT research center affiliation(s): [CSRA.] Tel. (937) 255-3636 x4562, email: James.Petrosky@afit.edu

Sponsor Funded Research Projects

"Support Activities to Homeland Security." Sponsor: DHS/DNDO. Funding: $200,000 - Petrosky 10%, Slagley 40%, Varshney 40%, Cooper 10%.

"Distance Learning Countering Weapons of Mass Destruction Graduate Certificate (CWMD) Program." Sponsor: DHS/DNDO. Funding: $300,000 - Petrosky 10%, Slagley 40%, Varshney 40%, Cooper 10%.

Refereed Journal Publications

J.C. Paxton, M.F. Reeder, E.F. Dean, A. Cahill, J. Rutledge, and J. Petrosky, "Effect of upstream heating examined via the wind tunnel-enhanced experimental irradiation test system," *JRERE*, vol. 38, no. 1, pp. 281–290, March 2020.

Knight, S., Korlacki, R., Dugan, C., Petrosky, J., Mock, A., Dowben, P., Mann, J. M., Kimani, M.M., Schubert, M. "Infrared-active phonon modes in single-crystal thorium dioxide and uranium dioxide." Journal of Applied Physics 127, 125103 (2020), doi:10.1063/1.5143724 (Published Online: 23 March 2020).

Hamilton, N., Graham, S., Carbino, T., Petrosky, J., and Betances, Addison. "Adaptive-Hybrid Redundancy with Error Injection." Electronics 2019, 8(11), 1266; doi: 10.3390/electronics8111266 (published 1 November 2019).

Nicole Benker, Elena Echeverria, Robert Olesen, Brant Kananen, John McClory, Yaroslav Burak, Volodymyr Adamiv, Ihor Teslyuk, George Peterson, Ben Bradley, Ethiyal R. Wilson, James Petrosky, Bin Dong, Jeffry Kelber, Jennifer Hamblin, Jacques Doumani, Peter A. Dowben, Axel Enders; "Possible Detection of Low Energy Solar Neutrons Using Boron Based Materials." Radiation Measurements, 129, October 2019, doi:10.1016/j.radmeas.2019.106190.

PHILLIPS, GRADY T.
Research Assistant Professor of Engineering Physics (through ARS), Department of Engineering Physics, AFIT
Appointment Date: 2014 (AFIT/ENP); BS, Physics, Wofford College, 1990; BA, Mathematics, Wofford College, 1990; MS, Physics, Clemson University, 1993; PhD, Applied Physics, Air Force Institute of Technology, 2006. Dr. Phillips' research interests include remote sensing encompassing spectral signatures from laser/material interactions, hyperspectral imagery, and environmental monitoring, and experimental research utilizing laser physics, spectroscopy, chemical kinetics, and flow dynamics to advance technologies in high power chemical lasers, gas phase lasers, and optical diagnostics. AFIT research center affiliation(s): [CDE.] Tel. 505-803-6127

Other Significant Research Productivity

Predicted performance of a high power, transverse flow, diode-pumped alkali laser system using a nine-level Rb –He rate package in support of a MDA STTR to develop a high-energy laser analysis tool.

RICE, CHRISTOPHER A.
Research Assistant Professor, Department of Engineering Physics, AFIT Appointment Date: 2012 (AFIT/ENP); BS, Electrical Engineering, Cedarville University, 2004; MS, Electrical Engineering, Air Force Institute of Technology, 2006; PhD, Applied Physics, Air Force Institute of Technology, 2012. Dr. Rice is interested in topic areas related to high energy lasers, remote sensing, and optical diagnostics. His work on specific research topics currently include atmospheric propagation of diode pumped alkali lasers; diode pumped alkali and rare gas laser gain construction;

aerosol measurement and validation; modeling, simulation, and validation of directed energy simulations; and remote sensing. AFIT research center affiliation(s): [CDE] and [CTISR.]

Sponsor Funded Research Projects

"Marine Atmospheric Modeling." Sponsor: University of New Hampshire. Funding: $14,999 - Rice 100%. [CDE]

Refereed Journal Publications

D. E. Thornton, D. Mao, M. F. Spencer, C. A. Rice, and G. P. Perram, "Digital holography experiments with degraded temporal coherence," Opt. Eng., vol. 59, no. 10, p. 1, Jan. 2020.

D. E. Thornton, M. F. Spencer, C. A. Rice, and G. P. Perram, "Impacts of Laboratory Vibrations and Laser Flicker Noise on Digital Holography," IEEE J. Quantum Electron, vol. 56, no. 5, Oct. 2020.

J. E. McCrae et al., "Measurements of optical turbulence over 149-km path," Opt. Eng., vol. 59, no. 08, p. 1, Jun. 2020.

N. D. Haluska, G. P. Perram, and C. A. Rice, "Efficient cascade lasing on over 17 wavelengths from two-photon excitation of the cesium 62D states," Opt. Commun., vol. 476, p. 126328, Dec. 2020.

T. M. True, C. A. Rice, and G. P. Perram, "The cesium 62P3/2 to 82S1/2 line shape broadened by He, Ar, and Kr," J. Quant. Spectrosc. Radiat. Transf., vol. 250, p. 107010, Jul. 2020.

D. E. Thornton, M. F. Spencer, C. A. Rice, G. P. Perram, and G. P. Perram, "Digital holography efficiency measurements with excess noise," Appl. Opt., vol. 58, no. 34, p. G19, Dec. 2019.

Rice, C. A., Lapp, K., Rapp, A., Miller, W. S., & Perram, G. P. (2019). Rubidium D1 and D2 far wing line shapes induced by rare gases. Journal of Quantitative Spectroscopy and Radiative Transfer, 224, 550–555.

Refereed Conference Papers Accepted on the Basis of Abstract Review

J. E. McCrae, C. A. Rice, S. T. Fiorino, S. R. Bose-Pillai, and A. J. Archibald, "Wave Optics Simulations of a Dual Beacon Hartmann Turbulence Sensor," in IEEE Aerospace Conference Proceedings, 2020.

D. Mao, D. E. Thornton, C. A. Rice, M. F. Spencer, and G. P. Perram, "Effects of sinusoidal phase modulation on the signal-to-noise ratio in a digital holography system," in Unconventional and Indirect Imaging, Image Reconstruction, and Wave front Sensing 2019, 2019, vol. 11135, p. 14.

D. E. Thornton, M. F. Spencer, C. Rice, and G. P. Perram, "Laser linewidth measurements using digital holography," in Unconventional and Indirect Imaging, Image Reconstruction, and Wave front Sensing 2019, 2019, vol. 11135, p. 15.

Patent Applications

Bose-Pillai, S.R., J.E. McCrae, C.A. Rice, and S.T. Fiorino, "Estimation of Atmospheric Turbulence Parameters using Differential Motion of Extended Features in Time-lapse Imagery," provisional application filed in Jun 2019.

Haluska, Rice, Perram, "Diode pumped alkali laser extended to novel wavelengths via two-photon pumping." provisional application filed in Sept 2017.

RIES, HEIDI R., P

Professor of Physics, Department of Engineering Physics, AFIT Appointment Date: 1999 (AFIT/ENP); Dean for Research, Graduate School of Engineering and Management (AFIT/ENR); Interim Dean, Graduate School of Engineering and Management (2013); BS, Physics, The Ohio State University, 1982; MS, Physics, The Ohio State University, 1984; PhD, Applied Physics, Old Dominion University, 1987. Dr. Ries serves as AFIT's chief research officer, primary liaison to the Air Force Research Laboratory, and served as Interim Dean during FY13. Dr. Ries' research interests include radiation effects, nonlinear optical materials, electron paramagnetic resonance spectroscopy,

and laser processing of materials. Prior to joining the AFIT faculty, Dr. Ries served as Director of the Center for Materials Research at Norfolk State University in Norfolk, Virginia, and Associate Director of the Applied Research Center at the Jefferson Center for Research and Technology Research Park in Newport News, Virginia. Dr. Ries was elected to the ASEE Engineering Research Council Board of Directors in 2008 and served a two-year term as Secretary/Treasurer (2011-2013). She has served on the Engineering and Science Foundation of Dayton Board since 2005 and as its Chair since 2015. Dr. Ries serves as a peer evaluator and team chair for Higher Learning Commission accreditation processes. She was recognized by the Dayton Daily News as one of the region's 2009 Ten Top Women, and was the Air Force's civilian winner of the 2011 Department of Defense Women's History Month Foreign Language and Science, Technology, Engineering and Math (STEM) Role Model Award. Tel. (937) 255-3636 x4544,email: Heidi.Ries@afit.edu

Sponsor Funded Research Projects

"AFOSR Speaker Funding." Sponsor: AFOSR. Funding: $6,840 - Ries 100%.

SAMIN, ADIB, J.
Assistant Professor of Nuclear Engineering, Department of Engineering Physics, AFIT Appointment Date: 2019 (AFIT/ENP); BS, Chemistry (math minor), Wayne State University, 2008; MS, Chemical Physics, The Ohio State University, 2012; PhD, Mechanical Engineering, The Ohio State University, 2017. Dr. Samin was awarded a graduate student fellowship in 2010 and was the recipient of The Director's Postdoctoral Fellowship at Los Alamos National Laboratory in 2018. He spent three years as a postdoctoral researcher at The Ohio State University working on modeling materials for next generation nuclear reactor concepts and corrosion. He also spent a year at LANL examining structural materials for nuclear reactors. Dr. Samin's research interests include multi-scale modeling of materials in extremes and electrochemistry with applications focused in corrosion and nuclear energy. Dr. Samin has authored over thirty refereed archival journal publications. Tel. (937) 255-4535x4767, email: Adib.Samin@afit.edu

Sponsor Funded Research Projects

"A physics-informed machine learning approach for investigating the oxidation of metallic alloys." Sponsor: AFOSR. Funding: $22,000 - Samin 100%.

Refereed Journal Publications

Samin, A. J. A physics-based machine learning study of the behavior of interstitial helium in single crystal W–Mo binary alloys, Journal of Applied Physics, 2020. 127 (17):p. 175904

Samin, A. J. The effects of dilute concentrations of substitutional Re or Os on the thermodynamics and kinetics of oxygen in tungsten Physica B: Condensed Matter, 2020. 580: p. 411937.

Samin, A.J., Anderson, D. A., Holby, E. H., and Uberuaga, B. P. *Ab initio based examination of the kinetics and thermodynamics of oxygen in Fe-Cr alloys*, Physical Review B, 2019. 99: p. 174202.

SAUNDERS, PETER A., Maj
Assistant Professor of Atmospheric Science, Department of Engineering Physics, AFIT Appointment Date: 2019 (AFIT/ENP); BS, Florida State University, Tallahassee, 2007; MS, Florida State University, 2010; PhD, University of Utah, 2019. Maj Saunders' research interests tropical meteorology, numerical weather modeling, mesoscale phenomena such as lightning and localized flooding, as well as applying artificial intelligence and machine learning to weather forecasting. Prior to his PhD studies, Maj Saunders served as Flight Commander, 75th Operations Support Squadron, Hill AFB, Utah, Wing Weather Officer and Executive Officer, 8th Operations Group, Kunsan AB, Republic of Korea, and Flight Commander, 26th Operational Weather Squadron, Barksdale AFB, Louisiana. He is a member of the American Meteorological Society. Tel. (937) 255-3636 x4505, email: Peter.Saunders@afit.edu

Refereed Journal Publications

Saunders, Peter, Yafan Yu, and Zhaoxia Pu 2019. "Sensitivity of Numerical Simulations of Hurricane Joaquin (2015) to Cumulus Parameterization Schemes: Implications for Processes Controlling a Hairpin Turn in the Track." Journal of the Meteorological Society of Japan. Ser. II.

Refereed Conference Papers Accepted on the Basis of Abstract Review

Saunders, P.A., & Pu, Z. 2020. "Studying the sudden onset and evolution of outer rain band precipitation of Hurricane Harvey (2017) using numerical simulations with data assimilation and cloud initiation." Poster presentation given at the 100th annual American Meteorological Society Conference, Boston, MA.

Saunders, P.A., & Pu, Z. 2019. "Numerical Simulations of Hurricane Harvey with data assimilation and cloud initiation." Poster presentation given at the 99th annual American Meteorological Society Conference, Phoenix, AZ.

SHATTAN, MICHAEL B., LTC

Assistant Professor of Nuclear Engineering, Department of Engineering Physics, AFIT Appointment Date: 2018 (AFIT/ENP); BS, United States Military Academy 1999; MS, Massachusetts Institute of Technology 2008; PhD, University of Tennessee 2018. LTC Shattan's research interest focus on the use of Laser-Induced Breakdown Spectroscopy (LIBS) for nuclear forensics purposes as well as studying the physics and chemistry of simulated nuclear fireball environments via laser spectroscopy techniques. Additionally, LTC Shattan is interested in Resonance Enhanced Multiphoton Ionization (REMPI) techniques for trace gas and particulate detection. Before joining AFIT, he was a PhD candidate at the University of Tennessee. He also holds a Professional Engineer license in the commonwealth of Virginia. Tel. (937) 255-3636 x4587, email Michael.Shattan@afit.edu

Refereed Journal Publications

Jason C Wood and Michael B. Shattan. Lithium Isotope Measurement Using Laser-Induced Breakdown Spectroscopy and Chemo metrics. Appl. Spectrosc. (2020). doi: 10.1177/0003702820953205.

Ashwin P. Rao, Mark Gragston, Anil K. Patnaik, Paul S. Hsu, and **Michael B. Shattan**. "Measurement of electron density and temperature from laser-induced nitrogen plasma at elevated pressure (1–6 bar)," Optics Express, 27, 33779-33788 (2019).

Refereed Conference Papers Accepted on the Basis of Full Paper Review

Shattan, M. B., Rao A.C., Wood J.C., *Laser Induced Breakdown Spectroscopy Diagnostics for Nuclear Debris,* Vancouver, OSA Optical Sensing and Sensors Congress, July 2020.

Rao A. C., Auxier II J.D., Shattan M. B., *Applications of Portable LIBS for Actinide Analysis*, Vancouver, OSA Optical Sensing and Sensors Congress, July 2020.

Refereed Conference Papers Accepted on the Basis of Abstract Review

Rao, A.P., Cook, M.T., Auxier J.D., Shattan, M.B, *Detection of Gallium Concentrations in Cerium and Plutonium Alloys via Hand Held Laser Induced Breakdown Spectroscopy*, Palm Springs, The Federation of Analytical Chemistry and Spectroscopy Societies (FACSS) National Meeting, October, 2019.

Wood, J.C., Shattan, M.B*, Isotopic Determination of LiOH-H20 by Laser-Induced Breakdown Spectroscopy*, Palm Springs, The Federation of Analytical Chemistry and Spectroscopy Societies (FACSS) National Meeting, October, 2019.

STEWARD, BRYAN J.

Research Assistant Professor of Optical Engineering, Department of Engineering Physics, AFIT Appointment Date: 2015 (AFIT/ENP); BS, Optical Sciences & Engineering, University of Arizona, 2004; MS, Applied Physics, Air Force Institute of Technology, 2006; PhD, Optical Sciences & Engineering, Air Force Institute of Technology, 2011. Dr. Steward's current research interests include infrared and electro-optical remote sensing, physics-based sensor and scene modeling, and algorithm development primarily for application to technical intelligence problems. Additional

interests include characterization of battlespace combustion (e.g. muzzle flash, detonations, and rocket plumes), methods for assessing on-orbit sensor performance, and machine learning. He has 16 archival publications and presentations. Before joining AFIT, he spent over nine years at the National Air and Space Intelligence Center (NASIC) where he most recently led R&D activities as a Principal Intelligence Analyst in the Persistent Infrared Squadron. AFIT research center affiliation(s): [CSRA] and [CTISR.] Tel. (937) 255-3636 x4639, email: bryan.steward.ctr@afit.edu

Sponsor Funded Research Projects

"Support to TAP Lab Effort (STAPLES)." Sponsor: SMC. Funding: $911,255 - Steward 95%, Taylor 5%. [CTISR]

"ASSET Scenes for Future Operationally Resilient Ground Evolution (FORGE)." Sponsor: SMC. Funding: $300,000 - Steward 100%. [CTISR]

TOURNAY, ROBERT C., Lt Col
Assistant Professor of Atmospheric Science, Department of Engineering Physics, AFIT Appointment Date: 2018 (AFIT/ENP); BS, University of Maryland, College Park, 2000; MS, Naval Postgraduate School, 2008; PhD, Colorado State University, 2016. Lt Col Tournay's research interests include land surface-atmosphere interaction, numerical weather modeling, hydrology and flooding as well as applying artificial intelligence and machine learning to weather forecasting. Prior to his PhD studies, Lt Col Tournay served as Commander, 16th Weather Squadron, Offutt AFB, Nebraska as well as Commander, 46th Weather Squadron, Eglin AFB, Florida. Lt Col Tournay deployed to Iraq in support of Operation IRAQI FREEDOM as well as Qatar in support of AF Central Command operations. He is a member of the American Meteorological Society. Tel. (937) 255-3636 x4743, email: Robert.Tournay@afit.edu

Sponsor Funded Research Projects

"MOA - AFTAC Endowed Term Chairs." Sponsor: AFTAC/XPB. Funding: $30,000 - Tournay 100%. [NEAT]

Refereed Conference Papers Accepted on the Basis of Abstract Review

Grossnickle, J., S.T. Fiorino# , K.J. Keefer, H.R. Tseng, and R.C. Tournay, "Determining Bulk Aerosol Absorption from Off-Axis Backscattering using Rayleigh Beacon Laser Pulses," 2020 Annual DEPS S&T Symposium, West Point, NY, 9-13 March 2020.

Jagoda, D., S.T. Fiorino, S. Peckham, K.J. Keefer, R. Tournay, and J.E. Schmidt, "A Method for Routine PM2.5 Observation and Incorporation into Numerical Weather Prediction," 2020 Annual DEPS S&T Symposium, West Point, NY, 9-13 March 2020.

John Fioretti, R. Tournay, A. Geyer. (2020). "Characterizing Regime-Based Flow Uncertainty for Source Term Estimation Applications," American Meteorological Society Conference, Boston, MA, 12 – 16 Jan 2020.

Joanna Williams, R. Tournay, O. Nava. (2020). "Precipitation System Impact on GPS Signal Variability," American Meteorological Society Conference, Boston, MA, 12 – 16 Jan 2020.

Nathan Beveridge, A. Geyer, R. Tournay (2020). "Single Station Forecasting from Deep Learning Methods," American Meteorological Society Conference, Boston, MA, 12 – 16 Jan 2020.

Julie Grossnickle, S. Fiorino, R. Tournay (2020). "Determining Bulk Aerosol Absorption from Off-Axis Backscattering using Rayleigh Beacon Laser Pulses," American Meteorological Society Conference, Boston, MA, 12 – 16 Jan 2020.

Dan Jagoda, S. Fiorino, R. Tournay (2020). "Assessment of Improved WRF-CHEM PM2. 5 Characterization via Implementation of an Aerosol Measurement Network," American Meteorological Society Conference, Boston, MA, 12 – 16 Jan 2020.

Brandon Bailey, A. Geyer, R. Tournay (2020). "Next-Generation Air Force Weather Metrics via Bayes Cost Analysis," American Meteorological Society Conference, Boston, MA, 12 – 16 Jan 2020.

Tournay, R. C., Nava, O. A., & Tseng, H. R. (2020, January). Influence of Tropical Cyclones on Total Electron Content. In 100th American Meteorological Society Annual Meeting. AMS

Schwalbe, S. G.*#, R. D. Loper, R. Tseng, R. Tournay, O. A. Nava, and C. D. Lewis (2019), "Modeling the Effects of a Second Sun on Ionospheric Composition and Structure," American Geophysical Union 2019 Fall Meeting, San Francisco, CA, 9-13 Dec 2019.

Michelle Kanipe, H.R. Tseng, R. Tournay, "Mid-Atmosphere Response to ENSO," American Geophysical Union 2019 Fall Meeting, San Francisco, CA, 9-13 Dec 2019.

Brian Urbancic, H.R. Tseng, R. Tournay, "Relating Arctic Oscillation to Stratospheric and Mesospheric Winter Conditions," American Geophysical Union 2019 Fall Meeting, San Francisco, CA, 9-13 Dec 2019.

TSENG, H. ROSE, Lt Col

Assistant Professor of Atmospheric Science, Department of Engineering Physics, AFIT Appointment Date: 2016 (AFIT/ENP); BS, University of California at Los Angeles (UCLA), 2004; MS, Naval Postgraduate School, 2010; PhD, UCLA, 2016. Lt Col Tseng's research interests include future climatological changes, the influence of aerosols on precipitation and tropical cyclones, and the Arctic sea ice decline, as these topics pertain to future political, societal and environmental impacts. Prior to her PhD studies, Lt Col Tseng served as Commander, Detachment 1, 607th Weather Squadron at Camp Red Cloud, Republic of Korea. Lt Col Tseng has given a number of talks regarding her research on the effects of black carbon on precipitation to include the University of California (Carbon Neutrality Initiative) and the Pardee RAND Graduate School (LA Policy Symposium). Lt Col Tseng also serves as Board Advisor for Women Veteran Issues for The BREATH Center in San Clemente, CA. Lt Col Tseng served a deployment tour as USAF Joint Meteorological and Oceanographic Officer- Afghanistan and NATO Headquarters Resolute Support Chief Meteorological Officer from April- October 2017 in Kabul, Afghanistan.

Refereed Conference Papers Accepted on the Basis of Abstract Review

Grossnickle, J., S.T. Fiorino# , K.J. Keefer, H.R. Tseng, and R.C. Tournay, "Determining Bulk Aerosol Absorption from Off-Axis Backscattering using Rayleigh Beacon Laser Pulses," 2020 Annual DEPS S&T Symposium, West Point, NY, 9-13 March 2020.

Grossnickle, J., S.T. Fiorino , K.J. Keefer, H.R. Tseng, and R.C. Tournay, "Determining Bulk Aerosol Absorption from Off-Axis Backscattering using Rayleigh Beacon Laser Pulses," 24th Conference on Integrated Observing and Assimilation Systems for the Atmosphere, Oceans, and Land Surface (IOAS-AOLS), 100th Annual American Meteorological Society Meeting, Boston, MA, Jan 2020. (Poster and web posting: https://ams.confex.com/ams/2020Annual/meetingapp.cgi/Paper/370190.

Tournay, R. C., Nava, O. A., & Tseng, H. R. (2020, January). Influence of Tropical Cyclones on Total Electron Content. In 100th American Meteorological Society Annual Meeting. AMS.

Schwalbe, S. G.*#, R. D. Loper, R. Tseng, R. Tournay, O. A. Nava, and C. D. Lewis (2019), "Modeling the Effects of a Second Sun on Ionospheric Composition and Structure," American Geophysical Union 2019 Fall Meeting, San Francisco, CA, 9-13 Dec 2019.

Brian Urbancic, H.R. Tseng, R. Tournay, "Relating Arctic Oscillation to Stratospheric and Mesospheric Winter Conditions," American Geophysical Union 2019 Fall Meeting, San Francisco, CA, 9-13 Dec 2019.

Williams, J., Nava, O., Emmons, D. J., & Tseng, H. L. R. (2019). Influence of Lightning on Total Electron Content during Hurricane Michael (2018). AGUFM, 2019, NH31B-08.

TUTTLE, RONALD F.

Associate Professor of Nuclear Engineering, Department of Engineering Physics, AFIT Appointment Date: 2001 (AFIT/ENP); BS, Chemical Engineering, University of Missouri (Columbia), 1968; MS, Nuclear Engineering, University of Missouri (Columbia), 1970; PhD, Nuclear Engineering, University of Missouri (Columbia), 1980. Dr. Tuttle's research areas include applications of active and passive remote sensing, spectroscopy, diagnostics, and signals processing to problems in intelligence collection and exploitation. Other areas of interest include nuclear weapon effects and space nuclear power systems modeling and mechanics of aerosols. He has published in both unclassified and classified refereed archival journals and conference proceedings. Dr. Tuttle served as Director, Center for Technical Intelligence Studies and Research (CTISR), AFIT, until Aug 2012.

VARSHNEY, GAIVEN
Research Assistant Professor of Nuclear Engineering, Department of Engineering Physics, AFIT; Appointment Date: 2019 (AFIT/ENP); Post-Doctoral Research Associate, 2016 (AFIT/ENP); BS (Honors), Chemistry, Aligarh Muslim University, INDIA, 2001; MS, Analytical Chemistry, Aligarh Muslim University, INDIA, 2003; M. Phil., Applied Chemistry, Z.H. College of Engineering and Technology, A.M.U, INDIA, 2004; Ph.D., Applied Chemistry, Z.H. College of Engineering and Technology, A.M.U., INDIA, 2008. Dr. Varshney's current research interests involve several nuclear forensic areas, including but not limited to, detection of radioactive elements, experimental separation and analysis of nuclear debris from different nuclear accidents and tests, radiation detection, and materials characterization. Tel. (937) 255-3636 x4574, Email: gaiven.varshney@afit.edu.

Refereed Journal Publications

J. Cezeaux*, A.A. Bickley, G. Varshney, J.C. Petrosky, "Morphological Classification and Analysis of Fuel Bearing Debris from a Non-Critical Event," Journal of Radiation Effects Research and Engineering, Vol. 38, Issue 1, (2020). (S//RD).

Refereed Conference Papers Accepted on the Basis of Full Paper Review

D. Gum*, G. Varshney, J.W. McClory, A.A. Bickley, and A. Holland, "A Machine Learning Approach to Characterizing Particle Morphology in Nuclear Forensics," accepted by the *Hardened Electronics and Radiation Technology Conference*, August 2020.

WEEKS, DAVID E.
Professor of Physics, Department of Engineering Physics, AFIT Appointment Date: 1993 (AFIT/ENP); BA, Physics, Colgate University, 1983; MS, Physics, Georgia Institute of Technology, 1985; PhD, Physics, University of Arkansas, 1989. Dr. Weeks' research interests include the development of time dependent wave packet methods to model the quantum mechanics of simple chemical reactions and compute associated state to state reactive scattering matrix elements. Of particular interest are new methods that incorporate non-adiabatic coupling between electronic and nuclear degrees of freedom. New research interests include fiber laser modeling and the development of plasma models to improve the operation of noble gas laser systems. AFIT research center affiliation(s): [CDE.]
Tel. (937) 255-3636 x4561, email: David.Weeks@afit.edu

Sponsor Funded Research Projects

"Predicting High Power Fiber Laser Performance with Refractive Index and Dopant Index Profiles." Sponsor: Creare. Funding: $10,000 - Weeks 100%. [CDE]

"Predicting High Power Fiber Laser Performance with Refractive Index and Dopant Index Profiles." Sponsor: Creare. Funding: $10,000 - Weeks 100%. [CDE]

Refereed Journal Publications

Loper, R. D., and Weeks, D. E., "A fully quantum calculation of broadening and shifting coefficients of the D1 and D2 spectral lines of alkali-metal atoms colliding with noble-gas atoms," Journal of Physics B: Atomic, Molecular and Optical Physics, Vol. 53, No. 20, p. 205403, 15 Sep 2020.

D.E. Weeks, C.D. Lewis, L.A. Schlie, and G.P. Perram, "Temperature dependence of the fine structure mixing induced by ^{4}He and ^{3}He in K and Rb Diode Pumped Alkali Lasers," Appl. Phys. B, 126, 79 (2020).

L.T. Belcher, G.S. Kedziora, and D.E. Weeks, "Analytic non-adiabatic derivative coupling terms for spin-orbit MRCI wave functions. I. Formalism," J. Chem. Phys. 151, 234104 (2019).

L.T. Belcher, C.D. Lewis, G.S. Kedziora, and D.E. Weeks, "Analytic non-adiabatic derivative coupling terms for spin-orbit MRCI wavefunctions. II. Derivative coupling terms and coupling angle for KHe (A2Π1/2) ⇔KHe (B2Σ1/2)," J. Chem. Phys. 151, 234109 (2019).

D.J. Emmons, D.E. Weeks, "Effect of Ar($3p^5$4p; 2p)+M -> Ar($3p^5$4s; 1s)+M branching ratio on optically pumped rare gas laser performance," Opt. Express 27, 35689-35699 (2019).

Patents Awarded

Superconducting levitation bearing with an optically switched electromagnetic driver. (U.S. patents 5,061,679 and 5,120,706).

WOLF, PAUL J.

Professor of Physics, Department of Engineering Physics, AFIT Appointment Date: 1994 (AFIT/ENP), and Associate Dean for Academic Affairs, Graduate School of Engineering and Management (AFIT/EN); BS, Regis College, 1978; MS, Air Force Institute of Technology, 1979; PhD, Air Force Institute of Technology, 1985. Dr. Wolf serves as the Associate Dean for Academic Affairs responsible for administrative leadership for all academic matters in the Graduate School and serves as AFIT's accreditation liaison to the Higher Learning Commission and ABET. Dr. Wolf's current scholarly interests include emergent behaviors of complex systems, foundations of quantum mechanics, and existential threat analyses. Dr. Wolf has made experimental contributions to atomic/molecular spectroscopy, reactive and non-reactive collision kinetics, laser-based thin film deposition processes, ionospheric and atmospheric chemistry, and environmental monitoring. Prior to joining the AFIT faculty in 1994, Dr. Wolf served as Chief, Visible Chemical Laser Section at the Air Force Weapons Laboratory (Kirtland AFB, NM), Director/Principal Investigator of the Materials Physics Division at the F.J. Seiler Research Laboratory (USAFA, CO), Assistant Professor of Physics in the Physics Department at the U.S. Air Force Academy, and Research Director for Impulse Laser Effects at the Defense Nuclear Agency. He has over 20 publications in refereed archival journals. Tel. (937) 255-3636 x4560, email: Paul.Wolf@afit.edu

5.3. DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING

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5.3.1. DOCTORAL DISSERTATIONS

AUNG, RONALD, M., Improving Closely Spaced Dim Stellar Objects through Improved Multi-Frame Blind Deconvolution. AFIT-ENG-DS-20-S-004. Faculty Advisor: Dr. Stephen C. Cain. Sponsor: AFOSR.

DICKEY, JOSHUA, T., Neural Network Models for Nuclear Treaty Monitoring: Enhancing the Seismic Signal Pipeline with Deep Temporal Convolution. AFIT-ENG-DS-20-J-004. Faculty Advisor: Dr. Brett J. Borghetti. Sponsor: AFTAC. [CCR]

KNAPP, JON, S., Facilitating Automated Machine to Machine Protocol Analysis. AFIT-ENG-DS-20-S-094. Faculty Advisor: Dr. Gilbert L. Peterson. Sponsor: N/A.

LITCHER, MICHAEL, J., Star Tracker Accuracy Improvement and Optimization for Attitude Measurement in Three-Axis. AFIT-ENG-DS-20-S-012. Faculty Advisor: Dr. Stephen C. Cain. Sponsor: NASA/GRC.

PATEL, PRANAV, R., Direct Digital Synthesis: A Flexible Architecture for Advanced Signals Research for Future Satellite Navigation Payloads. AFIT-ENG-DS-20-S-014. Faculty Advisor: Dr. Richard K. Martin. Sponsor: N/A. [ANT] [CCR]

RONDEAU, CHRISTOPHER, Improving Industrial Internet of Things (IIoT) Cyberattack Resiliency Using Distinct Native Attribute (DNA) Fingerprinting.-J-007. Faculty Advisor: Dr. Michael A. Temple. Sponsor: N/A.

WAYNE, HENRY, C., Analytic Provenance for Software Reverse Engineers. AFIT-ENG-DS-20-S-010. Faculty Advisor: Dr. Gilbert L. Peterson. Sponsor: AFRL/RI.

WESTING, NICHOLAS, M., Physics-Constrained Hyperspectral Data Exploitation Across Diverse Atmospheric Scenarios. AFIT-ENG-DS-20-S-021. Faculty Advisor: Dr. Richard K. Martin. Sponsor: NASIC/GSP.

5.3.2. MASTER'S THESES

ACOSTA, SHAREE, B., Flight Characteristic Verification of the Variable Camber Compliant Wing. AFIT-ENG-MS-20-M-003.Faculty Advisor: Dr. Robert C. Leishman. Sponsor: AFRL/RQVS.

ALAMRI, ARIF, Artificial Intelligence in Pursuit-Evasion Games, Specifically in the Scotland Yard Game. AFIT-ENG-MS-20-S-003. Faculty Advisor: Dr. Kenneth M. Hopkinson. Sponsor: N/A.

BARKER, NATHAN, V., Development of a Drone Mounted Wireless Attack Platform. AFIT-ENG-MS-20-M-005. Faculty Advisor: Dr. Barry E. Mullins. Sponsor: N/A. [CCR]

BARTELT, BRYAN, Global Gradient Based Phase Unwrapping Algorithm for Increased Performance in Wave Front Sensing. AFIT-ENG-MS-20-M-006. Faculty Advisor: Dr. Stephen C. Cain. Sponsor: AFRL/RYMT.

BOETTIGER, JAMES, P., A Comparative of the Detection and Tracking Capability Between Novel Event-Based And Conventional Frame-Based Sensors. AFIT-ENG-MS-20-M-007. Faculty Advisor: Dr. Michael a. Marciniak. Sponsor: N/A. [CDE] [CTISR]

BROWN, MARC, R., One-Dimensional Multi-Frame Blind Deconvolution Using Astronomical Data for Spatially separable Objects. AFIT-ENG-MS-20-M-008. Faculty Advisor: Maj. David J. Becker. Sponsor: AFRL/RDSMC.

BURFEIND, BRANDON, C., Interoperable ADS-B Confidentiality. AFIT-ENG-MS-19-M-009. Faculty Advisor: Dr. Robert F. Mills. Sponsor: AF/A3OJ. [CCR]

CARROLL, JASON, D., Aerial Laser Based Terrain Navigation A Limited Demonstration of the Airborne Laser Perception System. AFIT-ENG-MS-20-M-010. Faculty Advisor: Dr. John F. Raquet. Sponsor: Draper.

COLSON, BLAKE, M., effects of Long Term Evolution Waveform on Synthetic Aperture Radar Image Quality Metrics. AFIT-ENG-MS-20-M-011. Sponsor: AFRL/RYMD.

CROW, DAVID, R., Cyber-Physical System Intrusion A Case Study of Automobile Identification Vulnerabilities and Automated Approaches for Intrusion Detections. AFIT-ENG-MS-20-M-012. Faculty Advisor: Dr. Scott R. Graham. Sponsor: AFRL.

CROWL, MICHAEL, R., Use of LIDAR in Automated Aerial Refueling to Improve Stereo Vision Systems. AFIT-ENG-MS-20-M-013. Faculty Advisor: Dr. Scott L. Nykl. Sponsor: AFRL/RQQC. [ANT]

DAUGHERTY, JOSHUA, A., Monte Carlo Tree Search Applied to a Modified Pursuit/Evasion Scotland Yard Game with Rendezvous Spaceflight Operation Applications. AFIT-ENG-MS-20-J-003. Faculty Advisor: Dr. Kenneth M. Hopkinson. Sponsor: N/A.

DUKARM, CHRISTOPHER, Mobile Data Analysis Using Dynamic Binary Instrumentation and Static Analysis. AFIT-ENG-MS-20-M-016. Sponsor: N/A. [CCR]

ECHEVERRY, NICHOLAS, C., Signal Quality Monitoring of GNSS Signals Using a Chip shape Deformation Metric. AFIT-ENG=MS-20-M-017. Faculty Advisor: Maj. Joan A. Betances. Sponsor: AFMC. [CSRA]

FLACK, NATHANIEL, W., Developing a Serious Game to Explore Joint All Domain and Control. AFIT-ENG-MS-20-M-019. Sponsor: AF/CYTCOE. [CCR]

FRENCH, BRADELY, S., Determining Virtual Practicality From Physical Stereo Vision Images and GPS. AFIT-ENG-MS-20-M-020. Faculty Advisor: Dr. Scott L. Nykl. Sponsor: AFRL/RQQC. [ANT]

FRIEDEL, ZACHARY, P., Event-Based Visual Inertial Odometry Using Smart Features. AFIT-ENG-MS-20-M-021. Faculty Advisor: Dr. Robert C. Leishman. Sponsor: N/A.

GALLAHER, JOSHUA, P., Automated Detection and Mitigation of Inefficient Visual Searching Using Electroencephalography and Machine Learning. AFIT-ENG-MS-20-M-022. Faculty Advisor: Dr. Brett J. Borghetti. Sponsor: AFOSR. [CCR]

GARRETSON, JOSHUA, J., Zernike Piston Statistics in Turbulent Multi-Aperture Optical Systems. AFIT-ENG-MS-20-M-023. Faculty Advisor: Dr. Stephen C. Cain. Sponsor: AFRL/RYMT.

HAYDEN, MICAH, J., Multi-Channel Security Through Data Fragmentation. AFIT-ENG-MS-20-M-026. Faculty Advisor: Dr. Scott R. Graham. Sponsor: N/A.

KEMPF, JERROD, M., Mismatched Filters Effects on Synthetic Aperture Radar Image Quality Metrics. AFIT-ENG-MS-20-M-030. Faculty Advisor: Dr. Julie A. Jackson. Sponsor: AFRL/RYMD.

KIM, ALEXANDER, D.H., Digital Forensics Tools Integration. AFIT-ENG-MS-20-M-031. Faculty Advisor: Dr. Gilbert L. Peterson. Sponsor: N/A.

LEE, ANDREW, T., Objects Detection with Deep Learning to Accelerate Pose Estimations for Automated Aerial Refueling. AFIT-ENG-MS-20-M-035. Faculty Advisor: Dr. Scott L. Nykl. Sponsor: AFRL/RQQC. [ANT]

LEPLEY, THOMAS, A., Metasurface Antenna for Wideband Applications. AFIT-ENG-MS-20-M-036. Faculty Advisor: Dr. Peter J. Collins. Sponsor: NRTF. [CCR]

MADDEN, ERIK, M., Extracting Range Data From Images Using Focus Error. AFIT-ENG-MS-20-M-037. Faculty Advisor: Dr. Stephen C. Cain. Sponsor: USAFA.

MADISON, ZACHARY, D., Honey Hive A Network Intrusion Detection System Framework Utilizing Distributed Internet of Things Honeypot Sensors. AFIT-ENG-MS-20-M-038. Faculty Advisor: Dr. Barry E. Mullins. Sponsor: DHS. [CCR]

MAGNESS, JAKE, M., Silver: Simulation-Based Logic Bomb Identification/Verification for Unmanned Vehicles. AFIT-ENG-MS-20-M-039. Faculty Advisor: Lt. Col. Patrick J. Sweeney. Sponsor: AFRL/RYWA.

MATSUI, YOUSUKE, Z., Neal Real-Time ZigBee Device Discrimination Using CB-DNA Features. AFIT-ENG-MS-20-M-043. Faculty Advisor: Maj. Joan A. Betances. Sponsor: AFRL.

MIRELES, LUCUS, E., Implications and Limitations of Securing an InfiniBand Network. AFIT-ENG-MS-20-M-044. Faculty Advisor: Dr. Scott R. Graham. Sponsor: AFRL.

MOCHOCKI, SEAN, A., Relational Database design and Multi-Objective Database Queries for Position Navigation and Timing data. AFIT-ENG-MS-20-M-045. Faculty Advisor: Dr. Robert C Leishman. Sponsor: N/A.

MORSE, KYLE, Detecting Ping1090i ADS-B Spoofing Devices Using DNA Fingerprinting. AFIT ENG-J-005. Faculty Advisor: Dr. Michael A. Temple. Sponsor: N/A. [ANT]

MYERS, LOREN, E., Verifying and Improving a Flight reference System's Performance. AFIT-ENG-MS-20-M-046. Faculty Advisor: Maj. Aaron J. Canciani. Sponsor: TS.

NAFZIGER, GRANT, T., Wireless Sensor Network Optimization for Radio Tomographic Imaging. AFIT-ENG-MS-20-M-047. Faculty Advisor: Dr. Richard K. Martin. Sponsor: N/A. [ANT] [CCR]

O'BRIEN, NICHOLAS, J., A Non-Destructive Evaluation Application Using software Defined Radios and Bandwidth Expansion. AFIT-ENG-MS-20-M-049. Faculty Advisor: Dr. Peter J. Collins. Sponsor: N/A. [ANT] [CCR]

O'GORMA, NICHOLAS A., Focus Beam System Biaxial Material Characterization. AFIT-ENG-MS-20-M-050. Faculty Advisor: Dr. Michael J. Havrilla. Sponsor: AFRL/RYS.

ORNER, JACOB, Q., Applying Data Organizational Techniques to Enhance Air Force Learning. AFIT-ENG-MS-20-M-052. Faculty Advisor: Maj. Richard Dill. Sponsor: N/A. [CCR]

PARK, YOUNGJUN, Development and Evaluation of a Security Agent for Internet of Thing. AFIT-ENG-MS-20-M-053. Faculty Advisor: Dr. Barry E. Mullins. Sponsor: DHS. [CCR]

PATRICK, LATCHAM, R., Comparison of Visual Simultaneous Localization and Mapping Methods for Fixed Wing Aircraft Using SlamBench2. AFIT-ENG-MS-20-M-034. Faculty Advisor: Dr. Clark N. Taylor. Sponsor: N/A. [ANT]

PEARSON, PAYTON, E., Chrono's Spacecraft with Chiron Probe: Exploration of the Hydrosphere, Principle Satellites, Atmosphere, and Rings of Uranus. AFIT-ENG-MS-20-S-015. Faculty Advisor: Dr. Carl R. Hartsfield. Sponsor: N/A. [CSRA]

PETTIT, DILLION, M., Cyber Assessments and scoring Model for small Unmanned Aerial Vehicles. AFIT-ENG-MS-20-M-055. Faculty Advisor: Dr. Scott R. Graham. Sponsor: AFRL.

ROSARIO- MOREL, L., Joint 1D and 2D Neural Networks for Automatic Modulation Recognition. AFIT-ENG-MS-20-S-016. Faculty Advisor: Dr. Richard K. Martin. Sponsor: N/A. [CCR]

SARANTSEV, KIRILL, A., Maximizing Accuracy Through Stereo Vision Camera Positioning for Automated Aerial Refueling. AFIT-ENG-MS-20-M-059. Faculty Advisor: Dr. Clark. N. Taylor. Sponsor: AFRL. [ANT]

VEGEDES, JOSEPH, A., A Study of Execution Performance for Rust-Based Objects vs Data Oriented Architectures. AFIT-ENG-MS-20-M-065. Faculty Advisor: Dr. Douglas D. Hodson. Sponsor: N/A.

WATSON, ANDREW, Simulated Experience Evaluation in Developing Multi-Agent Coordination Graphs. AFIT-ENG-MS-20-J-015. Faculty Advisor: Dr. Gilbert L. Peterson. Sponsor: N/A.

WILLIAMS, JEREMIAH, C., Dynamic Micromechanical Fabry-Perot Cavity Sensors Fabricated by Multiphoton Absorption Onto Optical Fiber Tips. AFIT-ENG-MS-20-M-074. Faculty Advisor: Dr. Hengky Chandrahalim. Sponsor: AFOSR.

YI, TERRENCE, J., Semantic Segmentation of aerial Imagery Using U-Nets. AFIT-ENG-MS-20-M-075. Faculty Advisor: Dr. Robert C. Leishman. Sponsor: N/A.

5.3.3. FACULTY BIOGRAPHIES & RESEARCH OUTPUT

Notes: Research Center affiliations are listed in [ ] if applicable.

BETANCES, JOAN A., Maj
Assistant Professor of Electrical Engineering, Department of Electrical and Computer Engineering, AFIT Appointment Date: 2016 (AFIT/ENG); BSEE, Walla Walla University, 2003; MS, Air Force Institute of Technology, 2012; PhD, Electrical Engineering, Air Force Institute of Technology, 2016. Maj Betances' research interests include software-defined radios, cognitive radios, and wireless security. He is a member of Eta Kappa Nu and Tau Beta Pi honor societies. AFIT research center affiliation(s): [ANT], [CSRA], and [CCR.]

BECKER, DAVID J., Maj
Assistant Professor of Electric Engineering, Department of Electrical and Computer Engineering, AFIT Appointment Date: 2018 (AFIT/ENG); BSEE, University of Maine Orono, 2006; MS, Air Force Institute of Technology, 2013; PhD, Electrical Engineering, Air Force Institute of Technology, 2018. Maj Becker's research interests include space object detection from electro-optical sensors and image processing. Tel. (937) 255-3636 x4371, email: David.Becker@afit.edu

BORGHETTI, BRETT J.
Associate Professor of Computer Engineering, Department of Electrical and Computer Engineering, AFIT Appointment Date: 2008 (AFIT/ENG); BSEE, Worcester Polytechnic Institute, 1992; MSCS, Air Force Institute of Technology, 1996; PhD, Computer Science, University of Minnesota, 2006. Dr. Borghetti's research interests include machine learning, autonomous agents, and multi-agent systems. AFIT research center affiliation(s): [ANT], [CCR], [COA], [CTISR.] Tel. (937) 255-3636 x4612, email: Brett.Borghetti@afit.edu

Sponsor Funded Research Projects

"Information Acquisition Deficit Detection and Mitigation through Neurophysiological-sensed Operator Pattern." Sponsor: AFOSR. Funding: $72,512 - Borghetti 50%, Oxley 50%.

Refereed Journal Publications

Westing, Nicholas M., Gross, Kevin C., Borghetti, Brett, J., Martin, Jacob, and Meola, Joseph, "Learning Set Representations for LWIR In-Scene Atmospheric Compensation" *IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing*, 2 Apr 2020, Vol 13, pp 1438-1449 https://ieeexplore.ieee.org/document/9055124

Dickey, Joshua, T., Borghetti, Brett, J., Junek, William, and Martin, Richard "Beyond Correlation: A Path-invariant Measure for Seismogram Similarity" *Seismological Research Letters*, 6 Nov 2019, DOI: 10.1785/0220190090 https://pubs.geoscienceworld.org/srl/article-pdf/doi/10.1785/0220190090/4862061/srl-2019090.1.pdf

Westing, Nicholas M., Borghetti, Brett, J., Gross, Kevin C., "Fast and Effective Techniques for LWIR Radiative Transfer Modeling: A Dimension Reduction Approach," *Remote Sensing (MDPI)*, 9 Aug 2019, Vol 11, issue 6, pp.1866-1886,DOI:10.3390/rs11161866 https://www.mdpi.com/2072-4292/11/16/1866/htm

Refereed Conference Papers Accepted on the Basis of Full Paper Review

Crow, David R., Graham, Scott R., Borghetti, Brett J., Sweeney, Patrick J., "Empirical Dynamic Modeling as a Basis For an Intrusion Detection System" *14th International Conference on Critical Infrastructure Protection (IFIP)*, Arlington, VA, USA, Mar 2020.

Villarreal, Micah N., *Kamrud, Alexander J., Borghetti, Brett J., "Confirmation Bias Estimation from Electroencephalography with Machine Learning," *Human Factors and Ergonomics Society (HFES) Annual Conference, 2019,* Seattle, WA, 28 Oct-1 Nov 2019.

Refereed Conference Papers Accepted on the Basis of Abstract Review

Crow, David R., Graham, Scott R., Borghetti, Brett J., "Fingerprinting Vehicles with CAN Bus Data Samples," *15th* International Conference on Cyber Warfare and Security (ICIW), Norfolk, VA, Feb 2020.

BROWN, FRANK M.
Professor Emeritus of Electrical Engineering, Department of Electrical and Computer Engineering, AFIT Appointment Date: 1961 (AFIT/ENG); BS, MS, PhD, the Ohio State University. Dr. Brown's research interests are discrete mathematics and operations research.

CAIN, STEPHEN C.
Associate Professor of Electrical Engineering, Department of Electrical and Computer Engineering, AFIT Appointment Date: 2003 (AFIT/ENG); BSEE, University of Notre Dame, 1992; MSEE, Michigan Technological University, 1994; PhD, University of Dayton, 2001. Dr. Cain's research interests include electro-optics, remote sensing, and signal processing. Tel. (937) 255-3636 x4716, email: Stephen.Cain@afit.edu

Sponsor Funded Research Projects

"Super-Resolution Imaging via an Expectation-Maximization Algorithm Designed for Dim Objects Resident." Sponsor: AFOSR. Funding: $39,795 - Cain 100%.

Refereed Journal Publications

Stephen C. Cain, "Non-linear statistical photo calibration of photodetectors without calibrated light sources," *Appl. Opt*. 59, pp. 2767-2775 (March 2020).

Stephen C. Cain, "Fourier propagation tool for aberration analysis and a point spread function calculation of systems With curved focal planes, *OSA Continuum* 3(6), pp. 1579-1588 (June 2020).

Aung, R.M., and Cain, S.C., "Improving closely spaced dim object detection through multiframe blind deconvolution of near stellar neighbourhoods," *Journal of Modern Optics*, Volume 67, Issue 13, Sep 2020.

Refereed Conference Papers Accepted on the Basis of Abstract Review

Ronald Aung (student) and Stephen Cain, "Multi-Frame Blind Deconvolution of Closely Spaced Dim Stellar Objects," AMOS Technical Conference, September 2019, Maui, HI.

Patents Awarded

Nicholas Yielding, Adrian Catarius, Stephen Cain and Michael Seal, "Statistical Photo-Calibration of Photo-Detectors for Radiometry without Calibrated Light Source," issue date of 02-Jun-20, U. S. Patent No. 10,670,745.

CANCIANI, AARON J., Capt
Assistant Professor of Electrical Engineering, Department of Electrical and Computer Engineering, AFIT Appointment Date: 2015 (AFIT/ENG); BSEE, Air Force Academy, 2010; MSEE, Air Force Institute of Technology, 2012; PhD, Electrical Engineering, Air Force Institute of Technology, 2016. Capt Canciani's research interests include GPS-alternative navigation systems using environmental signals, SLAM, deep learning, and vision navigation. He is a member of The Institute of Navigation (ION). AFIT research center affiliation(s):

Sponsor Funded Research Projects

"Eglin Magnetic Survey & Data Collect." Sponsor: AFRL/RW. Funding: $79,000 - Canciani 100%. [ANT]

"Magnetic Calibration Research." Sponsor: ONR. Funding: $43,750 - Canciani 50%, Curro 50%. [ANT]

"Magnetic Calibration Research." Sponsor: ONR. Funding: $131,250 - Canciani 50%, Curro 50%. [ANT]

"Navigation for A2AD, Long Range, Over Water Ingress." Sponsor: AFRL/RY. Funding: $400,000 - Canciani 60%, Leishman 30%, Raquet 10%. [ANT]

Refereed Journal Publications

Lee TN, Canciani AJ. MagSLAM: Aerial simultaneous localization and mapping using Earth's magnetic anomaly field. *NAVIGATION*. 2020; 1–13. https://doi.org/10.1002/navi.352

Canciani, A.J., C. Brennan, "A comparison of scalar and vector magnetic navigation using Earth crustal fields" *IEEE Transactions on Aerospace and Electronic Systems, Vol X, No. X, Date*

C. Yang, J. Strader, Y. Gu, A. Canciani, and K. Brink, " Cooperative UAV Navigation using Magnetic Anomaly Measurements and Limited Inter-Vehicle Ranging Information," *Journal of Aerospace Information Systems,* (2020).

CHANDRAHALIM, HENGKY

Assistant Professor of Electrical Engineering, Department of Electrical and Computer Engineering, AFIT Appointment Date: 2017 (AFIT/ENG); BSC, The Ohio State University, 2000; MEng, Cornell University, 2004; MSc, Cornell University, 2008; PhD, Electrical and Computer Engineering, Cornell University, 2009. Dr. Chandrahalim's research interests include mutually enhancing electronic, photonic, and photonic multifunctional microsystems, fabrication techniques for novel integrated nanosystems, and molecular scale sensing. He is a member of the OSA and senior member of the IEEE. Tel. (937) 255-3636 x4483, email: Hengky.Chandrahalim@afit.edu

Sponsor Funded Research Projects

"3-D Nanomachining of Remote Sensors on Optical Fibers." Sponsor: AFOSR. Funding: $55,590 - Chandrahalim 100%.

"Interactions of Light and Acoustic Waves in Statically and Dynamically Structured Liquid Crystalline." Sponsor: AFOSR. Funding: $50,000 - Chandrahalim 100%.

"Feasibility Study of Employing Tunable RF MEMS Filters for Next-Generation GPS Payloads." Sponsor: AFRL/RV. Funding: $82,133 - Chandrahalim 100%. [CSRA]

"Dynamically Tunable Nonlinear Optical Media in Metastructural Photonics." Sponsor: AFRL/RX. Funding: $20,000 - Chandrahalim 100%.

Refereed Journal Publications

Jonathan W. Smith, Jeremiah C. Williams, Joseph S. Suelzer, Nicholas G. Usechak, and Hengky Chandrahalim, "*Three-dimensional Fabry–Pérot cavities sculpted on fiber tips using a multiphoton polymerization process*," J. Micromech. Microeng. 30, 2020, pp. 125007.

Michael D. Sherburne, Candice R. Robert*, John S. Brewer Jr., Thomas E. Weber, Tod V. Laurvick, and Hengky Chandrahalim, "*Comprehensive optical strain sensing through the use of colloidal quantum dots*," ACS Appl. Mater. Interfaces, 12, 2020, pp. 44156-44162.

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Matthew Vincie, Tod Laurvick, Hengky Chandrahalim, Richard Cobb, and James Sattler, "*Avoiding transients in low-level sensing of secondary electron yield*," IEEE Sensors Conference, 2020.

Jeremiah C. Williams, Jonathan W. Smith, Joseph S. Suelzer, Nicholas G. Usechak, and Hengky Chandrahalim, "*Optical fiber-tip heat sensor featuring a multipositional Fabry–Pérot cavity resonator*," IEEE Sensors Conference, 2020.

Jeremiah C. Williams, Joseph S. Suelzer, Nicholas G. Usechak, and Hengky Chandrahalim, "Optical fiber tip micro anemometer," IEEE Sensors Conference, 2020.

Michael D. Sherburne, Candice R. Roberts* John S. Brewer Jr.*, Thomas E. Weber, Tod V.Laurvick, and Hengky Chandrahalim, "Strain sensing using colloidal quantum dots integrated with epoxy," IEEE Sensors Conference, 2020.

Israel Dunk and Hengky Chandrahalim, "Microelectromechanical phase detectors for phase-locked loop applications," IEEE Sensors Conference, 2020.

Refereed Conference Papers Accepted on the Basis of Abstract Review

Michael T. Dela Cruz, Ling Wang, and Hengky Chandrahalim, "Liquid crystal-enhanced photo phone cells," Conference on Lasers and Electro-Optics (CLEO) 2020, pp. SW4G.6. (Oral Talk).

Jonathan W. Smith, Jeremiah C. Williams, Joseph S. Suelzer, Nicholas G. Usechak, and Hengky Chandrahalim, "3-D optical cavities created using local light-triggered polymerization on fiber tips," Conference on Lasers and Electro-Optics (CLEO) 2020, pp. ATu3K.6. (Oral Talk).

Patent Applications

Title: Temperature-immune self-referencing Fabry–Pérot cavity sensors Inventors: Hengky Chandrahalim and Jonathan W. Smith US Patent App. 16/785,718, 2020 Date: 13 Aug 2020
Link: https://patents.google.com/patent/US20200257049A1/en).

Title: Noncontact liquid crystalline broadband optoacoustic sensors Inventors: Hengky Chandrahalim and Michael T. Dela Cruz US Patent App. 16/782,608, 2020 Date: 13 Aug 2020.

Invention Disclosures

Flat lens optical limiter. Inventors: Thomas M. Cooper, Edward J. Hurd Jr. Hengky Chandrahalim, Matthew S. Mills and Heidi D. Nelson-Quillin, Air Force Disclosure# 2087, Filing date: March 31, 2020.

A mechanically-enabled microscale Fabry–Pérot optical cavity on an optical fiber tip Inventors: Jeremiah C. Williams and Hengky Chandrahalim Air Force Disclosure# 2066 Filing date: February 18, 2020.

A monolithically integrated microscale pressure sensor on an optical fiber tip Inventors: Jeremiah C. Williams and Hengky Chandrahalim, Air Force Disclosure# 2065, Filing date: February 18, 2020.

Monolithically integrated microscale flow sensors on optical fiber tips Inventors: Jeremiah C. Williams and Hengky Chandrahalim, Air Force Disclosure# 2054, Filing date: January 21, 2020.

Liquid crystal (LC)-enhanced photo phones, Inventors: Hengky Chandrahalim and Michael T. Dela Cruz Air Force Disclosure# 2041, Filing date: December 09, 2019.

COLLINS, PETER J.
Professor of Electrical Engineering, Department of Electrical and Computer Engineering, AFIT Appointment Date: 2006 (AFIT/ENG); BA, Bethel College, MN, 1985; BSEE, University of Minnesota, 1985; MSEE, Air Force Institute of Technology, 1990; PhD, Air Force Institute of Technology, 1996. His research interests include low observables, computational electromagnetics, radar cross section metrology, remote sensing, and electromagnetic material design and analysis. He is a senior member of the IEEE. AFIT research center affiliation(s): [ANT], [CCR], and [CSRA.]
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Sponsor Funded Research Projects

"FASTBALL: Frugal Atmospheric Sounder Test Bed Auto-pointing Luneburg Lens." Sponsor: Undisclosed. Funding: $17,500 - Collins 100%. [CSRA]

"Enabling Technologies for Radar Scattering Measurements." Sponsor: SAF/FBIB. Funding: $142,390 - Collins 100%.

"Enabling Technologies for Advanced Munitions." Sponsor: SAF/FBIB. Funding: $100,000 - Collins 50%, Hartsfield 25%, Lingenfelter 25%.

Refereed Journal Publications

John Lee, Peter J. Collins, and Julie Ann Jackson, "Sparse Representation of Targets with Mixed Scattering Primitives," Journal of the Applied Computational Electromagnetics Society, Volume: 35, Number: 6, 2020.

Alex Paul, Collins P. J., Temple M., "Application of Machine Learning to Enhance Antenna Termination State Estimation Using Stimulated Unintended Radiated Emissions," IEEE Ant & Wireless Prop Letters, Volume: 18, Issue: 11, Nov. 2019.

Christopher Vergara, Richard K. Martin, Peter J. Collins, and James R. Lievsay, "Multi-Sensor Data Fusion between Radio Tomographic Imaging and Noise Radar," IET Radar, Sonar & Navigation, Volume: 14, Issue: 2, pp. 187-193, Feb. 2020.

Refereed Conference Papers Accepted on the Basis of Full Paper Review

Spencer R. Sellers, Peter J. Collins, and Julie Ann Jackson, "Augmenting Simulations for SAR ATR Neural Network Training," IEEE International Radar Conference, Washington D.C., 27 Apr – 1 May 2020.

CURRO, JOSEPH A., Maj
Assistant Professor of Electrical Engineering, Department of Electrical and Computer Engineering, AFIT Appointment Date: 2018 (AFIT/ENG); BSEE, Clarkson University, 2010; MSEE, Air Force Institute of Technology, 2012; PhD, Electrical Engineering, Air Force Institute of Technology, 2018. Capt Curro's research interests include GPS-alternative navigation systems using environmental signals. Interests also include using machine learning and neural networks for alternative navigation. He is a member of The Institute of Navigation (ION). AFIT research center affiliation(s): [ANT.] Tel. (937) 255-3636 x4620, email: Joseph.Curro@afit.edu

Sponsor Funded Research Projects

"Android Sensor Framework for ATAK." Sponsor: AFRL/RI. Funding: $70,000 - Curro 100%. [ANT]

"Artificial Intelligence Opponent for Contested Space (AIOCS) - AI Development." Sponsor: AFRL/RV. Funding: $34,500 - Curro 100%. [ANT]

"Advanced Tactics Development through Deep Reinforcement Learning." Sponsor: AFRL/RH. Funding: $250,000 - Curro 100%. [ANT]

"Deep Reinforcement Learning for Air Combat." Sponsor: AFRL/RQ. Funding: $30,000 - Curro 100%. [ANT]

Refereed Conference Papers Accepted on the Basis of Abstract Review

Ellis, David, Curro, Joseph, "Localization and Navigation with Imagery and Pedestrian Inertial Measurements Utilizing Artificial Neural Networks," Proceedings of the 2020 International Technical Meeting of the Institute of Navigation, San Diego, California, January 2020, pp. 672-682. https://doi.org/10.33012/2020.17170.

Curro, J., Skouson, M., Introduction to a Deep Reinforcement Learning Solution for Various Simulation Environments, 88th Symposium – Military Operations Research Society MORS, 2020.

Curro, J., Skouson, M., "Introduction to a Deep Reinforcement Learning Solution for Various Simulation Environments," In Joint Navigation Conference (JNC) 2020.

DAVIS, NATHANIEL J., IV
Professor Emeritus, Department of Electrical and Computer Engineering, AFIT Appointment Date: 2005 (AFIT/ENG); BSEE, Virginia Polytechnic Institute and State University, 1976; MSEE, Virginia Polytechnic Institute and State University, 1977; PhD, Purdue University, 1985. Dr. Davis' research interests include computer communications networks, cyber operations, and large scale computer architectures. He is a senior member of the IEEE and a member of the Sigma Xi, Eta Kappa Nu, and Tau Beta Pi honorary societies.

DEYOUNG, MARK, E., Lt Col
Assistant Professor of Computer Engineering, Department of Electrical and Computer Engineering, AFIT Appointment Date: 2018 (AFIT/ENG); BS, Columbia College, 2003; MS, Air Force Institute of Technology, 2008; PhD, Computer Engineering, Virginia Tech, 2018. Lt Col DeYoung's research interests include hardware/software design, embedded systems, cyber situational awareness, computational statistics, software engineering, and reverse engineering. He is a member of Eta Kappa Nu and Upsilon Pi Epsilon honor societies. AFIT research center Affiliation: [CCR.] Tel. (937) 255-3636 x3368, email: Mark.DeYoung@afit.edu

Refereed Conference Papers Accepted on the Basis of Full Paper Review

Newlin, M., Smathers, K., and DeYoung, M. "ARC containers for AI workloads: Singularity performance overhead," *Proceedings of the Practice and Experience in Advanced Research Computing (PEARC19)*, Chicago, IL, 28 July – 1 August 2019.

Newlin, M., Reith, M., and DeYoung, M. "Synthetic Data Generation with Machine Learning for Network Intrusion Detection Systems," *Proceedings of the 18th European Conference on Cyber Warfare & Security (ECCWS 2019)*, University of Coimbra, Portugal, 4-5 July 2019.

DILL, RICHARD, MAJ
Assistant Professor of Computer Engineering, Department of Electrical and Computer Engineering (AFIT) Appointed Date: 2018. BS, Computer Science, University of Maryland, 2004; MS, Computer Science, AFIT 2008, PhD, Computer Science, AFIT 2018. Maj Dill's research interests include computer and mobile device security, embedded systems, algorithms, and artificial intelligence. Tel: (937) 255-3636x3652. Email: Richard.dill@afit.edu

Sponsor Funded Research Projects

"Rapidly Developing and Evaluating War gaming Operational Decisions." Sponsor: AFRL/XP. Funding: $33,040 - Dill 80%, Hopkinson 20%. [CCR]

"AI-Centric Multi-domain War gaming." Sponsor: AFRL/RH. Funding: $39,960 - Dill 100%. [CCR]

GRAHAM, SCOTT R.
Associate Professor of Computer Engineering, Department of Electrical and Computer Engineering, AFIT Appointment Date: 2015 (AFIT/ENG); BS, Electrical Engineering, Brigham Young University, 1993; MS, Electrical Engineering, Air Force Institute of Technology, 1999; PhD, Electrical Engineering, University of Illinois at Urbana-Champaign, 2004. Dr. Graham's research interests include the intersection between real physical systems and the computers that control them. Specific areas of interest include trusted avionics and vehicular computer systems. AFIT research center affiliation(s): [CCR.] Tel. (937) 255-3636 x4581, email: Scott.Graham@afit.edu

Sponsor Funded Research Projects

"Cyber Resiliency at the Component Level." Sponsor: AFLCMC/XZZ. Funding: $200,000 - Graham 50%, Betances 50%. [CCR]

"Cyber Resiliency at the Component Level." Sponsor: AFLCMC/XZZ. Funding: $50,000 - Graham 60%, Martin 20%, Mullins 20%. [CCR]

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Pettit, D.M., Graham, S.R., Sweeney, P.J., "Searching for Stars: Analyzing and Defining UAV Cyber Risk Assessments," *IARIA International Journal on Advances in Security*, vol 13, no 1&2, Jun 2020.

Hamilton, N.S., Graham, S.R., Carbino, T.J., Petrosky, J.C., Betances, J.A., "Adaptive-Hybrid Redundancy with Error Injection," *MDPI Journal of Electronics*, Vol 8, no.11, Nov 2019.

Refereed Conference Papers Accepted on the Basis of Full Paper Review

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Pettit, D.M., Graham, S.R., Dill, R., "Zero Stars: Analysis of Cybersecurity Risk of Small COTS UAVs," IARIA V SECUREWARE 19, Nice, France, Oct 2019.

Crow, D.R., Graham, S.R., Borghetti, J.B., Sweeney, P.J., "Empirical Dynamic Modeling as a Component of an Intrusion Detection System," *14th International Conference on Critical Infrastructure Protection*, Arlington, VA, USA, Mar 2020.

Hayden, M.J, Graham, S.R., Betances, J.A., Mills, R.M., "Multi-Channel Security through Data Fragmentation," *14th International Conference on Critical Infrastructure Protection*, Arlington, VA, USA, Mar 2020.

Mireles, L.E., Graham, S.R., Dunlap, S.J., Sweeney, P.J., Dallmeyer M.J., "Implications of Securing and Infiniband Network," *14th International Conference on Critical Infrastructure Protection*, Arlington, VA, USA, Mar 2020.

Pettit, D.M., Graham, S.R., "Cybersecurity Risk Assessment for Small Unmanned Aerial Vehicles," *14th International Conference on Critical Infrastructure Protection*, Arlington, VA, USA, Mar 2020.

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Crow, D.R., Graham, S.R., Borghetti, J.B., "Fingerprinting Vehicles with CAN Bus Data Samples," *15th International Conference on Cyber Warfare and Security (ICCWS 2020)*, Norfolk, VA, Feb 2020.

Books and Chapters in Books

Cintron, L.A., Graham, S.R., Hodson, D.D., Mullins, B.E., "Modeling Liability Data Collection Systems for Intelligent Transportation Infrastructure using Hyperledger Fabric," *Critical Infrastructure Protection XIII,* Springer, Cham, Switzerland, pp. 137-156, 2019.

Lassiter, R. M., Graham, S.R., Carbino, T.J., Dunlap S.J., "Electronic Control Unit Discrimination Using Wired Signal Distinct Native Attributes (WS-DNA)," *Critical Infrastructure Protection XIII,* Springer, Cham, Switzerland, pp. 103-121, 2019.

Hacker, K.L., Graham, S.R., Dunlap, S.J., Vehicle Identification and Route Reconstruction via TPMS Data Leakage, *Critical Infrastructure Protection XIII*, Springer, Cham, Switzerland, pp. 123-136, 2019.

Schmitt, D.J., Graham, S.R., Sweeney, P.J., Mills, R.M., "Vulnerability Assessment of Infiniband Networking," *Critical Infrastructure Protection XIII,* Springer, Cham, Switzerland, pp. 179-205, 2019.

GUNAWARDENA, SANJEEV

Research Assistant Professor of Electrical Engineering, Department of Electrical and Computer Engineering, AFIT Appointment Date: 2014 (AFIT/ENG); BSEE & BS, Engineering Physics, Ohio University, 1997; MSEE, Ohio University, 2000; PhD, Ohio University, 2007. Dr. Gunawardena's research interests include satellite navigation and

timing (SatNav), navigation warfare, software defined radio, reconfigurable computing, and domain-specific programmable ASICs. He is a member of the US Institute of Navigation. AFIT research center affiliation(s): [ANT], [CCR], and [CSRA.] Tel. (937) 255-3636 x4659, email: Sanjeev.Gunawardena@afit.edu

Sponsor Funded Research Projects

"SatNav Signal Monitoring and Analysis Technology Development." Sponsor: AFRL/RV. Funding: $214,900 - Gunawardena 100%. [ANT]

"SatNav Signal Monitoring and Analysis Technology Development." Sponsor: AFRL/RV. Funding: $100,000 - Gunawardena 100%. [ANT]

"Advanced GPS Technologies Development Experiment Support." Sponsor: AFRL/RV. Funding: $150,864 - Gunawardena 100%. [ANT]

"SatNav Signal Monitoring and Analysis Technology Development." Sponsor: AFRL/RY. Funding: $351,870 - Gunawardena 100%. [ANT]

Refereed Conference Papers Accepted on the Basis of Full Paper Review

Echeverry, N. C., Betances F, A., Gunawardena, **S.**, Temple F, M. A., Signal Quality Monitoring using a Chip Shape Deformation Metric for Global Navigation Satellite System Signals, Proceedings of the 33rd International Technical Meeting of the Satellite Division of The Institute of Navigation, Virtual, September 2020.

Gunawardena, S., A High Performance Easily Configurable Satnav SDR for Advanced Algorithm Development and Rapid Capability Deployment, Proceedings of the International Technical Meeting of the Institute of Navigation: ITM2021 Virtual, January 25-28, 2021.

Refereed Conference Papers Accepted on the Basis of Abstract Review

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Carroll, M., Hebert, J., Gunawardena, S., GPS Authentication Using Machine Learning, Joint Navigation Conference of the Institute of Navigation, Cincinnati, OH, September 2020. (Conference postponed to September 2020, originally scheduled for June 2020).

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Gunawardena, S., Rügamer, A., Hameed, M. S., Arizabaleta, M., Pany, T., Arriba, J., ION Software-Defined Radio Metadata Standard Final Report, *Proceedings of the 32nd International Technical Meeting of the Satellite Division of the Institute of Navigation (ION GNSS+ 2019)*, Miami, Florida, September 2019, pp. 3785-3800. https://doi.org/10.33012/2019.17027 .

Raquet, N., Gunawardena, S., Patel, P., Hinks, J., Phase Optimized Constant Envelope Transmission-Induced Pseudorange Biases and Mitigation, *Proceedings of the 2019 Joint Navigation Conference of the Military Division of the Institute of Navigation*, Long Beach CA, July 2019.

Braun, A., Gunawardena, S., High Fidelity Satellite Navigation Front-End for Signal Quality Monitoring and Advanced Authentication, *Proceedings of the 2019 Joint Navigation Conference of the Military Division of the Institute of Navigation*, Long Beach CA, July 2019.

HAMILTON, NICOLAS, S., Maj

Assistant Professor of Electrical Engineering, Department of Electrical and Computer Engineering, AFIT Appointment Date: 2019 (AFIT/ENG); BS, Electrical Engineering, Rose-Hulman Institute of Technology, 2009; MS, Electrical Engineering, Air Force Institute of Technology, 2011; PhD, Electrical Engineering, Air Force Institute of Technology, 2019. Maj Hamilton's research interests include radiation hardening through redundancy, field programmable gate arrays, and very large scale integrated circuits. He is a member of the Tau Beta Pi honor society. Tel. (937) 255-3636 x4220, email: nicolas.hamilton@afit.edu

Refereed Journal Publications

Nicolas Hamilton, Scott Graham, Timothy Carbino, James Petrosky, J. Addison Betances, "Adaptive-Hybrid Redundancy with Error Injection," MDPI Journal of Electronics, vol. 8, no. 11, 1 Nov 2019.

Refereed Conference Papers Accepted on the Basis of Full Paper Review

Hamilton, Nicolas S., Graham, Scott R., Petrosky, James C., Carbino, Timothy J., Betances, J. Addison, "Adaptive-Hybrid Redundancy for Rad-Hardening" NAECON 2019.

HARTRUM, THOMAS C.
Associate Professor Emeritus of Electrical Engineering, Department of Electrical and Computer Engineering, AFIT Appointment Date: 1977 (AFIT/ENG); BEE, The Ohio State University, 1969; MS, The Ohio State University, 1969; PhD, The Ohio State University, 1973; MBA, Wright State University, 1979. Dr. Hartrum's field of expertise is software engineering.

HAVRILLA, MICHAEL J.
Professor of Electrical Engineering, Department of Electrical and Computer Engineering, AFIT Appointment Date: 2002 (AFIT/ENG); BS, Michigan State University, 1987; MSEE, Michigan State University, 1989; PhD, Michigan State University, 2001. Dr. Havrilla' s research interests include electromagnetic theory, guided wave theory and applications, electromagnetics of complex media, material characterization, low observables, electromagnetic scattering, and antenna theory. He is a member of HKN and Sigma Xi, senior member of the IEEE, and a Full Member of the International Union of Radio Science-Commission B. Tel. (937) 255-3636 x4582, email: Michael.Havrilla@afit.edu

Sponsor Funded Research Projects

"Material Measurement Laboratory Research." Sponsor: SAF/FBIB. Funding: $225,000 - Havrilla 100%.

Refereed Journal Publications

M. Hyde and M. Havrilla, "Near-field effects on partially coherent light scattered by an aperture," Journal of Physics Communications, vol. 3, no. 8, pp. 085012, August 2019, doi/10.1088/2399-6528/ab3b63, in print.

N. Rogers, M. Havrilla, M. Hyde and Alex Knisely, "Nondestructive electromagnetic characterization of uniaxial sheet media using a two-flanged rectangular waveguide probe," IEEE Transactions on Instrumentation and Measurement, vol. 69, no. 6, pp. 2938-2947, June 2020, in print.

Refereed Conference Papers Accepted on the Basis of Full Paper Review

N. O'Gorman and M. Havrilla, Biaxial Material Characterization Utilizing a Focus Beam System, APEMC 2020, Canceled due to covid-19.

N. O'Gorman and M. Havrilla, Focus Beam System Biaxial Cross-Polarization 2nd Sample Method, ICEAA August 2020, canceled due to covid-19.

HODSON, DOUGLAS D.
Associate Professor of Software Engineering, Department of Electrical and Computer Engineering, AFIT Appointment Date: 2011 (AFIT/ENG); BS, Physics, Wright State University, 1985; MS, Electro-Optics, University

of Dayton, 1987; MBA, University of Dayton, 1999; PhD, Computer Engineering, Air Force Institute of Technology, 2009. Dr. Hudson's research interests include real-time distributed simulation architectures for training, test and analysis, networks, design patterns for modeling radar, and infrared effects. His research interests also include the modeling and simulation of Quantum Key Distribution protocols. AFIT research center affiliation(s): [ANT], [CCR], [COA], and [CSRA.] Tel. (937) 255-3636 x4719, email: Douglas.Hodson@afit.edu

Refereed Journal Publications

Chris Weimer, J.O. Miller, Raymond Hill, Douglas D. Hodson, "Agent Scheduling in Opinion Dynamics: A Taxonomy and Comparison Using Generalized Models," Journal of Artificial Societies and Social Simulation (JASSS), Vol 22, No 4, 2019.

Refereed Conference Papers Accepted on the Basis of Full Paper Review

Joseph Tippit, Douglas Hodson, Michael Grimaila, "Julia and Singularity for High Performance Computing," The 18th International Conference on Scientific Computing (CSC'20), Las Vegas, NV, Jul 27-30, 2020.

Drew Campbell, Jake Hall, Iyanu Odebode, Douglas Hodson, Michael Grimaila, "Trojan Banker Simulation Using Python," The 18th International Conference on Scientific Computing (CSC'20), Las Vegas, NV, Jul 27-30, 2020.

Amber Modlin, Andres Gregory, Iyanu Odebode, Douglas Hodson, Michael Grimaila, "CovidLock a New Form of Ransomware," The 18th International Conference on Scientific Computing (CSC'20), Las Vegas, NV, Jul 27-30, 2020.

Braeden Bowen, Jeremy Ergybar, Iyanu Odebode, Douglas Hodson, Michael Grimaila, "The New Office Threat: A Simulation Environment of Watering Hole Cyber Attacks," The 18th International Conference on Scientific Computing (CSC'20), Las Vegas, NV, Jul 27-30, 2020.

Hai Vo, Raymond Kozlowski, Iyanu Odebode, #Douglas Hodson, Michael Grimaila, "Simulation of SYN Flood Attack and Counter-Attack Methods Using Average Connection Times," The 18th International Conference on Scientific Computing (CSC'20), Las Vegas, NV, Jul 27-30, 2020.

HOPKINSON, KENNETH M.
Department Head, Professor, Department of Electrical and Computer Engineering, AFIT Appointment Date: 2004 (AFIT/ENG); BSCS, Rensselaer Polytechnic Institute, 1997; MSCS, Cornell University, 2002; PhD, Cornell University, 2004. Dr. Hopkinson research interests include wired and wireless networking, fault tolerant and reliable distributed systems, middleware, operating systems, net-centric warfare, network security, cloud computing, machine learning applied to remote sensing, and the use of networks to enhance critical infrastructures. Dr. Hopkinson is a Senior Member of the IEEE, a Senior Member of the ACM, and a member of the Upsilon Pi Epsilon, and the Eta Kappa Nu honorary societies. AFIT research center affiliation(s): [ANT], [CCR], [CSRA], and [CTISR.] Tel. (937) 255-3636 x4579, email: Kenneth.Hopkinson@afit.edu

Sponsor Funded Research Projects

"Cluster Cognition for Multi-INT Target Extraction and Analysis." Sponsor: Undisclosed. Funding: $43,100 - Hopkinson 35%, Betances 35%, Steward 15%, Hawks 15%. [CTISR]

"Task-Oriented Dynamic Knowledge Graphs for Information Integration at Operation Centers." Sponsor: 711 HPW. Funding: $30,000 - Hopkinson 100%.

"Verifying and Validating Cyber-Physical Software Systems via Software Modeling." Sponsor: AFRL/RQ. Funding: $60,000 - Hopkinson 100%.

"Cluster Cognition for Multi-INT Target Extraction and Analysis." Sponsor: Undisclosed. Funding: $28,733 - Hopkinson 35%, Betances 35%, Steward 15%, Hawks 15%. [CTISR]

"Artificial Intelligence Opponent for Contested Space (AIOCS) - Multi-Asset Scenarios." Sponsor: AFRL/RV. Funding: $34,500 - Hopkinson 100%. [CSRA]

"Artificial Intelligence Opponent for Contested Space (AIOCS) - Training Strategies." Sponsor: AFRL/RV. Funding: $34,500 - Hopkinson 100%. [CSRA]

"Verifying and Validating Cyber-Physical Software Systems via Software Modeling." Sponsor: AFRL/RQ. Funding: $40,000 - Hopkinson 100%.

"Task-Oriented Dynamic Knowledge Graphs for Information Integration at Operation Centers." Sponsor: AFRL/RH. Funding: $30,000 - Hopkinson 100%.

Refereed Journal Publications

Heglund, J., Hopkinson, K., Tran, H.T., Social Sensing: Towards Social Media as a Sensor for Resilience in Power Systems and Other Critical Infrastructures, *Taylor and Francis Journal of Sustainable and Resilient Infrastructure*, 12 March 2020, pp. 1-13.

Becherer, N., Pecarina, J., Nykl, S., Hopkinson, K., Improving Optimization of Convolutional Neural Networks through Parameter Fine-tuning, *Springer Neural Computing and Applications*, Volume 31, Issue 8, August 2019, pp. 3469-3479.

JACKSON, JULIE A.
Associate Professor of Electrical Engineering, Department of Electrical and Computer Engineering, AFIT Appointment Date: 2009 (AFIT/ENG); BS, Electrical Engineering, Wright State University, 2002; MS, Electrical Engineering, The Ohio State University, 2004; PhD, Electrical Engineering, The Ohio State University 2009. Dr. Jackson's research interests include electromagnetic and statistical modeling, radar imaging algorithms, and radar signal exploitation. She is a member of IEEE, Eta Kappa Nu, and Tau Beta Pi. AFIT research center affiliation(s): [CTISR.] Tel. (937) 255-3636 x4678, email: Julie.Jackson@afit.edu

Sponsor Funded Research Projects

"Radar and RF Sensors Technology Research Report." Sponsor: AFRL/STO. Funding: $30,933 - Jackson 100%. [CTISR]

"Signal Detection in Linearly Mixed Observations with Background Replacement." Sponsor: AFOSR. Funding: $30,975 - Jackson 100%.

Refereed Journal Publications

J. A. Jackson and F. Lee-Elkin, "Exploiting Channel Crosstalk for Polarimetric SAR Compressive Sensing," in IEEE Transactions on Aerospace and Electronic Systems, vol. 56, no. 1, Feb. 2020, pp. 475-485. https://ieeexplore.ieee.org/document/8718553

A. Evers and J. A. Jackson, "Generalized Phase Gradient Autofocus Using Semidefinite Relaxation PhaseEstimation," in IEEE Transactions on Computational Imaging, vol. 6, pp. 291-303, 2020. https://ieeexplore.ieee.org/document/8878126

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J. Kempf and J. A. Jackson, "A Modified Least-Squares Mismatch Filter for Use in Radar Applications with Additive Noise," 2020 IEEE International Radar Conference, Washington DC, Apr 27 – May 1, 2020, ID 4033, p. 1-6

S. Sellers, P. Collins, and J. A. Jackson, "Augmenting Simulations for SAR ATR Neural Network Training," 2020 IEEE International Radar Conference, Washington DC, Apr 27 – May 1, 2020, paper ID 4167, p. 1-6.

A. Evers and J. A. Jackson, "A Comparison of Autofocus Algorithms for Back projection Synthetic Aperture Radar," 2020 IEEE International Radar Conference, Washington DC, Apr 27 – May 1, 2020, paper ID 4021, p. 1-6.

KING, DAVID, W., Lt Col
Assistant Professor of Computer Science, Department of Electrical and Computer Engineering, AFIT Appointment Date: 2019 (AFIT/ENG); BS Computer Science, University of Maryland, 2005, MS, Cyber Operations, AFIT, 2014, PhD, Computer Science, AFIT, 2019. Lt Col King's research interests include complex adaptive systems, machine learning and multi-agent systems. Tel: (937) 255-3636x4579. Email: david.king@afit.edu

Refereed Conference Papers Accepted on the Basis of Full Paper Review

David King, Lukas Esterle, and Gilbert Peterson, Entropy-Based Team Self-Organization with Signal Suppression, the 2019 Conference on Artificial Life (2019), Newcastle, UK, 29 Jul – 2 Aug 2019.

King, David W**.**, Peterson, Gilbert L. "Decentralized Control Strategies for Unmanned Aircraft System Pursuit and Evasion," 2019 IEEE 90th Vehicular Technology Conference, Proc 2019, Sep 2019.

LAMONT, GARY B.
Professor of Electrical Engineering, Department of Electrical and Computer Engineering, AFIT Appointment Date: 1970 (AFIT/ENG); Bachelor of Physics, University of Minnesota, 1961; MSEE, University of Minnesota, 1967; PhD, University of Minnesota, 1970. Dr. Lamont teaches courses in computer science and computer engineering. His research interests include: evolutionary computation, artificial immune systems, intrusion and anomaly detection, information security, parallel and distributed computation, combinatorial optimization problems (single objective and multi-objective), software engineering, digital signal processing, and intelligent and distributed control. He has advised many MS and PhD students in these disciplines. Dr. Lamont has authored several textbooks (Multi-Objective EAs, Computer Control), various book chapters, as well as numerous papers. Dr. Lamont was also an engineering systems analyst for the Honeywell Aerospace Division for six years. He is a member of IEEE (senior member) ACM, ASEE, SIAM, Tau Beta Pi, and Eta Kappa Nu. Tel. (937) 255-3636 x4718, email: Gary.Lamont@afit.edu

LAURVICK, TOD V. Maj
Electrical Engineering Division Chief, Assistant Professor of Electric Engineering, Department of Electrical and Computer Engineering, AFIT Appointment Date: 2016 (AFIT/ENG); BSEE, Michigan Technological University, 1995; MS, Air Force Institute of Technology, 2009; PhD, Electrical Engineering, Air Force Institute of Technology, 2016. Maj Laurvick's research interests include advancement of micro/nanoscale fabrication techniques and how they apply to sensing and actuation. AFIT research center affiliation(s): [CSRA.]

Refereed Conference Papers Accepted on the Basis of Abstract Review

M. Sherburne, T. Laurvick, L. Burggraf, I. Bean, P. Crandall, M. Du, C. Adams, E. Burke, V. Klimov, I. Fedin, and T.E. Weber, "Characterizing Nanomaterial Response for sub-100 ps X-ray Scintillation," 61st Annual Meeting of the APS Division of Plasma Physics, 21 Oct 2019

Patent Applications

M. Sherburne, T. Laurvick "Using 3D Printing Rapid Manufacturing to integrate Colloidal Quantum Dots as a Radiation Scintillator," Mar 2020 (currently in legal review).

M. Sherburne, T. Laurvick, "Colloidal Quantum Dots Loaded Into Polymer for Use in optical non-Destructive Testing Strain Detecting Applications," Mar 2020 (currently in legal review).

LEISHMAN, ROBERT C.
Research Assistant Professor of Autonomy, Department of Electrical and Computer Engineering, AFIT Appointment Date: 2016 (AFIT/ENG); BS, Utah State University, 2006; MS, Brigham Young University, 2009; PhD, Mechanical

Engineering, Brigham Young University, 2013. Dr. Leishman's research interests include guidance, navigation and control of small unmanned aerial vehicles, GPS-denied navigation using vision systems, and autonomous systems and robotics. He is a member of The Institute of Navigation (ION) and The Institute of Electrical and Electronics Engineers (IEEE), including the IEEE Controls Systems Society (CSS) and IEEE Robotics and Automation Society (RAS). AFIT research center affiliation(s): [ANT.] Tel. (937) 255-3636 x4755, email: Robert.Leishman@afit.edu

Sponsor Funded Research Projects

"ENG18-001 PNT Focused Distance Learning Electrical Engineering Master's Degree." Sponsor: 796 TSS. Funding: $80,000 - Leishman 50%, Canciani 25%, Gunawardena 25%. [ANT]

"Scorpion Suite Development and Support." Sponsor: C5ISR CENTER. Funding: $200,000 - Leishman 50%, Taylor 50%. [ANT]

"Expedited Up-close Visual Inspection of Aircraft Exteriors Using an Autonomous Multi-rotor Based System." Sponsor: AFRL/RX. Funding: $150,000 - Leishman 50%, Taylor 50%. [ANT]

"ENG18-004 PNT Focused Distance Learning Electrical Engineering Master's Degree." Sponsor: C5ISR. Funding: $80,000 - Leishman 50%, Canciani 25%, Gunawardena 25%. [ANT]

"PNT Focused Distance Learning Electrical Engineering Master's Degree." Sponsor: AFRL/RV. Funding: $60,000 - Leishman 25%, Canciani 25%, Curro 25%, Taylor 25%. [ANT]

"Eglin Magnetic Survey & Data Collect." Sponsor: AFRL/RW. Funding: $150,000 - Leishman 100%. [ANT]

"GNSS Antenna Characterization." Sponsor: Ohio State University. Funding: $148,000 - Leishman 100%. [ANT]

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T. B. Bodin, J. M. Bindewald, R. C. Leishman, G. L. Peterson, and D. R. Jacques, "A Development Platform for Behavioral Flexibility in Autonomous UAS," *Int. J. Intell. Robot. Appl.*, vol. 4, no. 1, pp. 57–72, 2020.

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Z. P. Friedel and R. C. Leishman, "Smart Features for Dynamic Vision Sensors," in *IEEE/ION PLANS*, Portland, OR. 2020 (postponed until Sept 2020).

S. Mochocki, K. J. Kauffman, R. C. Leishman, and J. Racquet, "Relational Database for PNT Data," in *IEEE/ION PLANS*, Portland, OR Apr. 2020 (postponed until Sept 2020).

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Kauffman, K., Marietta, D., Raquet, J., Carson, D. , Leishman, R. C., Canciani, A., Schofield, A., Caporellie, M., "Scorpion : A Modular Sensor Fusion Approach for Complementary Navigation Sensors," in *ION/IEEE PLANS*, Portland, OR Apr. 2020 (postponed until Sept 2020).

R. M. Watson, J. N. Gross, C. N. Taylor, and R. C. Leishman, "Uncertainty Model Estimation in an Augmented Data for Robust State Estimation," in *ION GNSS+*, 2020.

LIEVSAY, JAMES R., Maj
Assistant Professor of Electrical Engineering, Department of Electrical and Computer Engineering, AFIT Appointment Date: 2017 (AFIT/ENG); BSEE, United States Air Force Academy, 2006; MSEE, Air Force Institute of Technology, 2011; PhD, Electrical Engineering, University of Oklahoma, 2017. Maj Lievsay's research interests include radar and array signal processing. AFIT research center affiliation(s): [ANT] and [CTISR.] Tel. (937) 255-3636 x3369, email: James.Lievsay@afit.edu

LIN, ALAN C. Lt Col
Adjunct Assistant Professor of Computer Science, Department of Electrical and Computer Engineering, AFIT Appointment Date: 2015 (AFIT/ENG); BSCE, Rutgers University, 2004; MSCS, Air Force Institute of Technology, 2008; PhD, Computer Science, Air Force Institute of Technology, 2015. Maj Lin's research interests include cyber security and education, serious gaming and gamification, data mining, space systems, and software engineering. He is a member of Tau Beta Pi. AFIT research center affiliation(s): [CCR.]

MARTIN, RICHARD K.
Professor of Electrical Engineering, Department of Electrical and Computer Engineering, AFIT Appointment Date: 2004 (AFIT/ENG); BS, Electrical Engineering and Physics, University of Maryland, 1999; MS, Electrical Engineering, Cornell University, 2001; PhD, Electrical Engineering, Cornell University, 2004. Dr. Martin's research interests include source localization, navigation, radio tomographic imaging, and 3D laser radar imaging. AFIT research center affiliation(s): [ANT] and [CCR.] Tel. (937) 255-3636 x4625, email: Richard.Martin@afit.edu

Sponsor Funded Research Projects

"Classification Methods and Passive Augm of Spectropolarmetric LADAR." Sponsor: AFRL/RW. Funding: $50,000 - Martin 100%.

Refereed Journal Publications

Joshua Dickey, Brett Borghetti, William Junek, and Richard K. Martin, "Beyond Correlation: A Path-Invariant Measure for Seismogram Similarity," *Seismological Research Letters*, vol. 91, no. 1, pp. 356–369, Jan 2020.

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Christian K. Keyser, Richard K. Martin, Helena Lopez-Aviles, Khanh Nguyen, Arielle M. Adams, and Demetrios Christodoulides, "Single-Pulse, Kerr-Effect Mueller Matrix LiDAR Polarimeter," *Optics Express*, vol. 28, no. 9, pp. 13694-13713, Apr 2020.

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Patent Applications

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MAYBECK, PETER S.
Professor Emeritus of Electrical Engineering, Department of Electrical and Computer Engineering, AFIT Appointment Date: 1973 (AFIT/ENG); BS, Massachusetts Institute of Technology, 1968; PhD, Massachusetts Institute of Technology, 1972. Dr. Maybeck's research interests include optimal estimation and stochastic control Kalman filtering, adaptive estimation, pointing and tracking, optimally aided inertial navigation systems, and multiple model adaptive filtering. He is the author of the widely recognized three-Volume reference text, "Stochastic Models, Estimation and Control," and over 100 technical articles. Dr. Maybeck has received numerous national and local awards including the C. Holmes MacDonald Distinguished Young Electrical Engineering Teach and the ASEE Frederick Emmons Terman Award as the outstanding Electrical Engineering Professor in the US and 1985. He is a fellow of the IEEE. AFIT research center affiliation(s): [CCR]

MERKLE, LAURENCE D.
Assistant Professor of Computer Science, Department of Electrical and Computer Engineering, AFIT Appointment Date: 2015 (AFIT/ENG); BS, Computer and Systems Engineering, Rensselaer Polytechnic Institute, 1987; MSCE, Air Force Institute of Technology, 1992; PhD, Computer Engineering, Air Force Institute of Technology, 1996. Dr. Merkle's research interests include Serious Games, Quantum Information Systems, Computational Science and Engineering, Computing Education, Evolutionary Computation, Secure Computing, Space Situational Awareness. AFIT research center affiliation(s): [ANT], [CCR], and [CSRA] Tel. (937) 255-3636 x4526, email: *Laurence.Merkle@afit.edu*

Refereed Conference Papers Accepted on the Basis of Abstract Review

T. Dontigney, L. Merkle, R. Cobb, J. Colombi, G. Lamont. Methodology for Comparison of Algorithms for Real-World Multi-objective Optimization Problems: Space Surveillance Network Design. Comparison of Multi-Objective Optimization Algorithms for GEO Space Surveillance Network Architecture Design. 20th Annual Advanced Maui Optical and Space Surveillance Technologies Conference, 2019.

L. Hsia, L. Merkle, D. Weeks, G. Vernizzi, M. Lanzerotti, D. Langley. Physically Unclonable Characteristics for Verification of Transmon-Based Quantum Computers. Government Microcircuit Applications and Critical Technology Conference, 2020.

MILLS, ROBERT F.
Professor of Electrical Engineering, Department of Electrical and Computer Engineering, AFIT Appointment Date: 2003 (AFIT/ENG); BS, Electrical Engineering, Montana State University, 1983; MS, Electrical Engineering, AFIT, 1987; PhD, Electrical Engineering, University of Kansas, 1994. Dr. Mills' research interests include electronic warfare, network security, and cyber resilience in weapon systems. He is a Senior Member of the IEEE and is a member of the Eta Kappa Nu and Tau Beta Pi honor societies. AFIT research center affiliation(s): [CCR.]
Tel. (937) 255-3636 x4527, email: Robert.Mills@afit.edu

Refereed Journal Publications

Beach, P.M., Mailloux, L.O., Langhals, B.T., and Mills, R.F., "Analysis of Systems Security Engineering Design Principles for the Development of Secure and Resilient Systems," IEEE Access, Vol 7, 24 Jul 2019, doi:10.1109/ACCESS.2019.2930718.

Sibiga, M., Mills, R., Rice, M., and Dunlap, S., "Applying Cyber Threat Intelligence to Industrial Control Systems," CSIAC Journal, Cyber Security & Information Systems Analysis Center, Vol 7, No 2, Aug 2019, pp 46-54.

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Wargo, T.W., Boggs, B.N., Temple, M.A., and Mills, R.F., "DNA Fingerprinting Ping 2020i ADS-B Beacons," IEEE Military Communications Conference, 12-14 Nov 2019.

Mailloux, L.O., and Mills, R.F. "Autonomous Space Resupply Vehicle Systems Security Design Principle Case Study," IEEE Workshop on Cyber Physical Systems (CPS-Sec) 2020, Virtual Conference, 29 June-1 July 2020.

Hayden, M., Graham, S., Betances, J., Mills, R., "Multi-Channel Security through Data Fragmentation," 14th International Conference on Critical Infrastructure Protection, Arlington, VA, USA, Mar 2020.

Books and Chapters in Books

Schmitt, D., Graham, S., Sweeney, P., and Mills, R., "Vulnerability Assessment of Infiniband Networking," Critical Infrastructure Protection XIII, Sringer, Cham, Switzerland, pp 179-205, 2019.

MULLINS, BARRY E.
Professor of Computer Engineering, Department of Electrical and Computer Engineering, AFIT Appointment Date: 2004 (AFIT/ENG); BS, Computer Engineering, University of Evansville, 1983; MS, Computer Engineering, Air Force Institute of Technology, 1987; PhD, Electrical Engineering, Virginia Polytechnic Institute and State University, 1997. Dr. Mullins' research interests cyber operations, critical infrastructure protection, cyber physical protection, computer/network/embedded systems security, wired/wireless networking, and reverse engineering.
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Sponsor Funded Research Projects

"Advanced Cyber Physical Security Research Support." Sponsor: AFRL/RY. Funding: $60,579 - Mullins 100%. [CCR]

Refereed Conference Papers Accepted on the Basis of Full Paper Review

Y. Park, R. Dill, and B. E. Mullins, "IoTAMU: Protecting Smart Home Networks via Obfuscation and Encryption," SECUREWARE 2019 The Thirteenth International Conference on Emerging Security Information, Systems, and Technologies, 27-31 October 2019, Nice, France, pp. 101-106.

Y. Park, M. G. Reith, and B. E. Mullins, "Operational Risk Assessment on Internet of Things: Mitigating Inherent Vulnerabilities," 18th European Conference on Cyber Warfare and Security ECCWS 2019, 4-5 July 2019, University of Coimbra, Coimbra, Portugal, pp. 346-353.

S. L. Long, R. Dill, and B E. Mullins, "Security Analysis of the Masimo MightySat: Data Leakage to a Nosy Neighbor," accepted - HICSS-54 (Hawaii International Conference on System Sciences 2021), Kauai, Hawaii, 5 Jan 2021.

R. D. Larkin and B E. Mullins, "Towards Dynamically Shifting Cyber Terrain with MTD," accepted – accepted 16th International Conference on Cyber Warfare and Security, Tennessee Tech University, Cookeville TN, 25-26 Feb 21.

Refereed Conference Papers Accepted on the Basis of Abstract Review

R. D. Larkin, R. J. Wagner, and B. E. Mullins, "Securing Photovoltaic System Deployments with Data Diodes," 47th IEEE Photovoltaic Specialists Conference (PVSC 47), June 15 - August 21, 2020, Virtual Meeting. (Submitted 2 Jun 20, accepted 8 Jun 20).

NOEL, GEORGE E., Lt Col
Assistant Professor of Computer Science, Department of Electrical and Computer Engineering, AFIT Appointment Date: 2019 (AFIT ENG); BS, Computer Science, Air Force Academy, 1998, MS, Information Resource Management, AFIT, 2002, PhD, Computer Science, AFIT, 2013. Lt Col Noel's research interests include artificial intelligence and natural language processing. Tel. (937) 255-3636x4613, email: George.noel@afit.edu

Refereed Conference Papers Accepted on the Basis of Full Paper Review

Orner, Jacob; Dill, Richard; Noel, George; PROF 2.0: Improving a Methodology for Topic Map and Skill Tree Creation, 2019 IEEE International Symposium on Multimedia, 9-11 Dec 2019, San Diego, CA.

NYKL, SCOTT L.
Associate Professor of Computer Science, Department of Electrical and Computer Engineering, AFIT Appointment Date: 2015 (AFIT/ENG); BS, Software Engineering, University of Wisconsin-Platteville, 2006; MS, Computer Science, Ohio University, 2012; PhD, Computer Science, Ohio University, 2013. Dr. Nykl's research interests include Computer Graphics, Interactive 3D Graphics, Level of Detail, Image-Based Rendering, GPGPU Programming/Parallel Computation, Distributed Real Time Visualizations, Computer Vision, Computational Geometry, Sensor Fusion, Linear Algebra, Numerical Analysis, Synthetic Vision (SVS), Augmented Reality (AR) Parallel/Concurrent Programming, Multi-Core/Multi-Threading, Algorithms, Big Data, and Networking, Data Structures. AFIT research center affiliation(s): [ANT] and [CCR] Tel. (937) 255-3636 x4395, email: Scott.Nykl@afit.edu

Sponsor Funded Research Projects

"Automated Aerial Refueling: Precise Relative Navigation Using Stereo Vision, Phase 3." Sponsor: AFRL/RQ. Funding: $40,000 - Nykl 100%. [ANT] [CCR]

"Automated Aerial Refueling: Precise Relative Navigation Using Stereo Vision, Phase 3." Sponsor: AFRL/RQ. Funding: $110,000 - Nykl 100%. [ANT] [CCR]

Refereed Journal Publications

K. Kim O, R. Leishman, and S. Nykl, "Virtual Testbed for Monocular Visual Navigation of Small Unmanned Aircraft Systems," The Journal of Defense Modeling and Simulation, vol. 0, no. 0, pp. 1–19, Sep 2020, URL: https://doi.org/10.1177/1548512920954545.

K. Graham, B. Heitmeyer, P. PatelO, J. AndersonS, S. Nykl, L. Merkle, and A. Lin, "Cyber Space Odyssey: A Competitive, Team-Oriented Serious Game in Computer Networking," IEEE Transactions on Learning Technologies, vol. 13, no. 3, pp. 502–515, Jul 2020, URL: https://doi.org/10.1109/TLT.2020.3008607.

A. Leighner, J. Roeber, P. Patel, J. Pecarina, and S. Nykl, "FPGA Accelerated Discrete-SURF for Vision based Aerial Navigation," Journal of DOD Research & Engineering (JDR&E), vol. 3, no. 1, pp. 1–13, 2020.

J. Roeber, S. Nykl, and S. Graham, "Assessment of Structure from Motion for Reconnaissance Augmentation and Bandwidth Usage Reduction," The Journal of Defense Modeling and Simulation, vol. 17, no. 2, pp. 213–225, 2020, URL: https: //doi.org/10.1177/1548512919844021.

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Refereed Conference Papers Accepted on the Basis of Full Paper Review

B. Burfeind, R. Mills, S. Nykl, J. Betances, and C. Sielski, "Confidential ADS-B: A Lightweight, Interoperable Approach," in 2019 IEEE Aerospace Conference, ser. IEEE Aerospace Conference. Big Sky, Montana: IEEE, 2019.

J. Anderson, S. Nykl, and T. Wishgolle, "Augmenting Flight Imagery from Aerial Refueling with a Virtual Boom to Test Occlusion," in Advances in Visual Computing: 12th International Symposium, ISVC 2019, Lake Tahoe, UT, USA, October 7-9, 2019, Proceedings, ser. Lecture Notes in Computer Science, G. Bebis, Ed. Springer International Publishing, 2019, vol. 10073, pp. 605–615.

J. A. Vagedes, D. D. Hodson, S. L. Nykl, and J. R. Millar, "ECS Architecture for Modern Military Simulators," in Proceedings of the International Conference on Scientific Computing (CSC). The Steering Committee of the World Congress in Computer Science, 2019, pp. 118–122.

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R. Raettig and S. Nykl, "Aided Stereo Vision Calibration Process for Automated Aerial Refueling," in Proceedings of the Institute of Navigation (ION) Joint Navigation Conference (JNC), ser. ION JNC '20. Cincinnati, OH, USA: Institute of Navigation, Sept 2020.

J. Larson and S. Nykl, "Convolutional Neural Networks to Improve Pose Estimation in Automated Aerial Refueling," in Proceedings of the Institute of Navigation (ION) Joint Navigation Conference (JNC), ser. ION JNC '20. Cincinnati, OH, USA: Institute of Navigation, Sept 2020.

V. Bownes* and S. Nykl, "Using Augmented Reality to Test Boom Occlusion Mitigation Methods in AAR," in Proceedings of the Institute of Navigation (ION) Joint Navigation Conference (JNC), ser. ION JNC '20. Cincinnati, OH, USA: Institute of Navigation, Sept 2020.

Patent Applications

Nykl, Scott and Woolley, Brian and Pecarina, John. *Process for Stereo Vision Relative Navigation of Airborne Vehicles*. U.S. Patent Pending 62/886,550, August, 2019.

PACHTER, MEIR

Professor, Department of Electrical and Computer Engineering, AFIT Appointment Date: 1993 (AFIT/ENG); BS, Israel Institute of Technology, 1967; MS, Israel Institute of Technology, 1969; PhD, Israel Institute of Technology, 1975. Dr. Pachter's fields of expertise include automatic control of aircraft and missiles, adaptive control and system identification, inertial and GPS navigation, autonomous control/neural networks/fuzzy logic control, nonlinear control, and applied mathematics. Dr. Pachter has published papers in these areas and in differential games, robotics, and the theory of computational geometry. Dr. Pachter is interested in the application of mathematics to the solution of engineering and scientific problems. His current areas of interest include military operations optimization, cooperative control, estimation and optimization, statistical signal processing, adaptive optics, inertial navigation, and GPS navigation. For his work on adaptive and reconfigurable flight control, he received the AFRL Air Vehicle's Directorate Foulois Award for 1994 together with Phil Chandler and Mark Mears. AFIT research center affiliation(s): [ANT] and [CCR] Tel. (937) 255-3636 x7247, email: Meir.Pachter@afit.edu

Sponsor Funded Research Projects

"UAV Optimal Control." Sponsor: AFRL/RQ. Funding: $40,000 - Pachter 100%.

"Intelligent Control in Adversarial and Stochastic Environments." Sponsor: AFOSR. Funding: $48,800 - Pachter 100%.

"Swarm and Counter swarm Tactics for Autonomous Space Vehicles." Sponsor: AFRL/RV. Funding: $40,000 - Pachter 100%. [CSRA]

Refereed Journal Publications

M. Pachter, A. Von Moll, E. Garcia, D. Casbeer and D. Milutinovic, "Two-on-One Pursuit," AIAA Journal of Guidance, Control and Dynamics, Vol. 42, No. 7, 2019, pp. 1638-1644.

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W. N. Caballaro, B. J. Lunday, R. F. Deckro and M. Pachter, "Informing National Security Policy by Modeling Adversarial Inducement and its Governance," Socio-Economic Planning Sciences, Vol. 69, March 2020.

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Weintraub I., E. Garcia and M. Pachter: "An Optimal Guidance Strategy for the Defense of a Non-Maneuverable target in 3-D," IET Journal of Control Theory & Applications , Vol. 14, No. 11, 2020, pp. 1531-1538.

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Von Moll, A., M. Pacter, E. Garcia, D. Casbeer and D. Milutinovic``Robust Policies for a Multiple Pursuer Single Evader Differential Game," published electronically on May 4, 2019, DOI 10.1007/s13235-019-00313-3, Dynamic Games And Applications, Vol. 10, No. 9, pp. 1-24.

M. Pachter, A. Von Moll and D. Casbeer, "Cooperative Pursuit by Multiple Pursuers of a Single Evader," AIAA Journal of Information Systems, Vol. 17, No. 8, pp. 371-389.

Refereed Conference Papers Accepted on the Basis of Full Paper Review

M. Vlassakis and M. Pachter, "Pure Pursuit of an Equal Speed Evader," Proceedings of the 60th Israel Annual Conference on Aerospace Sciences, Tel Aviv and Haifa, 4-5 March 2020.

I. Weintraub, R.Cobb, W. Baker and M. Pachter, "Direct Methods Comparison for the Active Target Defense Scenario," AIAA SciTech conference, Orlando, FL, January 6-10 2020.

Pachter, Meir and Patrick Wasz, "On a Two Cutters and Fugitive Ship Differential Game". Proceedings of the Conference on Decision and Control, Nice, France, December 11-13, 2019.

E. Garcia, A. Von Moll, D. Casbeer and M. Pachter, "Strategies for Defending a Coastline against Multiple Attackers". Proceedings of the Conference on Decision and Control, Nice, France, December 11-13, 2019

Eloy Garcia, David Casbeer and Meir Pachter, "Cooperative Two-Pursuer One-Evader Blocking Differential Game," American Control Conference, pp. 2702-2709, Philadelphia, PA, 10-12 July, 2019.

Patrick Wasz, Meir Pachter# and Khanh Pham, "Two-On-One Pursuit with a Non-Zero Capture Radius," Mediterranean Control Conference, Akko, Israel, July 1-4, 2019. Also chaired the session Guidance 2 - ThB01.

Meir Pachter, Eloy Garcia, Roger Anderson and David Casbeer, "Maximizing the Target's Longevity in the Active Target Defense Differential Game," European Control Conference, Naples, Italy, 25-28 June, 2019. Also chaired the Session.

E. Garcia, D. Casbeer and M. Pachter, "Capture the Flag -- A Differential Game," CCTA 2020 conference, 24-26 August 2020, Montreal, CA

M. Vlassakis* and M. Pachter, "Two-on-One Pursuit When the Pursuers Have the Same Speed as the Evader," IFAC Congress, July 12-17 2020, Berlin, Germany.

A. Von Moll, Z. Fuchs and M. Pachter, "Optimal Evasion against Dual Pure Pursuit," ACC 2020, 1-3 July, Denver, CO.

I. Weintraub, A. Von Moll, E. Garcia, D. Casbeer, Z. Demers and M. Pachter, "Maximum Observation of a Non-Maneuvering Target by a Slower Observer," ACC 2020, 1-3 July, Denver, CO.

I. Weintraub, M. Pachter and E. Garcia, "An Introduction to Pursuit-Evasion Games" (lecture), ACC 2020, 1-3 July, Denver, CO.

E. Garcia, I. Weintraub and M. Pachter, "Introduction to Cooperative Pursuit-Evasion Differential Games" (lecture), ACC 2020, 1-3 July, Denver, CO.

M. Pachter, "Multi-Player Pursuit-Evasion Differential Games" (lecture), ACC 2020, 1-3 July, Denver, CO

E. Garcia, D. Casbeer, M. Pachter, W. Curtiss and E. Doucette, "Two-team Linear-Quadratic Differential Game of Defending a Target," ACC 2020, 1-3 July, Denver, CO.

PETERSON, GILBERT L.
Professor of Computer Science, Department of Electrical and Computer Engineering, AFIT Appointment Date: 2002 (AFIT/ENG); BS, Architecture University of Texas at Arlington, 1995; MS, Computer Science, University of Texas at Arlington, 1998; PhD, University of Texas at Arlington, 2001. Dr. Peterson's research interests include uncertainty in artificial intelligence, robotics, machine learning, and digital forensics. AFIT research center affiliation(s): [ANT] and [CCR.] Tel. (937) 255-6565 x4281, email: Gilbert.Peterson@afit.edu

Sponsor Funded Research Projects

"Autonomy Capability Design and Development." Sponsor: AFRL/RH. Funding: $275,000 - Peterson 100%. [CCR]

Refereed Journal Publications

J.M. Bindewald, M.E. Miller, and G. L. Peterson, "Creating Effective Automation to maintain explicit User Engagement," *International Journal of Human-Computer Interaction*, pp. 1—14, 2019. doi: 10.1080/10447318.2019.1642618.

T.B. Bodin, J.M. Bindewald, R.C. Leishman, G.L. Peterson, and D.R. Jacques, "A Development Platform for Behavioral Flexibility in autonomous Unmanned Aerial Systems," International Journal of Intelligent Robotics and Applications, vol. 4, pp. 57-72, 2020. doi: 10.1007/s41315-020-00120-9.

Refereed Conference Papers Accepted on the Basis of Full Paper Review

J.S. Okolica, G.L. Peterson, and M.J. Mendenhall, "Middleware Unifying Framework for Independent Nodes System" Proceedings of the 33rd International FLAIRS Conference, pp. 205-208, 2020. (https://aaai.org/ocs/index.php/FLAIRS/FLAIRS20/paper/view/18432).

J.S. Okolica, A.C. Lin, and G.L. Peterson, "Gaming DevSecOps – A Serious Game Pilot Study," 2020 National Cyber Summit Research Track, pp. TBD, 2020.

W.C. Henry, G.L. Peterson, "Exploring Provenance Needs in Software Reverse Engineering," Systematic Approaches to Digital Forensic Engineering 2020, pp. TBD, 2020 (http://sadfe.org/papers/SADFE_2020_henry.pdf).

Books and Chapters in Books

K.-K. R. Choo, T. H. Morris, and G .L... Peterson (Eds.), *2020 National Cyber Summit (NCS) Research Track*, Advances in Intelligent Systems and Computing, Springer, 2020.

PIERCE, SCOTT J., Lt Col
Deputy Head, Department of Electrical and Computer Engineering, Assistant Professor of Electrical Engineering, Department of Electrical and Computer Engineering, AFIT Appointment Date: 2014 (AFIT/ENG); BS, Electrical Engineering, Brigham Young University, 2002; MSEE, Air Force Institute of Technology, 2008; PhD, Air Force Institute of Technology, 2015. Maj Pierce's research interests include image-aided navigation, autonomous control, cooperative navigation, sensor fusion, and flight path optimization. He is a member of ION and IEEE. AFIT research center affiliation(s): [ANT.] Tel. (937) 255-3636 x3419, email: Scott.Pierce@afit.edu

SATTLER, JAMES M., LT COL
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SWEENEY, PATRICK J., LT COL
Assistant Professor of Computer Engineering, Department of Electrical and Computer Engineering, AFIT Appointment Date: 2018 (AFIT/ENG); BS Computer Engineering, Clarkson University, 2003; MS Computer Engineering, AFIT, 2004; PhD Computer Engineering, Dartmouth College 2014. Lt Col Sweeney's research interest include Cybersecurity of Embedded Systems, Cyber Physical Systems, Trusted and Secure Avionics, and Reverse Engineering. Tel (937) 255-3636x4757. Email: Patrick.sweeney@afit.edu

Refereed Conference Papers Accepted on the Basis of Full Paper Review

Crow, D., Graham, S., Borghetti, B. and Sweeney, P., "Empirical Dynamic Modeling as a Basis for Intrusion Detection," 14th International Conference on Critical Infrastructure Protection, Washington D.C., Mar 2020 (Presented remotely).

Mireles, L., Graham, S., Dunlap S., Sweeney, P. and Dallmeyer, M. "Implications of Securing an InfiniBand Network," 14th International Conference on Critical Infrastructure Protection, Washington D.C., Mar 2020 (presented remotely).

Magness, J., Sweeney, P., Graham, S., Kovach, N. "Detecting Logic Bombs in the Autopilot Code of Unmanned Aerial Vehicles," 14th International Conference on Critical Infrastructure Protection, Washington D.C., Mar 2020 (Presented remotely).

TAYLOR, CLARK N.
Assistant Professor of Computer Engineering, Department of Electrical and Computer Engineering, AFIT Appointment Date: 2018 (AFIT/ENG); Electrical and Computer Engineering, Brigham Young University, 1995; Electrical and Computer Engineering, Brigham Young University, 1999, PhD, Electrical and Computer Engineering, University of California, 2004. Dr. Taylor's research interests include Bayesian Estimation, Distributed data Fusion, Vision-aided Navigation, and EO-based Geo-location. AFIT research center affiliation(s): [ANT.] Tel. (937) 266-3636x4614. Email: clark.taylor@afit.edu

Sponsor Funded Research Projects

"GPS-Denied Localization of Daughter-Ships in a Mother-Daughter Ship Collaborative Environment." Sponsor: AFRL/RQ. Funding: $50,000 - Taylor 100%. [ANT]

Refereed Journal Publications

"Robust Incremental State Estimation through Covariance Adaptation," *R. Watson, J. Gross, C.N. Taylor, and R.Leishman, in *IEEE Robotics and Automation Letters,* v. 5(2), April 2020, doi:10.1109/LRA.2020.2979655.

"Enabling Robust State Estimation through Measurement Error Covariance Adaptation," *R.M. Watson, J.N. Gross, C.N. Taylor, and R.C. Leishman, in *IEEE Transactions on Aerospace and Electronic Systems,* v. 56(3), June 2020, doi: 10.1109/TAES.2019.2941103.

Lee, A., Dallmann, W., Nykl, S., Taylor, C., and Borghetti, B., "Long-Range Pose Estimation for Aerial Refueling Approaches Using Deep Neural Networks, *Journal of Aerospace Information Systems*, Vol. 17, Number 11, Nov 2020.

Refereed Conference Papers Accepted on the Basis of Full Paper Review

"Covariance Estimation for Factor Graph Based Bayesian Estimation," A. Vanli and C.N. Taylor, accepted in Proceedings, IEEE International Conference on Information Fusion, 2020.

"A Variational Bayesian Approach for Estimating Colored Noise Parameters," H. Bai and C.N. Taylor, accepted in Proceedings, IEEE International Conference on Information Fusion, 2020.

"Visual Servoing for Final Approach Phase of Spacecraft Proximity Operations," W. Harris, R. Cobb, and C.N. Taylor, in Proceedings, ION/IEEE Position, Location and Navigation Symposium, 2020.

"Comparison of Visual Simultaneous Localization and Mapping Methods for Fixed-Wing Aircraft using SLAMBench2," P. Latcham, C.N. Taylor, in Proceedings, ION/IEEE Position, Location and Navigation Symposium, 2020.

"Invariant-EKF Design for a Unicycle Robot under Linear Disturbances," K. Coleman, H. Bai, and C.N. Taylor, in Proceedings, American Control Conference, 2020.

Refereed Conference Papers Accepted on the Basis of Abstract Review

"An Evaluation of Vision-aided Navigation Uncertainty," Rodenburg and C.N. Taylor accepted in Proceedings, ION GNSS+, 2020.

"Factor Graph-based Simultaneous Localization and Mapping using Magnetic Measurements," C.N. Taylor and A. Canciani, accepted in Proceedings, ION GNSS+, 2020.

"Uncertainty Model Estimation in an Augmented Data Space for Robust State Estimation," R.M. Watson, J.N. Gross, C.N. Taylor, and R.C. Leishman, accepted in Proceedings, ION GNSS+, 2020.

"Effects of Stereo Vision Camera Positioning on Relative Navigation Accuracy,"K. Sarantsev, C.N. Taylor, and S.L. Nykl, in Proceedings, ION International Technical Meeting (ITM) 2020.

"An Evaluation of Vision-aided Navigation Uncertainty," E. Rodenburg and C.N. Taylor in Proceedings, ION GNSS+, 2020.

"Uncertainty Model Estimation in an Augmented Data Space for Robust State Estimation," R.M. Watson, J.N. Gross, C.N. Taylor, and R.C. Leishman, in Proceedings, ION GNSS+, 2020.

"Relative Magnetic Position Sensor Assisted Dual Foot IMU Pedestrian Dead Reckoning," Jordan Eldridge and C.N. Taylor, accepted in *ION International Technical Meeting, 2021.*

"Error Characterization of Iterative Closest Point Pose Estimation," Rick Yuan and C.N. Taylor, accepted in *ION International Technical Meeting, 2021.*

TEMPLE, MICHAEL A.

Professor of Electrical Engineering, Department of Electrical and Computer Engineering, AFIT Appointment Date: 1996 (AFIT/ENG); BSE, Southern Illinois University, 1985; MSE, Southern Illinois University, 1986; PhD, Air Force Institute of Technology, 1993. Dr. Temple's research interests include the exploitation of signal (wired, wireless, intentional, unintentional, etc.) Distinct Native Attribute (DNA) features to improve device hardware and/or operation discrimination. This includes application to Radio Frequency (RF-DNA), Wired Signal (WS-DNA), and Correlation Based (CB-DNA) Fingerprinting methods that exploit inherent physical features to enhance authentication of hardware bit-level identities and the operational state of selected devices. Sponsored research activity, as adopted by and/or transitioned to Air Force, Department of Defense, and national agencies as provided approximately $1M annually in R&D Technology benefit. Senior member of IEEE since Jan 2002. AFIT research center affiliation(s): [ANT], [CSRA] and [CCR.] Tel. (937) 255-3636 x4279, email: Michael.Temple@afit.edu

Sponsor Funded Research Projects

"RF-EW Systems Support." Sponsor: AFRL/RY. Funding: $25,000 - Temple 100%. [CCR]

Refereed Journal Publications

Bihl, Pacienci, Bauer, Temple, "Cyber-Physical Security with RF Fingerprint Classification through Distance Measure Extensions of GRLVQ," Jour of Security and Comm Nets (SCN), Vol. 2020, ID: 3909763, Hindawi, Feb 2020.

Voetber, Temple, Carbino, Bukohl, Glavi†, Deneault, "Using Active DNA Fingerprinting to Discriminate AJP Conductive Ink Elements Embedded in ICs," Jour of DOD Rsrch & Engr (JDR&E), Vol. 2, No. 2, pp. 2-12, Aug 2019.

Paul, Collins, Temple, "Enhancing Microwave System Health Assessment Using ANNs," IEEE Antenna & Wireless Propagation Letters, DOI: 10.1109/LAWP.2019.2926932, Jul 2019.

Rondeau, Temple, Betances, Schubert Kabban, "Extending Critical Infrastructure Element Longevity Using Constellation-Based ID Verification," Jour of Computers & Security, Vol. 100, ID: 102073, Jan 2021.

Rondeau, Temple, Betances, Schubert Kabban, "Protection of Critical Infrastructure COTS Elements Using CB-DNA Fingerprints," Jour of DOD Rsrch & Engr (JDR&E), Vol. 3(2), pp. 2-19, Jul 2020.

Refereed Conference Papers Accepted on the Basis of Full Paper Review

Rondeau, Temple, Betances, "DNA Feature Selection for Discriminating WirelessHART IIoT Devices," 53rd Hawaii Int'l Conference on System Sciences (HICSS), pp. 6387-6396, 7-10 Jan 2020.

Wargo, Boggs, Temple, Mills, "DNA Fingerprinting Ping2020i ADS-B Beacons," 2019 Military Communications Conference (MILCOM19), Norfolk VA, 12-14 Nov 2019.

Refereed Conference Papers Accepted on the Basis of Abstract Review

Rondeau, Temple, "PHY-Based DNA Fingerprinting to Discriminate Wireless HART Sensor Network Devices," 2019 Security Week ICS Cyber Security Conference, Atlanta Georgia, 21-24 Oct 2019.

Patent Applications

Rondeau, Temple, Lopez, "Passive Physical Layer Distinct Native Attribute Cyber Security Monitor," Application Serial No. 63/031,132, Submitted: 28 May 2020.

TERZUOLI, ANDREW J., Jr.
Associate Professor of Electrical Engineering, Department of Electrical and Computer Engineering, AFIT Appointment Date: 1982 (AFIT/ENG); BS, Electrical Engineering, Polytechnic Institute of Brooklyn, 1969; MS, Electrical Engineering, Massachusetts Institute of Technology, 1970; PhD, Electrical Engineering, The Ohio State University, 1982. Dr. Terzuoli's research areas have included Antennas and Electromagnetics; Computer Model Based

Studies; Application of Parallel Computation, VLSI Technology, and RISC Architecture to Numerical and Transform Methods; Remote Sensing and Communication; Passive RF Sensing; Wave Scattering, Radar Cross Section, and Stealth (LO/CLO) Technology; Machine Vision and Image Processing; and Automated Object Recognition. He has published numerous reports and articles in journals and conference proceedings in these and related areas. His research is funded by various agencies including AFRL and NASIC. Prior to joining AFIT in 1982, Dr. Terzuoli was a research associate at the Electro Science laboratory at The Ohio State University and was a member of the technical staff at the Bell Telephone Laboratories in New Jersey. He is an active officer of IEEE and a fellow of the Electromagnetics Academy. AFIT research center affiliation(s): [CDE] and [CSRA] Tel. (937) 255-3636 x4717,
Email: Andrew.Terzuoli@afit.edu

Refereed Conference Papers Accepted on the Basis of Full Paper Review

Andrew Knisely, Andrew Terzuoli, "Numerical Dispersion Reduction in the Parabolic Wave Equation," *Proceedings of the 2019 International Conference on Electromagnetics in Advanced Applications (ICEAA 2019),* Granada, SP, 9-13, Sept 2019.

Andrew J. Knisely and Andrew J. Terzuoli, Jr, "Phase Screen Scintillation Model Accuracy Assessment Using FDM, FEM, and Spectral Techniques to solve the Parabolic Wave Equation," *Proceedings of the 2020 IEEE International Conference on Communications (ICC 2020),* Dublin, IR, 7-11 June 2020.

Andrew J. Knisely, Andrew J. Terzuoli, "Wideband SATCOM Model: Evaluation of Numerical Accuracy and Efficiency," Proceedings of the XXIVth International Society for Photogrammetry and Remote Sensing Congress (ISPRS 2020), Nice, FR, 14-20 June 2020.

Andrew J. Knisely, Andrew J. Terzuoli, "First Principle Scintillation Characterization of Natural and Artificial Disturbances on V/W Band Signals in the Ionosphere Using the Multiple Phase Screen Technique," Proceedings of the XXXIII General Assembly and Scientific Symposium (GASS) of the International Union of Radio Science (Union Radio Scientifique Internationale-URSI), Rome, IT, 29 Aug – 5 Sept, 2020.

Andrew J. Knisely, Andrew J. Terzuoli, "First Principle EMI Model of Wideband Signal Temporal Delay Induced By A HANE in the Ionosphere," Proceedings of the International Symposium on Electromagnetic Compatibility (EMC 2020), Rome, IT, 7-11 Sept 2020.

VINCIE, MATTHEW J., CAPT
Assistant Professor of Electrical Engineering, Department of Electrical and Computer Engineering, AFIT. Appointment Date: 2019. AS, Mechanical and Electrical Technology, Community College of the Air Force 2009; BS, Electrical Engineering, Virginia Polytechnic Institute and State University 2012; MS, Electrical Engineering, AFIT, 2014; PhD, Electrical Engineering, AFIT, 2019. Capt Vincie's research interests include Monolithic Microwave Integrated Circuis, Analog Circuit Design, Micro-electromechanical Systems, RF and Microwave Engineering, Solid-state Devices, Vacuum Tube Devices, Electron Emission, Control Systems, Circuit and Device Simulation, Instrumentation and Measurement, and Optoelectronics.

Refereed Conference Papers Accepted on the Basis of Full Paper Review

Matthew Vincie, Tod Laurvick, Hengky Chandrahalim, Richard Cobb, and James Sattler, "Avoiding transients in low-level sensing of secondary electron yield," IEEE Sensors Conference, 2020.

5.4. DEPARTMENT OF MATHEMATICS AND STATISTICS

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5.4.1. DOCTORAL DISSERTATIONS

N/A

5.4.2. MASTER'S THESES

BOARDMAN, BRIAN A, Modeling Nonlinear Heat Transfer for a Pin-on-disc Sliding System. AFIT-ENC-MS-20-M-001. Faculty Advisor: Dr. William P. Baker. Sponsor: AFRL/RQQ.

5.4.3. FACULTY BIOGRAPHIES & RESEARCH OUTPUT

Notes: Research Center affiliations are listed in [ ] if applicable.

AKERS, BENJAMIN F.
Professor of Mathematics, Department of Mathematics and Statistics, AFIT Appointment Date: 2011 (AFIT/ENC); BS, Pennsylvania State University, 2003; MA, University of Wisconsin - Madison, 2005; PhD, University of Wisconsin-Madison, 2008. Dr. Akers' research interests include nonlinear waves, applied mathematics, fluid mechanics, and numerical analysis. Dr. Akers' current research considers the stability and existence of traveling Water waves as well as the fluid flows induced by high energy lasers. AFIT research center affiliation(s): [CDE.] Tel. (937) 255-3636 x4522, email: Benjamin.Akers@afit.edu

Sponsor Funded Research Projects

"Applications of Radial Basis Functions." Sponsor: AFOSR. Funding: $41,738 - Akers 50%, Reeder 50%. [CDE]

Refereed Journal Publications

Akers, B. F., Ambrose, D. M., and Sulon, D. W., "Periodic Hydroelastic Waves with or without Mass II: Multiple Bifurcations and Ripples," *European Journal of Applied Mathematics*, Vol 30, No. 4, pp. 756-790, 2019.

Lawrence, A., and Akers, B.F., "Propagation of high energy lasers through clouds: modeling and simulation," *Applied Optics*, Vol. 59, Issue 33, 2020

Refereed Conference Papers Accepted on the Basis of Full Paper Review

Akers, B. F. and Seiders, M., "Numerical Simulation of Overturned Traveling Waves," *Nonlinear Water Waves – An Interdisciplinary Interface*, pp. 119-122, 2019.

Editorships in Professional Journals

Topics Editor, *Fluids*

Other Significant Research Productivity

Akers, B. F., "Dimension Breaking and Numerical Continuation," University of Washington webinar, Feb 2020.

ANDERSON, TIMOTHY S., Maj
Assistant Professor of Statistics, Department of Mathematics and Statistics, AFIT Appointment Date: 2019 (AFIT/ENC); BS, Midwestern State University, 2006; MA, University of Washington, 2011; PhD, Air Force Institute of Technology, 2019. Maj. Andersons' research interests include L-moments, uncertainty estimation, and computational statistics. Maj. Andersons' current research looks to maintain custody of satellite objects while decreasing required observations by implementing a sparse graphical representation of the multivariate volatility structure of correlated space objects.

BAKER, WILLIAM P.
Associate Professor of Mathematics, Department of Mathematics and Statistics, AFIT Appointment Date: 1986 (AFIT/ENC); BA, University of California at Irvine, 1969; MA, University of California at Irvine, 1970; PhD, Northwestern University, 1987. Dr. Baker's research interests include asymptotic and perturbation methods, wave propagation and scattering theory, applied mathematics, functional analysis, low observables, and numerical analysis. Dr. Baker's current research is in thermal dynamics of high speed wear, vibrational dynamics of thermally loaded materials, and dynamics and control of satellite structures. Dr. Baker is a Master Navigator with prior military assignments in flight test, satellite communications, cruise missile, and radar analysis. Tel. (937) 255-3636 x4517, email: William.Baker@afit.edu

Refereed Journal Publications

Smith, N. E., Cobb, R. G., and Baker, W. P., "Incorporating Stochastics into Optimal Collision Avoidance Problems Using Super quadratics," *Journal of Air Transportation*, Vol. 28, No. 2, pp 65-69, Apr 2020.

DeLeon, A., Baker, W., and Palazotto, A., "Modeling a Nonlinear Melt Region as a Result of High Speed Sliding," *Journal of Thermophysics and Heat Transfer*, Vol. 33, No. 3, pp 808-816, Jul 2019.

Refereed Conference Papers Accepted on the Basis of Abstract Review

Boardman, B., Palazotto, A., and Baker, W., "Modeling Nonlinear Heat Transfer for a Pin on Disc Sliding System," AIAA 45th Annual Dayton-Cincinnati Aerospace Science Symposium, Dayton OH, 3 Mar 2020.

BEMROSE, TRAVIS J., Maj
Assistant Professor of Mathematics, Department of Mathematics and Statistics, AFIT Appointment Date: 2016 (AFIT/ENC); BS, University of Idaho, 2003; MS, University of Texas at San Antonio, 2012; PhD, University of Missouri – Columbia, 2016. Maj Bemrose's research interests include Hilbert space frame theory, compressive sensing, numerical methods, and modeling and simulation. His current research is on the Paulsen problem, adaptive-dictionary image reconstruction, and equiangular frames. He has papers on subspace distances, unconditional convergence bounds for frames, introducing the concept of weaving frames, and cruise missile training simulators.

BROOKS, ERIC L., Lt Col
Assistant Professor of Statistics, Department of Mathematics and Statistics, AFIT Appointment Date: 2018 (AFIT/ENC); BS, University of South Carolina-Aiken, 2001; MS, Rochester Institute of Technology, 2012; PhD, Air Force Institute of Technology, 2018. Maj Brooks' research interests include big data, machine learning, statistical genetics, compressive sampling. In his current research, he addresses the high-dimensionality challenge associated with DNA data by leveraging concepts of compressive sampling for feature selection and dimensionality reduction. Tel. (937) 255-3636 x4398, email: Eric.Brooks@afit.edu

BULUTOGLU, DURSUN A.
Associate Professor of Statistics, Department of Mathematics and Statistics, AFIT Appointment Date: 2004 (AFIT/ENC); BS, University of Maryland at College Park, 1996; PhD, University of California, Berkeley, 2001. Dr. Bulutoglu's research interests include design of experiments and combinatorial problems in statistics. His papers are on finding GMA (generalized minimum aberration) factorial designs by enumerating all non-isomorphic orthogonal arrays. The tools he uses for enumerating orthogonal arrays are integer programming, constraint programming, and isomorphism rejection. Tel. (937) 255-3636 x4704, email: Dursun.Bulutoglu@afit.edu

Sponsor Funded Research Projects

"Improving Exact Algorithms for Finding Optimal Experimental Designs and Test Suites for Test and Evaluation." Sponsor: AFOSR. Funding: $34,299 - Bulutoglu 100%.

Refereed Journal Publications

Arasu, K. T., Bulutoglu, D. A., and Hollon, J., "Optimality of Binary Periodic Sequences of Odd Length and Its Applications to Finding near Optimal 2-Symbol Factorial Designs," *Statistics and Applications*, Vol 17, No. 2, pp. 87-98, 2019.

FICKUS, MATTHEW C.
Professor of Mathematics, Department of Mathematics and Statistics, AFIT Appointment Date: 2004 (AFIT/ENC); BS, University of Maryland, Baltimore County, 1995; MS, University of Maryland, Baltimore County, 1997; PhD, University of Maryland, College Park, 2001. Dr. Fickus' research interests include applied harmonic analysis, frame theory, and compressed sensing. Tel. (937) 255-3636 x4513, email: Matthew.Fickus@afit.edu

Refereed Journal Publications

Fickus, M., Jasper, J., Mixon, D. G., Peterson, J. D., and Watson, C. E., "Polyphase Equiangular Tight Frames and Abelian Generalized Quadrangles," *Applied Computational Harmonic Analysis*, Vol. 47, No. 3, pp. 628-661, Nov.2019.

Fickus, M. and Schmitt, C. A., "Harmonic Equiangular Tight Frames Comprised of Regular Simplices," *LinearAlgebra and Its Applications*, Vol. 586, pp. 130-169, Feb 2020.

GEYER, ANDREW J., Lt Col
Associate Professor of Statistics and Deputy Head, Department of Mathematics and Statistics, AFIT Appointment Date: 2014 (AFIT/ENC); BS, North Dakota State University, 2000; MS, Air Force Institute of Technology, 2009; PhD, Air Force Institute of Technology, 2014. Lt Col Geyer's research interests include design of experiments, combinatorial optimization problems in statistics, statistical performance metrics, and statistical classification techniques. The tools he uses are integer programming, constraint programming, graph isomorphism rejection, and multivariate statistical analysis. Lt Col Geyer has served as a weather officer in F-16, AH-64, OH-58D, and CH-47 flying units as well in units supporting US Army and Special Operations ground forces. Tel. (937) 255-3636 x4584, email: Andrew.Geyer@afit.edu

Refereed Journal Publications

Sanderson, D., White, E., Geyer, A., Roeder, W., and Gutman, A., "Optimizing the Lightning Warning Radii at Spaceport Florida," *Weather and Forecasting*, Vol. 35, No. 2, pp. 523–536, Feb 2020.

Haac, B. E., Nemirovsky, A., Teeter, W. A., Geyer, A. J., Cross, R. K., Stein, D. M., and Bafford, A. C., "Injury Characteristics and Outcomes of Patients with Inflammatory Bowel Disease after Trauma: A Propensity Score Matched Analysis," *Inflammatory Bowel Diseases,* Vol. 26, No. 8, pp. 1261-1267, Aug 2020.

Refereed Conference Papers Accepted on the Basis of Abstract Review

Skrovan, C. A. and Geyer, A. J., "An Analysis of the Lightning Detection Threshold Using Electric Field Mill Data at Cape Canaveral AFS, FL," American Meteorological Society 100th Annual Meeting. Boston, MA, 15 Jan 2020.

Nystrom, J., Hill, R. R., Pignatiello, J., Chicken, E., and Geyer, A. J., "Improving Lightning Prediction using Wavelet Transformations and Semi-Parametric Modeling," American Meteorological Society 100th Annual Meeting, Boston, MA, 15 Jan 2020.

Alarcon, G. A. and Geyer, A. J., "Predicting Weather Conditions Utilizing Artificial Neural Networks for C-17 Mission Planning," American Meteorological Society 100th Annual Meeting, Boston, MA, 14 Jan 2020.

Cheng, A. and Geyer, A. J., "Lightning Prediction for Space Launch Using Machine Learning Based on Electric Field Mills and Lighting Detection and Ranging Data," American Meteorological Society 100th Annual Meeting, Boston, MA, 14 Jan 2020.

Bailey, B. M. and Geyer, A. J., "Next-Generation Air Force Weather Metrics via Bayes Cost Analysis," American Meteorological Society 100th Annual Meeting, Boston, MA, 14 Jan 2020.

Beveridge, N. R., Geyer, A. J., and Tournay, R. C., "Single Station Forecasting from Deep Learning Methods," American Meteorological Society 100th Annual Meeting, Boston, MA, 13 Jan 2020.

HARTLAGE, ROBERT B., Lt Col
Assistant Professor of Statistics, Department of Mathematics and Statistics, AFIT Appointment Date: 2019 (AFIT/ENC); BS, University of Louisville, 2002; MS Eng., Wright State University, 2004; MS, Air Force Institute of Technology, 2007; PhD, Air Force Institute of Technology, 2012. Lt Col Hartlage's research interests include mathematical modeling of transportation systems, metaheuristics for quickly designing dynamic communication networks, and for solving network-type communication and transportation problems. Lt Col Hartlage's current research uses biologically inspired metaheuristics to solve resource constrained, multi-modal transportation problems. Tel. (937) 255-3636 x4630, email: Robert.Hartlage@afit.edu

JOHNSTONE, CHANCELLOR A. J., Capt
Instructor of Statistics, Department of Mathematics and Statistics, AFIT Appointment Date: 2020 (AFIT/ENC); BS, United States Air Force Academy, 2013; MS, Air Force Institute of Technology, 2015. Capt Johnstone's research interests include prediction using parametric and nonparametric methods, providing interpretable machine learning through shape-constraints, uncertainty quantification, and robust optimization. Capt Johnstone has been an Operations Research analyst supporting USAFE, AFAFRICA, and AFCENT with projects related to future-basing efforts, efficient aircraft scheduling, and aircraft utilization. Tel. (937) 255-3636 x4619 email: chancellor.johnstone@afit.edu

JORDAN, JEREMY D., Lt Col
Assistant Professor of Statistics, Department of Mathematics and Statistics, AFIT Appointment Date: 2016 (AFIT/ENC); BA, Aurora University, 2001; MS, Air Force Institute of Technology, 2007; PhD, Air Force Institute of Technology, 2012. Lt Col Jordan's research interests include combinatorial optimization, decision analysis, network theory and big data analysis. Lt Col Jordan has served as an operations research analyst for operational testing and human research as well as an international program manager for the Air Force Office of Scientific Research. AFIT research center affiliation(s): [COA.] Tel. (937) 255-3636 x4669, email: Jeremy.Jordan@us.af.mil

Sponsor Funded Research Projects

"Design of Networks in Uncertain Environment with Buffered Probability of Exceedance (bPOE)." Sponsor: AFOSR. Funding: $13,073 - Jordan 100%.

LAIR, ALAN V.
Professor of Mathematics and Head, Department of Mathematics and Statistics, AFIT Appointment Date: 1982 (AFIT/ENC); BA, North Texas State University, 1970; MS, Texas Tech University, 1972; PhD, Texas Tech University, 1976. Dr. Lair's research interests include parabolic and elliptic partial differential equations, functional analysis, applied mathematics, and nonlinear diffusion. He has published several papers on the properties of solutions of various nonlinear partial differential equations. Tel. (937) 255-3636 x4519, email: Alan.Lair@afit.edu

LIU, TONY, Capt
Assistant Professor of Mathematics, Department of Mathematics and Statistics, AFIT Appointment Date: 2019 (AFIT/ENC); BA, Rutgers University, 2012; MS, Air Force Institute of Technology, 2014; PhD, Arizona State University, 2019. Capt Liu's research interests include applied mathematics, approximation theory, and numerical analysis. Capt Liu's current research includes finding the optimal placement of sampling nodes for approximation methods. Tel. (937) 255-3636 x4722, email: Tony.Liu@afit.edu

Other Significant Research Productivity

Liu, T., "Optimal node sampling for RBF-FD on 2D regions by QR factorization," SIAM Imaging Sciences, Toronto, Canada, July 2020.

MAGNUS, AMY L.
Research Assistant Professor of Mathematics, Department of Mathematics and Statistics, AFIT Appointment Date: 2017 (AFIT/ENC); BSEE, Rochester Institute of Technology, 1990; MSEE, Air Force Institute of Technology, 1995; PhD, Air Force Institute of Technology, 2003. Dr. Magnus conducts research in distributed intelligence, i.e., the mature work that emerges from human computers teams. Her research combines multiple disciplines including information fusion, near & remote sensing, data analytics, constraint programming, and narrative analysis. Within these disciplines, Dr. Magnus works the seam between sensory organization and natural language processing translating signals to symbols and symbols into stories. Her contributions to artificial intelligence define the computational differences between training and learning; she designs and demonstrates studies where autonomy can be examined as an oscillating signal. AFIT research center affiliation(s): [CCR] and [CSRA.]

MORRILL, DANA F., Maj
Assistant Professor of Mathematics, Department of Mathematics and Statistics, AFIT Appointment Date: 2018 (AFIT/ENC); BS, Weber State University, 2005; MS, Air Force Institute of Technology, 2013; PhD, Air Force Institute of Technology, 2018. Maj Morrill's research interests include optical waves, applied mathematics, fluid

mechanics, and numerical analysis. Maj Morrill's current research considers fluid flows induced by high energy lasers. AFIT research center affiliation(s): [CDE.] Tel. (937) 255-3636 x4729, email: Dana.Morrill@afit.edu

NUNNALLY, BEAU A., Lt Col
Assistant Professor of Statistics, Department of Mathematics and Statistics, AFIT Appointment Date: 2018 (AFIT/ENC); BS, Virginia Polytechnic Institute and State University, 2004; MS, Air Force Institute of Technology, 2012; PhD, Air Force Institute of Technology, 2018. Maj Nunnally's research interests include classification, diagnostic testing, modeling and prediction, network analysis, regression, MANOVA, decision analysis, and decision support with multiple objectives. Maj Nunnally's current research is on inference in classification systems, sequential systems, and multiple-objective response surface methodology. Tel. (937) 255-3636 x4394, email: Beau.Nunnally@afit.edu

OXLEY, MARK E.
Professor of Mathematics, Department of Mathematics and Statistics, AFIT Appointment Date: 1987 (AFIT/ENC); BS, University of the Cumberland, 1978; MS, Purdue University, 1980; PhD, North Carolina State University, 1987. Dr. Oxley's research interests include partial differential equations, free and moving boundary value problems, finite-time extinction problems, functional analysis, optimization, artificial neural networks, wavelet analysis, classifier fusion, information fusion and evaluation of fusion techniques, receiver operating characteristic (ROC) curves, and ROC manifolds. AFIT research center affiliation(s): [ANT], [CTISR], and [NEAT.] Tel. (937) 255-3636 x4515, Email: Mark.Oxley@afit.edu

Sponsor Funded Research Projects

"MOA - AFTAC Endowed Term Chairs." Sponsor: AFTAC/XPB. Funding: $30,000 - Oxley 100%. [NEAT]

Refereed Journal Publications

Cordeiro, J. D., Kharoufeh, J. P., and Oxley, M. E., "On the Ergodicity of a Class of Level-Dependent Quasi-Birth-and-Death Processes," *Applied Probability Trust*, Vol. 51, No. 4, pp. 1109-1128, Dec 2019.

Books and Chapters in Books

Hartman, H. and Oxley, M. E., "Individual Exposure Health Risk Profile (IEHRP) – Developing a Risk Profile Tool Beyond Dose Response." *Total Exposure Health, an Introduction*. Boca Raton, FL, K. Phillips, D. Yamamoto, and L. Racz, eds., CRC Press, Taylor & Francis Group, 4 May 2020, pp, 31-40.

QUINN, DENNIS W.
Professor Emeritus of Mathematics, Department of Mathematics and Statistics, AFIT Appointment Date: 1974 (AFIT/ENC); BA, Mathematics, University of Delaware, 1969; MS, Applied Mathematics, University of Delaware, 1971; PhD, Applied Mathematics, University of Delaware, 1973. Dr. Quinn's fields of expertise include numerical methods, finite elements, finite differences, integral equation methods, numerical analysis, functional analysis, system identification, and applied mathematics. Dr. Quinn has advised several MS students in modeling toxic chemical exposure. Dr. Quinn has published papers dealing with integral and finite element solutions of acoustic problems, using the telegrapher's equation to model lightning, using the method of characteristics in cancer risk assessment, using the diffusion equation to model diffusion through the skin in pharmacokinetic modeling, and using the boundary element method for moving boundary problems.

REYNOLDS, DANIEL E.
Assistant Professor Emeritus of Statistics, Department of Mathematics and Statistics, AFIT Appointment Date: 1974 (AFIT/ENC); AB, University of Rochester, 1965; MS, Air Force Institute of Technology, 1971; MS, Wright State University, 1983. Mr. Reynolds' research interests include management cybernetics, learning theory, and exploring ways computer graphics can support statistical and mathematical education. In 1989, Mr. Reynolds received Tau Beta Phi's Outstanding Professor Award.

SCHUBERT KABBAN, CHRISTINE M.

Professor of Statistics, Department of Mathematics and Statistics, AFIT Appointment Date: 2010 (AFIT/ENC); BA, University of Dayton, 1992; MBA, Wright State University, 1994; MS, Wright State University, 1995; PhD, Air Force Institute of Technology, 2005. Dr. Schubert Kabban's research interests include classification techniques, diagnostic testing, ROC curve theory and extensions, human performance, information fusion, modeling and prediction, NDE methods, network analysis, regression and regression extensions, survey design and analysis, and general biostatistics. Dr. Schubert Kabban's current research is in evaluating the performance of classification systems and information-fused systems via ROC methodology, sequential strategies for classification, structural health monitoring of airframes, as well as epidemiological applications to disease prediction and medical diagnostics. Tel. (937) 255-3636 x4549, email: Christine.SchubertKabban@afit.edu

Sponsor Funded Research Projects

"Analytical Ensembles for Artificial Intelligence." Sponsor: 711 HPW. Funding: $20,633 - Schubert Kabban 50% Miller 50%.

Refereed Journal Publications

Barker, S., Krzastek, S. C., Vokes, R. A., Schubert, C. M., Cooley, L. F., and Hampton, L. J., "Examining the Effect Of an Animal-assisted Intervention on Patient Distress in Outpatient Cystoscopy," *Human-Animal Interaction Bulletin,* Vol 8, No. 1, pp. 23-37, Apr 2020.

Gold, S., White, E. D., Roeder, W., McAleenan, M., Schubert Kabban, C., and Ahner, D., "Probabilistic Contingency Tables: An Improvement to Verify Probability Forecasts," *Weather and Forecasting,* Vol. 35, No. 2, pp. 609-621, Apr 2020.

Jurado, J., Racquet, J., Schubert Kabban, C., and Gipson, J., "Residual-Based Multi-Filter Methodology for All Source Fault Detection, Exclusion, and Performance Monitoring," *Navigation*, Vol 67, No. 3, pp. 493-510, Aug 2020.

Refereed Conference Papers Accepted on the Basis of Full Paper Review

Henry, C., Schubert Kabban, C., Cherry, M., and Mooers, R., "Ranked Set Sampling Applied to Hit-Miss Probability of Detection Data: A Case Study," 45th *Annual Review of Progress in Quantitative Nondestructive Evaluation*, Vol. 38, AIP Conference Proceedings 2101(1), 090002-1-090002-11, 2019.

Rondeau, C. M., Temple, M. A., and Schubert Kabban, C., "TD-DNA Feature Selection for Discriminating WirelessHART IIoT Devices," Proceedings of the 53rd Hawaii International Conference on System Sciences, pp. 6387-6396, Jan 2020.

Gipson, J. S., Schubert Kabban, C. M., Leishman, R. C., and Jurado, J.D., "Real-time Trajectory Optimization for Collaborative Self-Localization in Random Aircraft Formations," 2020 IEEE/ION Position, Location and Navigation Symposium (PLANS), Portland, OR, pp. 118-124, Sep 2020.

Gipson, J. S., Leishman, R. C., and Schubert Kabban, C. M., "Swarm Control for Autonomous Navigation Support in Denied Environments," ICUAS Conference, Athens, Greece, pp 446-455, Sep 2020.

Books and Chapters in Books

Schubert Kabban, C. M., Mohd-Zaid, F., and Deckro, R. F., "Modern Methods for Characterization of Social Networks Through Network Models" Handbook of Military and Defense Operations Research, James P. Howard and Natalie M. Scala (Eds), p. 171-193, ISBN: 978-1138607330, Chapman & Hall/CRC, Feb 2020.

Other Significant Research Productivity

Grap, M. J., Schubert, C. M., and Burk, R. S. Author Response: Sacral Pressure Injury Study Commentary, *AORN Journal*, Vol. 110, No. 4, p. 358, Oct 2019. (Response to Commentary)

Schubert, C.M., "An Investigation of Analysis Approaches for Detecting Node Degradation in Common Network Models." Joint Statistical Meeting (JSM) 2020, virtual meeting. Aug 2020.

TURNER, JONATHAN S., Capt
Assistant Professor of Statistics, Department of Mathematics and Statistics, AFIT Appointment Date: 2019 (AFIT/ENC); BS, Texas State University, 2011; MS, Texas State University, 2012; MS, Air Force Institute of Technology, 2014; PhD, Air Force Institute of Technology, 2019. Capt Turner's research interests include combinatorial problems in statistics and discrete optimization with application towards data compression. The tools he uses for exploring combinatoric equivalence relations are discrete Fourier transform, integer programming, and heuristics. Tel. (937) 255-3636 x7403, email: Jonathan.Turner@afit.edu

WHITE, EDWARD D., III
Professor of Statistics, Department of Mathematics and Statistics, AFIT Appointment Date: 1998 (AFIT/ENC); BS, University of Tampa, 1990; MAS, Ohio State University, 1991; PhD, Texas A&M University, 1998. Dr. White's research interests include design of experiments, categorical data analysis, biostatistics, and model building.
Tel. (937) 255-3636 x4540, email: Edward.White@afit.edu

Refereed Journal Publications

Sanderson, D., White, E., Geyer, A., Roeder, W., and Gutman, A., "Optimizing the Lightning Warning Radii at Spaceport Florida," *Weather and Forecasting*, Vol. 35, No. 2, pp. 523–536, Feb 2020.

Gold, S., White, E. D., Roeder, W., McAleenan, M., Schubert Kabban, C., and Ahner, D., "Probabilistic Contingency Tables: An Improvement to Verify Probability Forecasts," Weather and Forecasting, Vol. 35, No. 2, pp. 609-621, Apr 2020.

Angell, E. E., White, E. D., Ritschel, J. D., and Thal, A. E., Jr., "Analysis of Military Construction Cost Growth in USAF Major Defense Acquisition Programs," *Defense Acquisition Research Journal,* Vol 27, No. 2, pp. 168-193, 2020.

Storm, S. M., Hill, R. R., Pignatiello, J. J., White, E. D., and Vining, G. G., "Point-wise Model Validation Over Experimental Regions Using Regression Confidence and Tolerance Intervals with Bayesian Relaxations," *Simulation,* Vol. 96, No. 1, pp. 75-87, 2020.

Elworth, C. J., White, E. D., Ritschel, J. D., and Brown, G. E., "Air Force Space Programs: Comparing Estimates to Final Development Budgets," *Defense Acquisition Research Journal,* Vol 26, No. 4, pp. 348-379, 2019.

Refereed Conference Papers Accepted on the Basis of Full Paper Review

Plack, E.A., Ritschel, J.D., White, E.D., and Koschnick, C.M. "Improving Acquisitions in Science and Technology Programs through Factor Development and Program Analysis," 88th MORS Symposium, New London, CT, 15-18 June 2020.

Other Significant Research Productivity

Plack, E. A., Ritschel, J. D., White, E. D., and Koschnick, C. M. "A Long Time Ago in an MDAP Far, Far Away," International Cost Estimation & Analysis (ICEAA), Dayton Chapter, 13 Mar 2020.

Myers, B. A., White, E. D., Ritschel, J. D., and Fass, R. D. "Are New Aircraft Engines Saving Money?" International Cost Estimation & Analysis (ICEAA), Dayton Chapter, 13 Mar 2020.

Ritschel, J. D., White, E. D., and Markman, M. R., "Developing Standard EMD Cost Factors for Major Defense Acquisition Program (MDAP) Platforms," Technical Report F19-017, Naval Postgraduate School Acquisition Research Program, 2020.

WOOD, AIHUA W.

Professor of Mathematics, Department of Mathematics and Statistics, AFIT Appointment Date: 1994 (AFIT/ENC); BS, Peking University, 1984; MS, University of Connecticut, 1988; PhD, University of Connecticut, 1990. Dr. Wood's research interests include partial differential equations, electromagnetic wave propagation, and Boltzmann equations. Tel. (937) 255-3636 x4272, email: Aihua.Wood@afit.edu

Sponsor Funded Research Projects

"Fast Methods for the Boltzmann Equation." Sponsor: AFOSR. Funding: $103,246 - Wood 100%.

Refereed Journal Publications

Alekseenko, A., Grandilli, A., and Wood A., "An Ultra-Sparse Approximation of Kinetic Solutions to Spatially Homogeneous Flows of Non-Continuum Gas," *Results in Applied Mathematics,* Vol. 5 (2020), 100085.

Charnley, M. and Wood, A., "Object Identification in Radar Imaging via the Reciprocity Gap Method," *Radio Science*, Vol 54, pp. 1-10, 2019.

Wood, A., Wood, R., and Charnley, M, "Through-the-wall radar detection using machine learning," *Results in Applied Mathematics,* Vol. 7 (2020), 100106.

5.5. DEPARTMENT OF OPERATIONAL SCIENCES

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5.5.1. DOCTORAL DISSERTATIONS

COTTON, JAMES, A., Behavioral Antecedents of Fuel Efficiency. AFIT-ENS-DS-20-M-290. Faculty Advisor: Dr. Seong-Jong Joo. Sponsor: USSSTATCOM.

5.5.2. MASTER'S THESES

AKERS, CHRISTINA, M., Undergraduate Pilot Training Attrition: An Analysis of Individual and Class Composition Component Factors. AFIT-ENS-MS-20-M-126. Faculty Advisor: Col. Adam D. Reiman. Sponsor: N/A. [COA]

ALAMRI, ABDULRAHMAN, D., Cost-Benefit Analysis of King Salman Causeway Between Saudi Arabia and Egypt. AFIT-ENS-MS-20-S-032. Faculty Advisor: Dr. William M. Cunningham III. Sponsor: N/A.

ALANAZI, NASSER, S., Investigation on an Avionics Parts Deficiencies in Royal Saudi Air Force Fleets. AFIT-ENS-MS-20-S-033. Faculty Advisor: Dr. William M. Cunningham III. Sponsor: N/A.

ALARCON, GARRETT, A., Predicting Upper Atmospheric Weather Conditions Utilizing Long-Short Term Memory Neural Networks for Aircraft Fuel Efficiency. AFIT-ENS-MS-20-M-129. Faculty Advisor: Lt. Col. Andrew W. Geyer. Sponsor: N/A.

ALGARNI, AYMAN, G., 3D Printing Technology for Solving Part Obsolescence.AFIT-ENS-MS-20-034. Faculty Advisor: Dr. William Cunningham III. Sponsor: N/A.

ALJUAID, SAMI, S., Part Cancellation Process Analysis In Royal Saudi Air Force. AFIT-ENS-MS-20-S-035. Faculty Advisor: Dr. William M. Cunningham III. Sponsor: N/A.

BORSZICH, AARON, A., Effects of KC-10 Divestment on Daily Competition. AFIT-ENS-MS-20-J-026. Faculty Advisor: Dr. Jeffery Weir. Sponsor: JCS/J4.

BRAKEVILLE, ADAM, J., A Random Forest Approach to Classify a Fixed Wallet Consumer. AFIT-ENS-MS-20-M-133. Faculty Advisor: Dr. Lance E. Champagne. Sponsor: N/A. [COA]

BRUBAKKEN, ADAM, J., Strategic Sourcing of Air Force Contingency Pharmaceuticals: A Cost-Benefit Analysis Approach. AFIT-ENS-MS-20-M-134. Faculty Advisor: Lt. Col. John M. Dickens. Sponsor: AFMRA/SG4M.

BURNS, RYAN, D., Simulation and Analysis of High Value Airborne Asset Defense Effectiveness with Kinetic Weapons and Noise Jamming. AFIT-ENS-MS-20-M-135. Faculty Advisor: Dr. John O. Miller. Sponsor: SDPE LM MFC. [ANT]

CALHOUN, PETER, A., Characterizing Uncertainty in Correlated Response Variables for Pareto Front Optimization. AFIT-ENS-MS-20-M-136. Faculty Advisor: Lt. Col. Beau A. Nunnally. Sponsor: N/A.

CALLAHAN, DANA, K., Commercial Augmentation and the Need for Demand Forecasting. AFIT-ENS-MS-20-J-027. Faculty Advisor: Col. Adam D. Reiman. Sponsor: USAF AMC/A9.

CHALE, MARC, W., Algorithm Selection Framework: A Holistic Approach to the Algorithm Selection Problem. AFIT-ENS-MS-20-M-137. Faculty Advisor: Dr. Jeffery D. Weir. Sponsor: N/A. [COA]

CHENG. ANSON, Lightning Prediction for Space Launch using Machine Learning Based Off of Electric Field Mills and Lightning Detection and Ranging Data. AFIT-ENS-MS-20-M-138. Faculty Advisor: Lt. Col. Andrew J. Geyer. Sponsor: 45thWS.

CHEROBINI, DANIEL, Inherent Jeopardy of Performance Based Contracting Metrics: A Simulation Experiment. AFIT-ENS-MG-20-M-139. Faculty Advisor: Dr. Seong-Jong Joo. Sponsor: ILA.

CIARAVINO, MARK, A., Simulation and Analysis of Cyber Operations for A2AD using AFSIM. AFIT-ENS-MS-20-M-140. Faculty Advisor: Dr. John O. Miller. Sponsor: SDPE LM MFC. [ANT]

COLBATH, DEREK, J., A Model to Analyze the Capacity of Pilot Training Production. AFIT-ENS-MS-20-J-029. Faculty Advisor: Dr. Alfred D. Thal. Sponsor: N/A.

COPE, FRANK, T., A Quantitative Analysis of USAF C-17 Pilot Computer Based Continuation Training. AFIT ENS-M-030. Faculty Advisor: Dr. William Cunningham III. Sponsor: 97 AMW/CV.

DANAHER, RICHARD, S., Hybrid Tri-Objective Optimization of F-15 Fleet Modernization Scheduling. AFIT-ENS-MS-20-M-142. Faculty Advisor: Lt. Col. Bruce A. Cox. Sponsor: AFLCMC. [ANT]

DEITSCHEL, JAMES, L., Preferred Treatment Methods for Patients with Inflammatory Bowel Disease. AFIT-ENS-MS-20-M-143. Faculty Advisor: Lt. Col. Andrew J. Geyer. Sponsor: UMMC.

ESPEGIO, GIOVANNA, Data Cleaning for Air Force Applications. AFIT-ENS-MS-20-J-033. Sponsor: SAF/IEN.

FEKETE, ROBEEAL, J., A Qualitative Assessment Of Air Force Logisticians' Knowledge of Advanced Manufacturing Techniques. AFIT-ENS-MS-20-J-035. Faculty Advisor: Lt. Col. John M. Dickens. Sponsor: DLA Aviation/CC.

FORREST, NICHOLAS, C., Conceptualization and Application of Deep Learning and Applied Statistics for Flight Plan Recommendation. AFIT-ENS-MS-20-M-147. Faculty Advisor: Dr. Raymond R. Hill Jr. Sponsor: AFWERX.

FRANCOIS, JOHN, K., Simulation of High Value Airborne Asset Defense with AFSIM. AFIT=ENS-MS-20-M-148. Faculty Advisor: Dr. John O. Miller. Sponsor: SDPE LM MFC. [ANT]

GIDDINGS, AARON, C., Predicting Pilot Success Using Machine Learning. AFIT-ENS-MS-20-M-150. Faculty Advisor: Dr. Raymond R. Hill Jr. Sponsor: AETC/DE 21.

GILBERT, CHRISTOPHER, R., Modeling Composite Fleets Utilizing Hybrid Airships. AFIT-ENS-MS-20-J-036. Faculty Advisor: Dr. Jeffery D. Weir. Sponsor: AFWIC.

GLADNEY, KYLE, Quantifying the Effect of Fleet Health on Sortie Execution in the F-16 Fleet. AFIT-ENS-MS-20-M-151. Faculty Advisor: Lt. Col. John M. Dickens. Sponsor: HAF/A4P.

HARTMAN, CORBIN, S., Predicting Failure of the United States Air Force F-22 Raptor Using Survival Analysis. AFIT-ENS-MS-20-M-289. Faculty Advisor: Dr. Seong-Jong Joo. Sponsor: N/A.

HARVEY, TRAVIS, C., Increasing Airlift Availability Through Optimization of Presidential Support Missions. AFIT-ENS-MS-20-J-038. Faculty Advisor: Dr. Darryl K. Ahner. Sponsor: AMC/A9. [COA]

HEIZER, STEVEN, J., Process Improvements in Missile Combat Crew Member Pre- and Post-alert Activities. AFIT-ENS-MS-20-S-042. Faculty Advisor: Dr. William M. Cunningham III. Sponsor: N/A.

HOWARD, KALYN, M., Aligning Performance Management Systems for Lasting Outcomes in Humanitarian Organizations. AFIT-ENS-MS-20-S-044. Faculty Advisor: Maj. Timothy W. Breitbach. Sponsor: CFE-DM.

HUFSTETLER, BRANDON, J., Heuristic Approaches for Near-Optimal Placement of GPS Based Multi-Static Radar Receivers in American Coastal Waters. AFIT-ENS-MS-20-M0154. Faculty Advisor: Lt. Col. Bruce A. Cox. Sponsor: N/A. [ANT]

INGRAM, MICHEAL, D., Explaining Weapon System Sustainment's Impact to Aircraft Availability. AFIT-ENS-MS-20-M-156. Faculty Advisor: Lt. Col. John M. Dickens. Sponsor: HAF/A4P.

KOSER, KORT, A., Wireless Technology for the Flight Line of the Future: A Multi-Criteria Decision Making And Utility Theory Analysis. AFIT-ENS-MS-20-J-042. Faculty Advisor: Lt. Col. Jason R. Anderson. Sponsor: AMC/A6 CTO.

LANGLAND, ANDREW, L., Resource and Capability Allocation Insights for A2/AD. AFIT-ENS-MS-20-M-157. Faculty Advisor: Dr. John O. Miller. Sponsor: SDPE LM MFC. [ANT]

LEE, STEPHEN, M., Ground Weather RADAR Signal Characterization through Application of Convolutional Neural Networks. AFIT-ENS-MS-20-M-158. Faculty Advisor: Dr. Lance E. Champagne. Sponsor: 45 WS/SYR.

LLOYD, ANDREW, H., High Value Airborne Asset Defense with Integrated Technology Battle Management of Assets. AFIT-ENS-MS-20-M-159. Faculty Advisor: Dr. Brian J. Lunday. Sponsor: SDPE.

LOHR, COLLIN, A., Analysis of the Impact of Distributed Logistics Operations on Mobility Aircraft. AFIT-ENS-MS-20-J-043. Faculty Advisor: Maj. Timothy W. Breitbach. Sponsor: AF/A5A.

MALONEY, JOSEPH, B., Simulating a Hypersonic Intelligence Surveillance and Reconnaissance (ISR) Aircraft's Military Utility in an Anti-Access Area Denial (A2AD) Environment. AFIT-ENS-MS-20-M-161. Faculty Advisor: Dr. Lance E. Champagne. Sponsor: SDPE. [COA]

MARQUETTE, FRANK, R., Trimming the Air Force Special Operations Command Redeployment Process. AFIT-ENS-MS-20-J-045. Faculty Advisor: Maj. Timothy Y. Breitbach. Sponsor: N/A.

MATTESON, DONOVAN, J., Comparative Analysis of Theater Tanker Planning Software. AFIT-ENS-MS-20-J-046. Faculty Advisor: Lt. Col. John M. Dickens. Sponsor: SAF/IEN.

O'NEAL, THOMAS, R., Sortie-based Aircraft Component Demand Rate to Predict Requirements. AFIT-ENS-MS-20-M-164. Faculty Advisor: Lt. Col. John M. Dickens. Sponsor: AFSC.

PARK, EDWARD, Y., Global Basing of Air Force Squadrons: an Adversary Deterrence Model with Solution Resiliency Analyses. AFIT-ENS-MS-20-M-165. Faculty Advisor: Dr. Brian J. Lunday. Sponsor: SDPE.

PEELE, ERIC, S., Restructuring Mobility Maintenance Organizations: Is it Time for Change? AFIT-ENS-MS-20-J-047. Faculty Advisor: Dr. Seong-Jong Joo. Sponsor: HQ AFMC/A4/10.

PUJATS, TREY, S., Forecasting Attrition by ASFC for the United States Air Force. AFIT-ENS-MS-20-M-166. Faculty Advisor: Dr. Raymond R. Hill Jr. Sponsor: HAF/A1PF.

RUSSELL, LEE, R., A Feasibility Analysis on the Air Force Employment of Escape Supply Chain Management Program. AFIT-ENS-MS-20-J-049. Faculty Advisor: Lt. Col. John M. Dickens. Sponsor: AFMC.

SALAZAR, AARON, J., Analysis with Dynamic Bayesian Networks Compared to Simulation. AFIT-ENS-MS-20-M-168. Faculty Advisor: Dr. Mark A. Gallagher. Sponsor: N/A.

SCHMIDT, BRADLEY, A., Diffusing the Lightning Integrated Technician Innovation. AFIT-ENS-MS-20-J-050. Faculty Advisor: Maj. Timothy W. Breitbach. Sponsor: N/A.

SCHROEDER, MARIA, N., Reconciliation of Hierarchical Time-Series Forecasting of Restaurant Attendance. AFIT-ENS-MS-20-M-170. Faculty Advisor: Dr. Lance E. Champagne. Sponsor: N/A. [COA]

SHANNON, ZACHARY, B., Resilient Aircraft Sustainment: Quantifying Resilience through Asset and Capacity Allocation. AFIT-ENS-MS-20-M-288. Faculty Advisor: Maj. Timothy W. Breitbach. Sponsor: N/A.

SKROVAN, CHARLES, A., 45 WS Electric Field Mill Lightning Prediction Threshold Analysis. AFIT-ENS-MS-20-M-171. Faculty Advisor: Lt. Col. Andrew J. Geyer. Sponsor: 45 WS/WXT.

SLOTTJE, JONATHAN, J., C-130J Flight Pilot Development: An Empirical Mixed Method Analysis on Aircraft Commander Upgrade.AFIT-ENS-MS-20-051. Faculty Advisor: Lt. Col. Jason Anderson. Sponsor: HQ AMC/A3/10.

SPANGLER, TYLER, M., Analysis and Forecasting of the 360th Air Force Recruiting Group Goal Distribution. AFIT-ENS-MS-20-M-172. Faculty Advisor: Dr. Raymond R. Hill Jr. Sponsor: 360RCG.

SPIEGEL, CONOR, S., Simulation and Analysis of Cruise Missile Autonomous Behaviors. AFIT-ENS-MS-20-M-173. Faculty Advisor: Dr. John O. Miller. Sponsor: SDPE LM MFC. [ANT]

STANTON, MARY, A., Autonomous Rovers: Flight Line Delivery of Maintenance Tools and Parts. AFIT-ENS-MS-20-J-052. Faculty Advisor: Lt. Col. Jason R. Anderson. Sponsor: HAF/A4/A4L.

STEPHENS, SEAN, T., Sustainability of the TF33 Engine a Case to Re-Engine the E-3 AWACS. AFIT-ENS-MS-20-J-053. Faculty Advisor: Dr. Seong-Jong Joo. Sponsor: N/A.

STRENGTH, RYAN, N., How are the Air Force pilot retention measures working in the Mobility Air Forces? AFIT-ENS-MS-20-J-055.Faculty Advisor: Dr. Alfred E. Thal. Sponsor: HAF/ACTF.

TAPIA, WILSON, Effects of Relocating West African Logistics Network Hub. AFIT-ENS-MS-20-M-175. Faculty Advisor: Maj. Timothy W. Breitbach. Sponsor: USAFRICOM J34.

THOMPSON, MAXWELL, C. Database Analysis to Improve U.S. Transportation Command Forecasting Processes. AFIT-ENS-MS-20-M-176. Faculty advisor: Dr. Brain J. Lunday. Sponsor: USTRANSCOM, JDPAC.

TINUCCI, KAYLA, N., Multivariate Analysis of Human Performance STRONG Lab Data. AFIT-ENS-MS-20-M-177. Faculty Advisor: Dr. Raymond R. Hill Jr. Sponsor: 711th.

WILLIAMS, CLARENCE, O., Meta Learning Recommendation System for Classification. AFIT-ENS-MS-20-M-181. Faculty Advisor: Dr. Jeffery D. Weir. Sponsor: N/A. [COA]

WOODS, MEGAN, K., A Metamodel Recommendation System using Meta-Learning. AFIT-ENS-MS-20-M-182. Faculty Advisor: Dr. Jeffery D. Weir. Sponsor: N/A. [COA]

5.5.3. GRADUATE RESEARCH PAPERS

BORSZICH, AARON, A., Effects of KC-10 divestment on Daily Competition. AFIT-ENS-MS-20-J-026. Faculty Advisor: Dr. Jeffery D. Weir. Sponsor: JCS/J4.

CALLAHAN, DANA, K., Commercial Augmentation and the Need for demand Forecasting SORTIE REQUIREMENTS. AFIT-ENS-MS-20-J-027. Faculty Advisor: Col. Adam D. Reiman. Sponsor: USAF AMC/A9.

COLBATH, DEREK, J., A Model to Analyze the Capacity of Pilot Training Production. AFIT-ENS-MS-20-J-029. Faculty Advisor: Dr. Alfred D. Thal. Sponsor: N/A.

COPE, FRANK, T., A Quantitative Analysis of USAF C-17 Pilot Computer Based Continuation Training. AFIT-ENS-MS-20-J-030. Faculty Advisor: Dr. William M. Cunningham. Sponsor: 97 AMW/CV.

ESPEGIO, GIOVANNA, Data Cleaning for Air Force Applications. AFIT-ENS-MS-20-J-033. Faculty Advisor: Col. Adam D. Reiman. Sponsor: SAF/IEN.

FEKETE, ROBERT, J., A Qualitative Assessment of Air Force Logisticians' Knowledge of Advanced Manufacturing Techniques. AFIT-ENS-MS-20-J-035. Faculty Advisor: Lt. Col. John M. Dickens. Sponsor: DLA Aviation/CC.

GILBERT, CHRISTOPHER, R., Modeling Composite Fleets Utilizing Hybrid Airships. AFIT-ENS-20-J-036. Faculty Advisor: Dr. Jeffery D. Weir. Sponsor: AFWIC.

HARVEY, TRAVIS, C., Increasing Airlift Availability through Optimization of Presidential Support Missions. AFIT-ENS-MS-20-J-038. Faculty Advisor: Dr. Darryl K. Ahner. Sponsor: AMC/A9.

HEIZER, STEVEN, J., Process Improvements in Missile Combat Crew Member Pre- and Post- Alert Activities. AFIT-ENS-MS-20-S-042. Faculty Advisor: Dr. William M. Cunningham. Sponsor: N/A.

KOSER, KORT, A., Wireless Technology for the Flight Line of the Future: A Multi-Criteria Decision Making and Utility Theory Analysis. AFIT-ENS-MS-20-J-042. Faculty Advisor: Lt. Col. Jason R. Anderson. Sponsor: AMC/A6CTO.

LOHR, COLLIN, A., Analysis of the Impact of Distributed Logistics Operations on Mobility Aircraft. AFIT-ENS-MS-J-043. Faculty Advisor: Maj. Timothy W. Breitbach. Sponsor: AF/A5A.

MARQUETTE, FRANK, R., Trimming the Air force Special Operations Command Redeployment Process. AFIT-ENS-MS-20-J-045. Faculty Advisor: Maj. Timothy W. Breitbach. Sponsor: N/A.

MATTESON, DONOVAN, J., Comparative Analysis of Theater Tanker Planning Software. AFIT-ENS-MS-20-J-046. Faculty Advisor: Lt. Col. John M. Dickens. Sponsor: SAF/IEN.

PEELE, ERIC, S., Restructuring Mobility Maintenance Organizations: Is it Time for Change? AFIT-ENS-MS-20-J-047. Faculty Advisor: Dr. Seong-Jong Joo. Sponsor: HQ AFMC/A4/10.

RUSSELL, LEE, R., A Feasibility Analysis on the Air Force Employment of Escape Supply Chain Management Program. AFIT-ENS-MS-20-J-049. Faculty Advisor: Lt. Col. John M. Dickens. Sponsor: AFMC.

SCHMIDT, BRADLEY, Diffusing the Lightning Integrated Technician Innovation. AFIT-ENS-MS-20-J-050. Faculty Advisor: Maj. Timothy W. Breitbach. Sponsor: N/A.

SLOTTJE, JONATHAN, J., C-130J Flight Pilot Development: An Empirical Mixed Method. AFIT-ENS-MS-20-J-051. Faculty Advisor: Maj. Timothy S. Anderson. Sponsor: HQ AMC/A3/10.

STANTON, MARY, A., Autonomous Rover Delivery of Maintenance Tools and Parts on the Flight Line. AFIT-ENS-MS-20-J-052. Faculty Advisor: Maj. Timothy S. Anderson. Sponsor: HAF/A4/A4L.

STEPHENS, SEAN, T., Sustainability of the TF33 Engine a Case to Re-Engine the E-3 AWACS. AFIT-ENS-MS-20-J-053. Faculty Advisor: Dr. Seong-Jong Joo. Sponsor: N/A

STRENGTH, RYAN, N., How are the Air Force Pilot Retention Measures Working in the Mobility Air Force? AFIT-ENS-MS-20-J-055. Faculty Advisor: Dr. Alfred D. Thal. Sponsor: HAF/ACTF.

5.5.4. FACULTY BIOGRAPHIES & RESEARCH OUTPUT

Notes: Research Center affiliations are listed in [ ] if applicable.

AHNER, DARRYL K.
Professor of Operations Research, Department of Operational Sciences, AFIT Appointment Date: 2010 (AFIT/ENS); Director, Scientific Test and Analysis Techniques (STAT) for Test and Evaluation (T&E) Center of Excellence, Appointment Date: 2012; Director, Center for Operational Analysis, Appointment Date: 2018, BS, Mechanical Engineering, United States Military Academy, 1990; MS, Applied Mathematics, Rensselaer Polytechnic Institute, 1999; MS, Operations Research & Statistics, Rensselaer Polytechnic Institute, 1999; PhD, Systems Engineering, Boston University, 2005. Dr. Ahner's research interests include dynamic programming, optimization of stochastic models, test and evaluation, software testing, information theory, and military operations research applications. Dr. Ahner is a licensed Professional Engineer in the Commonwealth of Virginia. Dr. Ahner is a member of the Military Operations Research Society, Institute of Electrical and Electronics Engineers, and the Institute for Operations Research and the Management Sciences. -Tel. (937) 255-6565 x4708, email: Darryl.Ahner@afit.edu

Sponsor Funded Research Projects

"STAT Applied to Automated Test and Analysis for Rapid Prototyping of Software Development." Sponsor: DRE. Funding: $523,000 - Ahner 50%, Thorsen 50%.

"AFSIM Modular Development to Support Spaced-Based Tactical ISR." Sponsor: AFRL/RV. Funding: $200,000 - Ahner 50%, Thorsen 50%.

"Tactical Space Mission Analysis with AFSIM." Sponsor: AFLCMC. Funding: $106,000 - Ahner 50%, Thorsen 50%.

"STAT Applied to Automated Test and Analysis for Rapid Prototyping of Software Development." Sponsor: DRE. Funding: $277,000 - Ahner 50%, Freels 50%.

"Analysis and Test Planning for Female Accommodation." Sponsor: AFSFC. Funding: $20,000 - Ahner 100%.

"AFSIM Modular Development to Support the Solar Space Power Initiative (SSPI)." Sponsor: AFRL/RV. Funding: $950,000 - Ahner 100%. [COA]

"DOE 320 Design of Experiments for Managers & REL-220 Reliability for Practitioners." Sponsor: 57 MXG. Funding: $18,318 - Ahner 50%, Thorsen 50%.

"#2019-196 Test & Evaluation Strategy Development for T-X Advanced Pilot Trainer." Sponsor: AFLCMC/WLZ. Funding: $1,103,804 - Ahner 50%, Thorsen 50%.

"AFSIM Modular Development to Support Spaced-Based Tactical ISR." Sponsor: AFRL/RVE. Funding: $350,000 - Ahner 50%, Thorsen 50%.

"Test and Evaluation Center of Excellence." Sponsor: DRE. Funding: $360,529 - Ahner 100%.

"University Affiliated Support in Automated Software Testing for DOT&E." Sponsor: DOT&E. Funding: $386,000 - Ahner 50%, Thorsen 50%.

"DOE 320/REL 320 Short courses." Sponsor: NAVSEA. Funding: $36,000 - Ahner 100%.

"University Affiliated Support in Automated Software Testing for DOT&E." Sponsor: DOT&E. Funding: $924 - Ahner 50%, Thorsen 50%.

Refereed Journal Publications

Gold, Sarah, Edward White, William Roeder, Mike McAleenan, Christine Schubert Kabban, and Darryl Ahner. "Probabilistic Contingency Tables: An Improvement to Verify Probability Forecasts." Weather and Forecasting 2020 (2020).

Ahner, D. and McCarthy, A. "Response surface modeling of precision-guided fragmentation munitions," The Journal of Defense Modeling and Simulation 17, no. 1 (2020): 83-97.

Keith, Andrew J., and Darryl K. Ahner. "A survey of decision making and optimization under uncertainty." Annals of Operations Research (2019): 1-35.

Ahner, Darryl K., Jennifer L. Thompson, and Karleine M. Justice. "Development of composite indices and a regional assessment framework for analyzing nation-state health." The Journal of Defense Modeling and Simulation 16, no. 4 (2019): 277-284.

Shallcross, Nicholas J., and Darryl K. Ahner. "Predictive models of world conflict: accounting for regional and conflict-state differences." The Journal of Defense Modeling and Simulation (2019): 1548512919847532.

Keith, Andrew, Darryl Ahner, and Nicole Curtis. "Evaluation theory and its application to military assessments." The Journal of Defense Modeling and Simulation 16, no. 4 (2019): 305-322.

Kline, A.G., Ahner, D.K., and Lunday, B.J., "A heuristic and metaheuristic approach to the static weapon target assignment problem," *Journal of Global Optimization*, Volume 78, Aug. 2020.

Caballero, W.N., Lunday, B.J., and Ahner, D.K., "Incentive Compatible Cost Sharing of Coalition Initiative with Probablistic Inspection and Penalties for Misrepresentation," *Group Decision and Negotiation*, Volume 29, Sept. 2020.

Editorships in Professional Journals

Editorial Board, Military Operations Research Society

ALBRECHT, TIMOTHY W., Col

Col. Timothy Albrecht is Director of the Center for Space Research and Assurance at the Air Force Institute of Technology (AFIT) where he leads a team of over 30 faculty and staff in focusing graduate student space research across multiple academic disciplines in strategic partnership with sponsors from the Air Force, DOD, USG, academia, and industry. Research areas include experimental CubeSats and payloads, satellite propulsion, cyber assurance, space domain awareness, autonomy, orbital engagement, and modeling and simulation. He has held analytic positions at a variety of command levels including Joint Staff, Air Staff, Component Command (AFCENT), and Combatant Command (EUCOM). He was the Commandant of the Community College of the Air Force and holds degrees from Northwestern University (BS Electrical Eng.), AFIT (MS and PhD Operations Research), and Air University (Masters Strategic Studies). He is a Joint Qualified Officer. AFIT research center affiliation(s): CSRA. Tel. (937) 255-3636 x4679, email: timothy.albrecht@afit.edu

Sponsor Funded Research Projects

"CubeSat-Optimized Software-Defined Flight Radio." Sponsor: Undisclosed. Funding: $30,000 - Albrecht 25%, Gunawardena 25%. Johnson 25%, Cobb 25%. [CSRA]

"Integration of NPS's Terahertz Imaging Camera for On-Orbit Demonstration." Sponsor: Undisclosed. Funding: $30,000 - Albrecht 25%, Bettinger 25%, Johnson 25%, Cobb 25%. [CSRA]

"Research Support to Sponsored Students (CSRA portion)." Sponsor: SAF/FBIB. Funding: $250,000 - Albrecht 25%, Bettinger 25%, Cobb 25%, Ayres 25%. [CSRA]

"CubeSat-Optimized Software-Defined Flight Radio." Sponsor: Undisclosed. Funding: $20,000 - Albrecht 25%, Gunawardena 25%, Johnson 25%, Cobb 25%. [CSRA]

"Integration of NPS's Terahertz Imaging Camera for On-Orbit Demonstration." Sponsor: Undisclosed. Funding: $20,000 - Albrecht 25%, Bettinger 25%, Johnson 25%, Cobb 25%. [CSRA]

ANDERSON, JASON R., Lt Col
Assistant Professor of Logistics and Supply Chain Management, Department of Operational Sciences, AFIT Appointment Date: 2016 (AFIT/ENS); Program Manager of Advanced Study of Air Mobility (ASAM) 2016; BS, Operations Research, United States Air Force Academy, 2000; MS, Masters of Science and Administration, Central Michigan University, 2007; MS, Masters of Logistics and Supply Chain Management, Air Force Institute of Technology, 2013; PhD, Logistics and Supply Chain Management, Air Force Institute of Technology. Lt Col Anderson's research interests include transportation, logistics management, inventory, operations management, simulation, and sourcing. Lt Col Anderson is a member of the Airlift/Tanker Association, American Society of Transportation & Logistics and the Council of Supply Chain Management Professionals. Tel. (937) 255-6565 x4533, email: Jason.Anderson@afit.edu

BREITBACH, TIMOTHY W., Maj
Assistant Professor of Logistics and Supply Chain Management, Department of Operational Sciences; AFIT Appointment Date: 2016 (AFIT/ENS); BA, University of Notre Dame, 2005; MS, Air Force Institute of Technology, 2012; PhD, Massachusetts Institute of Technology, 2017. Dr. Breitbach's research interests include supply chain finance and data analysis, humanitarian logistics and the role of supply chains in international development, supply chain resilience, and block chain. Maj Breitbach is a member of the Logistics Officer Association, Production and Operations Management Society and the Council of Supply Chain Management Professionals. AFIT research center affiliation(s):

CHAMPAGNE, LANCE E.
Assistant Professor of Operations Research, Department of Operational Sciences, AFIT Appointment Date: 2018 (AFIT/ENS); BS, Biomedical Engineering and Mathematics, Tulane University, 1991; MS, Operations Research, Air Force Institute of Technology, 1999; PhD, Operations Research, Air Force Institute of Technology, 2004. Dr. Champagne's research interests include agent-based and discrete-event simulation and applied and multivariate statistics. Dr. Champagne is a member of the Military Operations Research Society. AFIT research center affiliation(s): Tel. (937) 255-3636 x4646, email: Lance.Champagne@afit.edu

Sponsor Funded Research Projects

"AFRL Machine Learning Collaboration." Sponsor: AFRL/RY. Funding: $50,000 - Champagne 50%, Cox 50%.

"Education and Research Support for Modeling, Simulation, and Analysis." Sponsor: AFRL/SDPE. Funding: $235,000 - Champagne 40%, Robbins 25%, Lunday 20%, Jenkins 15%.

CIARALLO, FRANK W.
Associate Professor of Logistics and Supply Chain Management, Department of Operational Sciences, AFIT Appointment Date: 2019 (AFIT/ENS); BS, Electrical Engineering, Engineering & Public Policy, Carnegie Mellon University, 1986; MS, Manufacturing and Operations Systems, Carnegie Mellon University, 1988; PhD, Industrial Administration, Carnegie Mellon University, 1993. Dr. Ciarallo's research interests include strategies for centralization of stock in pharmaceutical distribution networks, study of aircraft component failures leading to lumpy spare part demands, Two-Echelon inventory systems with transshipment and quantity discounts, warehouse picking operations including picker congestion, evaluating airline boarding strategies for passenger aircraft, evaluating block chain capabilities to fulfill information needs of the healthcare system, modeling situation awareness of agents navigating on a network with imperfect information, and helper objectives in multi-objectivization for job shop scheduling. AFIT research center affiliation(s): Tel. (937) 255-3636 x4702, email: Frank.Ciarallo@afit.edu

Refereed Journal Publications

F.W. Ciarallo, R.R. Hill , K.K. Ward*, "An agent based model of passenger boarding for examining commercial aircraft boarding strategies," Journal of Applied Operational Research, Vol 11, No 1, 2019, pp 2-17, orlabanalytics.ca/jaor/archive/v11n1.htm.

J.P. Kristbaum*, F.W. Ciarallo, "Strengthening Criteria Independence through Optimization of Alternative Value Ratio Comparisons," to appear in EURO Journal on Decision Processes, (Manuscript No. EJDP-D-19-0060, Submitted August 2019, Accepted February 2020).

S.C. Bommer, M. Fendley, F.W. Ciarallo, "Mental Resource Assessment in Manufacturing (M-RAM): A Theoretical Framework for Cognitive Work Evaluation," in revision, Submitted to International Journal of Human Factors Engineering (Manuscript No. IJHFE-36019, Submitted January 2020, Revision 1 submitted June 2020).

J.P. Kristbaum*, F.W. Ciarallo, "Strategic Decision Facilitation: Supporting Critical Assumptions of the Human in Empirical Agent Based Modeling of Pairwise Value Comparisons," in revision, Submitted to Systems, Special issue on Human Factors in Systems Engineering, ed. M. Miller, C. Rusnock, (Manuscript No. systems-785707, Submitted April 2020, Revision 1 being prepared).

COX, BRUCE A., Lt Col
Assistant Professor and Division Chief of Operations Research Department of Operational Sciences, AFIT Appointment Date: 2018 (AFIT/ENS); BS, Worcester Polytechnic Institute, 1999; MS, Virginia Commonwealth University, 2006; PhD, Georgia Institute of Technology, 2011. Dr. Cox's research interests include large scale linear and convex optimization, robust optimization, heuristics, and optimal control. Lt Col Cox is the Vice President of the Cincinnati-Dayton Chapter of the Institute of Operations Research and Management Sciences and is a member of the Military Operations Research Society. AFIT research center affiliation(s): [CSRA.]

Sponsor Funded Research Projects

"Education and Development of MBSE Tools for Human-Centric Modeling." Sponsor: AFRL/711th. Funding: $100,000 - Cox 40%, Miller 20%, Colombi 20%, Jacques 20%. [ANT]

CUNNINGHAM, WILLIAM A.
Professor of Logistics and Supply Chain Management, Department of Operational Sciences; Program Chair, MS in Logistics and Supply Chain Management, Department of Operational Sciences, AFIT Appointment Date: 1994 (AFIT/ENS); BS, Business Administration, Missouri Southern State College, 1976; MS, Economics, Oklahoma State University, 1979; PhD, Economics, University of Arkansas, 1986. Dr. Cunningham's research interests include strategic mobility, cost/benefit analysis, econometric modeling, costing, privatization and A-76 studies, modal choice, network analysis, location analysis, supply chain management, and RFID. Dr. Cunningham is a member of the Heavy Duty Trucking Advisory Board. AFIT research center affiliation(s): [COA.] Tel. (937) 255-6565 x4283, email: William.Cunningham@afit.edu

Refereed Journal Publications

Order Fulfillment Errors and Military Aircraft Readiness," Michael Weber*, Daniel Steeneck and William Cunningham, Journal of Defense Analytics and Logistics**,** Vol. 4No. 1, 2020, pp. 71-87.

Refereed Conference Papers Accepted on the Basis of Abstract Review

Examining Determinants of Non-mission Capable Time for Cargo Aircraft Using Multiple Regression Analysis," Andrew Gill*, William Cunningham and Seong-Jong Joo. Western Decision Science Institute 49th Annual Meeting, April 7-10, Portland, OR. Although this conference did not take place due to COVID-19, the paper was accepted and a proceedings was published with the abstracts.

Editorships in Professional Journals

Editorial Review Board, Journal of Transportation Management

DECKRO, RICHARD F.
Distinguished Professor of Operations Research, Department of Operational Sciences, AFIT Appointment Date: 1994 (AFIT/ENS); Director, Future Operations Investigation Laboratory, BSIE, State University of New York at Buffalo,

1972; MBA, 1973, & DBA, 1976, Decision Sciences, Kent State University. Dr. Deckro's research, teaching, and consultation interests include the areas of information operations and information assurance, behavioral modeling including social network analysis, counter insurgency, irregular and hybrid warfare, applied mathematical programming and optimization, scheduling, network science and models, project and program management, modeling and analysis, space applications, campaign modeling, reconstruction and stabilization, measures of effectiveness and assessment, technology selection and management, advanced manufacturing methods, multi-criteria decision making, and decision analysis. Dr. Deckro is a Fellow of the Military Operations Research Society and US Principle Panel Member, NATO Science and Technology Organization, Systems Analysis and Studies Panel. AFIT research center affiliation(s): [CSRA.] Tel. (937) 255-6565 x4325, email: Richard.Deckro@afit.edu

Refereed Journal Publications

William N. Caballero, Brian J. Lunday & Richard F. Deckro "Leveraging Behavioral Game Theory to Inform Military Operations Planning," Military Operations Research, Vol. 25, No. 1 (2020), pp. 5-22

Books and Chapter

Christine M. Schubert Kabban, Fairul Mohd-Zaid & Richard F. Deckro, "Modern Methods for Characterization of Social Networks through Network Models," Handbook of Military and Defense Operations Research, edited by Natalie M. Scala and James P. Howard, II, Chapter 8, pp. 171-191, CRC Press, 2020.

Other Significant Research Productivity

Muhammad Sharjeel Riaz, Richard F Deckro & Mathew JD Robbins, "Value Focused Thinking Approach to Restore War Torn Countries: A case study of SSTRO Effort in Afghanistan in light of Pashtunwali Doctrine," *2020 Cincinnati-Dayton INFORMS Symposium*, Wright State University, OH, 31 January 2020.

Christine M. Schubert Kabban, Fairul Mohd-Zaid & Richard F. Deckro#, "Modern Methods for Characterization of Social Networks through Network Models," INFORMS Seattle, October, 2019. (Invited Talk).

DICKENS, JOHN M., Lt Col
Assistant Professor and Division Chief of Logistics and Supply Chain Management, Department of Operational Sciences, AFIT Appointment Date: 2018 (AFIT/ENS); BS, U.S. Military History, Air Force Academy, 2002; MS, Logistics and Supply Chain Management, Air Force Institute of Technology, 2011; Master of Military Operational Art & Science, Air University, 2014; PhD, Logistics Systems, University of North Texas, 2018. Lt Col Dicken's research interests include service-dominant logic, value and value creation, supply chain resilience, transaction cost economics, self-determination theory, resource-based view, experiments, survey, and simulation methodologies. AFIT Research Center Affiliation(s): Tel. (937) 255-3636 x4319, email: John.Dickens@afit.edu

GALLAGHER, MARK A.
Professor of Practice of Operations Research, Department of Operational Sciences, AFIT Appointment Date: 2019; BS, Operations Research and Computer Science, 1983; MS, Operations Research, Air Force Institute of Technology, 1986; PhD, Operations Research, Air Force Institute of Technology, 1992. Dr. Gallagher's research interests include applied statistics, forecasting, decision analysis, and linear programming. Dr. Gallagher is a Fellow of the Military Operations Research Society and member of the Institute for Operations Research and Management Sciences, Military and Security Society, and Air Force Association. AFIT research center affiliation(s): Tel. (937) 255-3636 x4703, email: Mark.Gallagher@afit.edu

Refereed Conference Papers Accepted on the Basis of Abstract Review

Gallagher, Mark A., Daniel S. Fenn and Shane N. Hall, "Evaluating Cyclic Risk Propagation through an Organization," accepted *Journal of Operational Risk*.

Other Significant Research Productivity

Villongco, Franco L., and Mark A. Gallagher, "Modeling Adaptive Adversaries through Reinforcement Learning," Military Operations Research Society Symposium, Online, June 16-18, 2020.

Mark A. Gallagher, "An Analytic Process from Issue Clarification to OR Technique Selection," Military Operations Research Society Symposium, Online, June 16-18, 2020.

Ledwith, C. Matthew, *Brandon J. Hufstetler and Mark A. Gallagher, "Stochastic Preemptive Goal Programming," Military Operations Research Society Symposium, Online, June 16-18, 2020.

Mark A. Gallagher, "Mapping Organizational Data to Identify Potential Algorithm Applications," Military Operations Research Society Symposium, Online, June 16-18, 2020.

Salazar, Aaron, and Mark A. Gallagher, "Analysis with Bayesian Networks Compared to Simulation," Military Operations Research Society Symposium, Online, June 16-18, 2020.

Salazar, Aaron, and Mark A. Gallagher, "Analysis with Bayesian Networks Compared to Simulation," Institute for Operations Research and Management Sciences (INFORMS) Cincinnati-Dayton Technical Symposium, Wright-State University, Beavercreek, Ohio, January 31, 2020.

Nestico, Leah, John Pav, Adam Campbell, Joseph M. Tama and Mark A. Gallagher, "Aligning a Budget to Enterprise Goals: Strategy-to-Task Assessments," Institute for Operations Research and Management Sciences (INFORMS) Annual Meeting, Seattle, Washington, October 20-23, 2019.

Villongco, Franco L., and Mark A. Gallagher, "Defense Enterprise Modeling: Planning Under Adversarial Uncertainty," Institute for Operations Research and Management Sciences (INFORMS) Annual Meeting, Seattle, Washington, October 20-23, 2019.

Chalé, Marc W., *Clarence O. Williams, *Brandon J. Hufstetler, and Mark A. Gallagher, "A Structured Approach for Selection of Machine Learning Techniques," Institute for Operations Research and Management Sciences (INFORMS) Annual Meeting, Seattle, Washington, October 20-23, 2019.

Salazar, Aaron J., and Mark A. Gallagher, "Comparison Analysis of Bayesian Networks, Discrete-Event, and Time-Oriented Simulations," Institute for Operations Research and Management Sciences (INFORMS) Annual Meeting, Seattle, Washington, October 20-23, 2019.

Hearnes, Warren (Moderator) with Mark A. Gallagher (Panelist), "Industry Job Search Panel," Institute for Operations Research and Management Sciences (INFORMS) Annual Meeting, Seattle, Washington, October 20-23, 2019.

Editorships in Professional Journals

Associate Editor, Military Operations Research

Editorial Board, Modeling and Simulation Journal

GAREE, MICHAEL J., Maj
Assistant Professor of Operations Research, Department of Operational Sciences, AFIT Appointment Date: 2020; BS, Physics & Mathematics, Ohio Northern University, 2008; MS, Operations Research, Air Force Institute of Technology, 2014; PhD, Industrial Engineering, 2020. Maj Garee's research interests include agent-based simulation, data visualization, computer science, social influence network analysis, and engineering education. Tel. (937) 255-3636 x4510, email: Michael.Garee@afit.edu

GLASSBURNER, AARON V., Maj
Assistant Professor of Logistics and Supply Chain Management, Department of Operational Sciences, AFIT Appointment Date: 2020 (AFIT/ENS); BS, Management/Computer Information Systems, Park University, 2004; MS, Logistics and Supply Chain Management, Air Force Institute of Technology, 2012; PhD, Business-Logistics Systems, University of North Texas, 2018. Maj Glassburner's research interests include inventory theory, game theory,

behavioral supply chain research, supply chain resilience, complex system governance, simulation modeling and stochastic optimization. AFIT Research Center Affiliation(s): Tel. (937) 255-3636 x4458, email: aaron.glassburner@afit.edu

GORLA, RAMA

Dr. Rama Gorla is currently employed as Professor of Aerospace Engineering at Air Force Institute of Technology, Wright Patterson Air Force Base in Dayton, Ohio. Prior to this, he worked as Professor of Mechanical Engineering and Fenn Distinguished Research Professor at Cleveland State University. Professor Gorla served as the University Ombudsperson and interacted with students, faculty and staff. He received the Ph.D. degree in Mechanical Engineering from the University of Toledo. His primary research areas are combustion, heat transfer and fluid dynamics. He worked as a turbomachinery design engineer at Teledyne Continental Motors Turbine Engines (TCM-TE) in Toledo, Ohio and as a design engineer of the aerothermodynamics of rotating machinery at Chrysler Corporation in Highland Park, Michigan. He completed a research program funded by NASA Lewis Research Center in Turbine Heat Transfer. Dr. Gorla has published over 675 technical papers in refereed journals and contributed several book chapters in Encyclopedia of Fluid Mechanics. He co-authored two text books: Turbomachinery published by Marcel & Dekker Company and Advanced Differential Equations published by Studera Press. NASA, AFOSR and local industry have sponsored his research. He is the recipient of two Distinguished Faculty awards from Cleveland State University, the first for research and the second for teaching. He was given the Teaching Excellence Award from the Northeast Ohio Council on Higher Education. He received the Distinguished Technical Educator Award from the Cleveland Technical Societies Council. He served as the Editor-in-Chief of the International Journal of Fluid Mechanics Research and Associate Editor of International Journal of Turbo and Jet Engines and International Journal of Applied Mechanics and Engineering. Professor Gorla is a Life Fellow of ASME.

Refereed Journal Publications

Roy, N.C., Saha, L.K., Hossain, M.A. and Gorla, R.S.R., "Blood Flow in a Stenotic Artery with Temperature-Dependent Viscosity," Heat Transfer Journal, 2020, pp. 1-22. DOI: 10.1002/htj 21943.

Tripathi, J., Vasu, B., Dubey, A., Gorla, R.S.R., Murthy, P.V.S.N., Anwar Beg, O. and Ponnaiah, S., "A review on Recent Advancements in the Hemodynamics of Nano-Drug Delivery Systems," International Journal of Nanoscience and Technology, 2020, DOI: 10.1615/Nanoscience Technology Int J/2020033448.

Dubey, A., Vasu, B., Anwar Beg, O., Gorla, R.S.R. and Kadir, A., "Computational Fluid Dynamic Simulation of Two-Fluid Non-Newtonian Nanohemodynamics through a Diseased Artery with a Stenosis and Aneurysm," Computer Methods in Biomechanics and Biomedical Engineering, 2020, DOI: 10.1080/10255842.2020.1729755.

Vasu, B., Dubey, A., Beg, O.A. and Gorla, R.S.R., "Micro polar Pulsatile Blood Flow Conveying Nanoparticles in a Stenotic Tapered Artery: Non-Newtonian Pharmacodynamic Simulation," Computers in Biology and Medicine, An International Journal, Vol. 126, 2020, pp. 104025, ISSN: 0010-4825. DOI: 1:1016/j. compbiomed. 2020.104025.02/10/2020.

HILL, RAYMOND R.

Professor of Operations Research, Department of Operational Sciences; Program Chair, Operations Research Doctoral Program; Program Chair, Graduate Test and Evaluation Certificate and Data Science Certificate; Director, Science of Test Research Laboratory, Department of Operational Sciences, AFIT Appointment Dates: 1997 (AFIT/ENS); BS, Mathematics, Eastern Connecticut State University, 1983; MS, Operations Research, Air Force Institute of Technology, 1988; PhD, Industrial and Systems Engineering, The Ohio State University, 1996. Dr. Hill's research interests include applied statistics and data analytics, in particular the application of design of experiments methodologies to test and evaluation; mathematical optimization, in particular the use of heuristic search methods for addressing particularly hard problems; and applied simulation modeling and analysis with particular interests in the area of agent-based modeling and the validation of such models. Dr. Hill is a member of the Military Operations Research Society. Tel. (937) 255-6565 x7469, email: Raymond.Hill@afit.edu

Refereed Journal Publications

Matthew D. Ferguson, Raymond R. Hill and Brian J. Lunday. June 2020. A Scenario-based Parametric Analysis of the Army Officer Assignment Problem. Journal of Defense Analytics and Logistics, Vol. 4, Issue 1, pp.89-106.

Ciarallo, F. W., R. R. Hill, and K. K. Ward. December 2019. An agent based model of passenger boarding for examining commercial aircraft boarding strategies. Journal of Applied Operations Research, Vol. 11, No. 1, pp: 2-17.

Weimer, C. W., Miller, J. O., Hill, R. R. and Hodson, D. D. October 2019. Agent Scheduling in Opinion Dynamics: A Taxonomy and Comparison Using Generalized Models. Journal of Artificial Societies and Social Simulation, Vol 22, No. 4, DOI: 10.18564/jasss.4065.

Refereed Conference Papers Accepted on the Basis of Full Paper Review

Keane, M. P., Lingenfelter, A. J., Walker, M., & Hill, R. R. (2020). Ballistic Limit Shot Dependency Testing in Composite Materials. In *AIAA SciTech 2020 Forum* (p. 1218).

Yost, K. J., Robbins, B. A., Perdikakis, W., Kitzmiller, C., Jones, K. and Hill, R. R. 2019. Quantifying Parameter Variability on a Population of Aerospace Synchronous Generators. *Proceedings of the 2019 IEEE International Electric Machines and Drives Conference (IEMDC)*.

Refereed Conference Papers Accepted on the Basis of Abstract Review

J. Nystrom, R. R. Hill, J. Pignatiello, E. Chicken and A.J. Geyer. "Improving Lightning Prediction Using Wavelet Transformations and Semi-Parametric Modeling." *American Meteorological Society 100th Annual Meeting*. Boston, MA. 15 January 2020. https://ams.confex.com/ams/2020Annual/webprogram/Paper369469.html.

Editorships in Professional Journals

Editor, Journal of Defense Analytics and Logistics

Editor, Military Operations Research

Associate Editor, Journal of Defense Modeling and Simulation

Associate Editor, Journal of Simulation

Associate Editor, International Journal of Mathematics in Operations Research

Associate Editor, Naval Research Logistics

Associate Editor, Quality Engineering

HOLZMANN, TIMOTHY W., Maj
Assistant Professor of Operations Research, Department of Operational Sciences, AFIT Appointment Date: 2019; BA, Mathematics, Cedarville University, 2004; MS, Operations Research, Air Force Institute of technology, 2009; PhD, Industrial Engineering, Clemson University, 2019. Maj Holzmann's research interests include combinatorial optimization, optimization under uncertainty, multi-objective optimization, decision support, and stochastic modeling. Maj Holzmann is a member of the Institute of Operations Research and the Management Sciences and Military Operations Research Society. AFIT research center affiliation(s): Tel. (937) 255-3636 x4337, email: Timothy.Holzmann@afit.edu

Sponsor Funded Research Projects

"45th Space Wing Bottleneck Study." Sponsor: SLS MAS. Funding: $48,600 - Holzmann 50%, Cox 10%, White 40%.

Refereed Conference Papers Accepted on the Basis of Full Paper Review

Holzmann, T. and Smith J.C., "Modeling the Shortest Path Interdiction problem with Randomized Strategies," Proceedings of the 2019 IISE Annual Conference, Orlando, FL, 18-21 May 2019.

JENKINS, PHILLIP R., Capt

Assistant Professor of Operations Research, Department of Operational Sciences, AFIT Appointment Date: 2019; BS, Mathematics, Ohio University, 2012; MS, Operations Research, Air Force Institute of Technology, 2017; PhD, Operations Research, Air Force Institute of Technology, 2019. Capt Jenkins' research interests include dynamic programming, approximate dynamic programming, Markov decision processes, stochastic programming, applied statistics, Machine learning, and multi-objective optimization. Capt Jenkins is a member of the Institute for Operations Research and the Management Sciences and the Military Operations Research Society. AFIT research center affiliation(s): Tel. (937) 255-3636 x4727, email: Phillip.Jenkins@afit.edu

Refereed Journal Publications

Jenkins, P.R., Robbins, M.J., and Lunday, B.J., "Robust, Multi-Objective Optimization for the Military Medical Evacuation Location-Allocation Problem," Omega, DOI: 10.1016/j.omega.2019-07.004, Dec 2020.

Jenkins, P.R., Robbins, M.J., and Lunday, B.J., "Approximate dynamic programming for the military aeromedical evacuation dispatching, preemption-rerouting, and redeployment problem," European Journal of Operational Research, DOI: 10.1016/j.ejor.2020.08.004, Aug 2020.

Jenkins, P.R., Lunday, B.J., and Robbins, M.J., "Approximate Dynamic Programming for Military Medical Evacuation Dispatching Policies," INFORMS Journal on Computing, DOI: 10.1287/ijoc.2019.0930, Aug 2020.

Robbins, M.J., Jenkins, P.R., Bastian, N.D., and Lunday, B.J., "Approximate Dynamic Programming for the Aeromedical Dispatching Problem: Value Function Approximation Utilizing Multiple Level Aggregation," Omega, Vol. 91, No. 102020, pp. 1-17, DOI: 10.1016/j.omega.2018.12.009, Mar 2020.

Refereed Conference Papers Accepted on the Basis of Abstract Review

Jenkins, P.R., Robbins, M.J., and Lunday, B.J., "Approximate Dynamic Programming for the Military Aeromedical Evacuation Dispatching, Preemption-Rerouting, and Redeployment Problem," 2020 Cincinnati-Dayton INFORMS Symposium, Dayton, OH, Jan 2020.

Jenkins, P.R., Lunday, B.J., and Robbins, M.J., "Robust, Multi-Objective Optimization for the Military Medical Evacuation Location-Allocation Problem," 2019 INFORMS Annual Meeting, Seattle, WA, 20-23 Oct 2019.

JOO, SEONG-JONG

Professor of Logistics & Supply Chain Management, Department of Operational Sciences; Co-Director, Distance Learning Program, MS, Logistics & Supply Chain Management; Program Chair, Logistics Doctoral Program, Department of Operational Sciences, AFIT Appointment Date: 2016 (AFIT/ENS); BS, Korea Air Force Academy (Seoul, Korea), 1982; MBA, Saint Louis University, 1992; PhD, Saint Louis University, 1995. Dr. Joo's research interests include sourcing, inventory management, transportation, and performance measurement and benchmarking. Dr. Joo is a member of the Academy of Management, American Production and Inventory Control Society, Decision Sciences Institute, Institute for Supply Management, and Production and Operations Management Society. AFIT research center affiliation(s): [COA.] Tel. (937) 255-6565 x4761, email: Seong-Jong.Joo@afit.edu

Sponsor Funded Research Projects

"Research, Analysis and Transition Support to the Directorate of Logistics and Sustainment/AFMC." Sponsor: HQ AFMC. Funding: $350,000 - Joo 45%, Steeneck 30%, Boehnke 20%, Breitbach 5%. [COA]

"Research, Analysis and Transition Support to the Directorate of Logistics and Sustainment/AFMC." Sponsor: HQ AFMC. Funding: $90,000 - Joo 45%, Ciarallo 30%, Reiman 20%, Cunningham 5%. [COA]

Refereed Journal Publications

Joo, S., Boehmke, B., Min, H., & Bayazit, O. (2020). Sourcing analytics for evaluating and selecting suppliers using DEA and AHP: a case of the aerospace company, *International Journal of Services and Operations Management* 35(4), 461-481.

Lee, Y., Joo, S., & Hwang, T. (2020). An aggregate DEA analysis for Korean bank performance using a chance-constrained approach, *International Journal of Operational Research* 38(4), 525-543.

Wang, Y., Anderson, J., Joo, S. and Huscroft, J. (2019). The leniency of return policy and consumers' repurchase intention in online retailing. *Industrial Management & Data Systems* 120 (1), 21-39.

Lee, Y. and Joo, S. (2019). Assessing the effects of exogenous factors for benchmarking hospitals with double bootstrapping. *Benchmarking: An International Journal* 27(1), 250-263.

Refereed Conference Papers Accepted on the Basis of Abstract Review

Joo#, S. & Yoon, G. (2019). Analyzing recurrent events of aircraft using survival analysis, *the 2019 INFORMS Annual Conference*, Seattle, WA, October 20, 2019.

Due to COVID-19, the 2020 WDSI meeting was cancelled around a month before the meeting date. The next four submissions have been published on the meeting website: http://wdsinet.org/Annual_Meetings/2020_Proceedings/ProceedingsPapers.html)

O'Neal*, T., Alamri*, A., Cherobini*, D., & Joo, S. (2020). Assessing maintenance performance for military aircraft using data envelopment, *the 49th Annual Meeting of the Western Decision Sciences Institute**, Portland, OR, April 7-10, 2020.

Gladney*, K., Akers*, C., Alanazi*, N., & Joo, S. (2020). Measuring the comparative performance of operations of air cargo wings using DEA, *the 49th Annual Meeting of the Western Decision Sciences Institute**, Portland, OR, April 7-10, 2020.

Gill*, A., Cunningham, W., & Joo, S. (2020). Examining determinants of non-mission capable time for cargo aircraft using multiple regression analysis, *the 49th Annual Meeting of the Western Decision Sciences Institute**, Portland, OR, April 7-10, 2020.

Ingram*, M., Aljuaid*, S., Alqarni*, A., Brubakken*, A., & Joo, S. (2020). Comparative evaluation of suicides at a national level, *the 49th Annual Meeting of the Western Decision Sciences Institute**, Portland, OR, April 7-10, 2020.

LACASSE, PHILLIP M., LTC
Assistant Professor Operations Research, Department of Operational Sciences, AFIT Appointment Date: 2019 (AFIT/ENS); BS, Mathematics, United States Military Academy, 2000; MS, Industrial Engineering, University of Wisconsin, 2010; PhD, Industrial Engineering, University of Wisconsin, 2019. LTC LaCasse's research interests include data science, probability and statistics, operations research, and sports analytics. AFIT research center affiliation(s): Tel. (937) 255-3636 x4318, email: Phillip.Lacasse@afit.edu

Sponsor Funded Research Projects

"Maximum Daily Capacity/Allowance (MDC/A) of Applicants Projected for Processing at Military Entrance." Sponsor: HQ USMEPCOM. Funding: $8,480 - LaCasse 100%.

Refereed Journal Publications
LaCasse, P., Otieno, W., Maturana, F., Predicting Contact-Without-Connection Defects on Printed Circuit Boards Employing Ball Grid Array Package Types: A Data Analytics Case Study in the Smart Manufacturing Environment, *SN Appl. Sci.* **2**, 156 (2020). https: doi.org/10.1007.s42452-019-1924-z.

LUNDAY, BRIAN J.
Professor of Operations Research, Department of Operational Sciences, AFIT Appointment Date: 2020 (AFIT/ENS); BS, Mechanical Engineering, U.S. Military Academy, West Point, 1992; MS, Industrial Engineering, University of Arizona, 2001; PhD, Industrial and Systems Engineering, Virginia Polytechnic Institute, 2010. Dr. Lunday's theoretical research interests include math programming, game theoretic models, and algorithmic design for global optimization, whereas his application research interests include network design, network interdiction, network restoration, facility location, and resource allocation/assignment. Dr. Lunday is a member of the Institute for Operations Research and Management Sciences, Military Operations Research Society, and Air Force Association. Tel. (937) 255-3636 x4624, email: Brian.Lunday@afit.edu

Sponsor Funded Research Projects

"Transportation and Distribution Research." Sponsor: USTC J8. Funding: $28,321 - Lundy 100%.

"Transportation and Distribution Research." Sponsor: USTRANSCOM. Funding: $22,000 - Lunday 100%.

"Transportation and Distribution Research." Sponsor: USTC J6. Funding: $74,679 - Lunday 100%.

Refereed Journal Publications

Bastian, W. N., Lunday, B. J., Fisher, C. B. & Hall, A. O. (2020) Models and Methods for Workforce Planning Under Uncertainty: Optimizing U.S. Army Cyber Branch Readiness and Manning. Omega, 92, 1-13. Available online at: https://doi.org/10.1016/j.omega.2019.102171.

Caballero, W. N., Lunday, B. J., & Uber, R. P. (2021) Identifying Behaviorally Robust Maximin Strategies for Normal Form Games under Varying Forms of Uncertainty. European Journal of Operational Research, 3, 971-982. Available online at: https://doi.org/10.1016/j.ejor.2020.06.022.

Caballero, W. N., & Lunday, B. J. (2020) Robust Influence Modeling under Structural and Parametric Uncertainty: An Afghan Counternarcotics Use Case. Decision Support Systems, 128, 1-11. Available online at: https://doi.org/10.1016/j.dss.2019.113161.

Caballero, W. N., Lunday, B. J., & Deckro, R. F. (2020) Leveraging Behavioral Game Theory to Inform Military Operations Planning. Military Operations Research, 25(1), 5-22. Available online at: https://www.mors.org/Publications/MOR-Journal/Search-Purchase-Issues/2020-MOR-Journal/BKctl/ViewDetails/SKU/MOR250105.

Caballero, W. N., Lunday, B. J., Deckro, R. F., & Pachter, M. (2020) Informing National Security Policy by Modeling Adversarial Inducement and its Governance. Socio-Economic Planning Sciences, 69, 1-15. Available online at: https://doi.org/10.1016/j.seps.2019.04.006.

Ferguson, M. D., Hill, R. R., & Lunday, B. J. (2020) A Scenario-Based Parametric Analysis of Stable Marriage Approaches to the Army Officer Assignment Problem. Journal of Defense Analytics and Logistics, 4(1), 89-106. Available online at: https://www.emerald.com/insight/content/doi/10.1108/JDAL-08-2019-0015/full/pdf.

Hanks, R. W., Lunday, B. J., & Weir, J. D. (2020) Robust Goal Programming for the Multi-objective Optimization of Data-Driven Problems: A Use Case for the United States Transportation Command's Liner Rate Setting Problem. Omega, 90, 101983. Available online at: https://doi.org/10.1016/j.omega.2018.10.013. (Affiliated with the Center for Operational Analysis)

McKenna, R. S., Robbins, M. J., Lunday, B. J., & McCormack, I. M. (2020) Approximate Dynamic Programming for the Military Inventory Routing Problem. Annals of Operations Research, 288, 391-416. Available online at: https://doi.org/10.1007/s10479-019-03469-8.

Robbins, M. J., Jenkins, P. R., Bastian, N. D., & Lunday, B. J. (2020) Approximate Dynamic Programming for the Aeromedical Evacuation Dispatching Problem: Value Function Approximation Utilizing Multiple Level Aggregation. Omega, 91, 1-17. Available online at: https://doi.org/10.1016/j.omega.2018.12.009

Summers, D. S., Robbins, M. J., & Lunday, B. J. (2020) An Approximate Dynamic Programming Approach for Comparing Firing Solutions in a Networked Air Defense Environment. Computers and Operations Research, 117, 1-15. Available online at: https://doi.org/10.1016/j.cor.2020.104890.

Lessin, A. M., Lunday, B. J., & Hill, R. R. (2019) A Multi-objective Bi-level Sensor Relocation Problem for Border Security. Institute for Industrial and System Engineering – Transactions, 51 (10), 1091-1109. Available online at: https://doi.org/10.1080/24725854.2019.1576952.

Caballero, W.N., Lunday, B.J., and Ahner, D.K., "Incentive Compatible Cost Sharing of Coalition Initiative with Probablistic Inspection and Penalties for Misrepresentation," *Group Decision and Negotiation*, Volume 29, Sept. 2020.

Refereed Conference Papers Accepted on the Basis of Abstract Review

Hornberger, Z. T., Cox, B.A., & Lunday, B. J. Optimal Heterogeneous Asset Location Modeling for Expected Spatiotemporal Search and Rescue Demands using Historic Event Data. 2019 INFORMS Annual Meeting, October 20-23, 2019, Seattle, WA.

Jenkins, P.R., Robbins, M.J., and Lunday, B.J. Approximate Dynamic Programming for the Military Aeromedical Evacuation Dispatching, Preemption-Rerouting, and Redeployment Problem. Cincinnati-Dayton INFORMS Technical Symposium, Dayton, OH, January 31, 2020.

Jenkins, P. R., Lunday, B. J., & Robbins, M. J. Robust Multi-Objective Optimization for the Military Medical Evacuation Location Allocation Problem. 2019 INFORMS Annual Meeting, October 20-23, 2019, Seattle, WA.

Lunday, B. J., Bastian, N. D., Fisher, C. B., & Hall, A. O. Robust Goal Programming to Optimize Army Cyber Branch Readiness and Manning Under Uncertainty. 2019 INFORMS Annual Meeting, October 20-23, 2019, Seattle, WA.

Editorships in Professional Journals

Associate Editor, Military Operations Research

MILLER, JOHN O. (Emeritus Faculty – Retired Feb 2020)
Associate Professor of Operations Research, Department of Operational Sciences; Program Chair, AFIT Appointment Date: 2002 (AFIT/ENS); Director, Combat Modeling Laboratory; BS, Biology, United States Air Force Academy, 1980; MBA, University of Missouri at Columbia, 1983; MS, Operations Research, Air Force Institute of Technology, 1987; PhD, Industrial Engineering, The Ohio State University, 1997. Dr. Miller's research interests include computer simulation, ranking and selection, agent based modeling, combat modeling, network centric warfare, high performance computing, applied statistics, and nonparametric statistics. AFIT research center affiliation(s): [COA.]

Sponsor Funded Research Projects

"Exploring Situation Awareness and Agent Interdependence for Education and Training." Sponsor: AFRL/RH. Funding: $95,000 - Miller 100%.

Editorships in Professional Journals

Associate Editor, International Journal of Operations Research

PIGNATIELLO, JOSEPH J.
Professor of Operations Research, Department of Operational Sciences; AFIT Appointment Date: 2010 (AFIT/ENV), 2011 (AFIT/ENS); BS, Mathematics, University of Massachusetts; MS, Industrial and Systems Engineering, The Ohio

State University, 1979; PhD, Industrial and Systems Engineering, The Ohio State University, 1982. Dr. Pignatiello's research interests include statistical process monitoring, change-point models, design and analysis of experiments, reliability, statistical data analysis, robust design and Six Sigma methods. Dr. Pignatiello is a Fellow of both the American Society for Quality and the Institute of Industrial and Systems Engineers. Tel. (937) 255-3636 x4311, email: Joseph.Pignatiello@afit.edu

Refereed Journal Publications

Vanli, O. Arda, Giroux, Rupert, Erman Ozguven, Eren, and Pignatiello, Joseph J., "Monitoring of Count Data Time Series: Cumulative Sum Change Detection in Poisson Integer Valued GARCH Models," Quality Engineering, Vol. 31, No. 3, pp. 439-452, 2019.

Freels, Jason K., Timme, D. A., Pignatiello, Joseph J., Jr., Warr, Richard L. and Hill, Raymond R., "Maximum Likelihood Estimation for the Poly-Weibull Distribution," Quality Engineering, DOI: 10.1080/08982112.2018.1557685, May 2019.

Editorships in Professional Journals

Editorial Board, Quality Engineering

Editorial Board, IIE Transactions

Editorial Advisory Board, International Journal of Lean Six Sigma

REIMAN, ADAM D.
Assistant Professor of Logistics and Supply Chain Management, Department of Operational Sciences, AFIT Appointment Date: 2014 (AFIT/ENS); BS, Astronautical Engineering, US Air Force Academy, 1995; MBA, Military Management, Touro University International, 2006; MS, Logistics Management, Air Force Institute of Technology, 2009; PhD Logistics, Air Force Institute of Technology, 2014. Dr. Reiman's research interests include airlift metrics, routing, scheduling, and fuel efficiency; energy efficiency, supply and demand; value-focused thinking, and heuristic search algorithms. Tel. (937) 255-3636 x4590, email: Adam.Reiman@afit.edu

ROBBINS, MATTHEW J.
Associate Professor of Operations Research, Department of Operational Sciences, AFIT Appointment Date: 2019; BS, Computer Systems Engineering, University of Arkansas, 1999; MS, Operations Research, Air Force Institute of Technology, 2005; PhD, Industrial Engineering, University of Illinois, 2010. Dr. Robbins' research interests include applied statistics, approximate dynamic programming, stochastic processes, game theory, Markov decision processes, machine learning, and simulation. Dr. Robbins is a member of the Institute for Operations Research and the Management Sciences, Military and Security Society, Optimization Society (Optimization under Uncertainty), and Military Operations Research Society. AFIT research center affiliation(s): Tel. (937) 255-3636 x4606, email: Matthew.Robbins@adit.edu

Refereed Journal Publications

Summers*, D.S., Robbins, M.J., Lunday, B.J., 2020. "An approximate dynamic programming approach for Comparing firing policies in a networked air defense environment," Computers & Operations Research, 117 (104890). DOI: https://doi.org/10.1016/j.cor.2020.104890.

Robbins, M.J., Jenkins*, P.R., Bastian, N.D., Lunday, B.J., 2020. "Approximate dynamic programming for the aeromedical evacuation dispatching problem: value function approximation utilizing multiple level aggregation," Omega, 91 (102020). DOI: https://doi.org/10.1016/j.omega.2018.12.009.

McKenna*, R.S., Robbins, M.J., Lunday, B.J., McCormack*, I.M., 2020. "Approximate dynamic programming for the military inventory routing problem," Annals of Operations Research, 288, 391-416. DOI: https://doi.org/10.1007/s10479-019-03469-8.

Jenkins*, P.R., Lunday, B.J., Robbins, M.J., 2019. "Robust, multi-objective optimization for the military medical evacuation location-allocation problem," Omega, (to appear) accepted 15 July 2019 (102088). DOI: https://doi.org/10.1016/j.omega.2019.07.004.

Jenkins*, P.R., Robbins, M.J., Lunday, B.J., 2019. "Approximate dynamic programming for military medical evacuation policies," INFORMS Journal on Computing, (to appear) accepted 16 August 2019. DOI: https://doi.org/10.1287/ijoc.2019.0930.

Editorships in Professional Journals

Associate Editor, Military Operations Research

Associate Editor, Naval Research Logistics

Other Significant Research Productivity

Jenkins*#, P.R., Robbins M.J., Lunday, B.J. "Approximate Dynamic Programming for the Military Aeromedical Evacuation Dispatching, Preemption-Rerouting, and Redeployment Problem," 2020 Cincinnati-Dayton INFORMS Symposium, January 31, Dayton, OH.

Jenkins*#, P.R., Lunday, B.J., Robbins, M.J. "Robust, Multi-objective optimization for the military medical evacuation location-allocation problem," 2019 INFORMS Annual Meeting, October 20-23, 2019, Seattle, WA.

ROBERTS, MATTHEW D., Maj

Assistant Professor of Logistics and Supply Chain Management, AFIT Appointment Date: 2020 (AFIT/ENS); BS, Southern Illinois University, Industrial Technology, 2004; MS, AFIT, Logistics & Supply Chain Management, 2013; PhD, Air Force Institute of Technology (AFIT), Logistics, 2017. Major Roberts's research interests include safety climate, supply chain strategy, leadership, and organizational behavior. His professional affiliations include Council of Supply Chain Management Professionals and Logistics Officer Associations.

Refereed Journal Publications

Douglas, M.A., Swartz, S.M., Richey, R.G., & Roberts, M.D. (2019). Risky business: Investigating influences on large truck drivers' safety attitudes and intentions. *Journal of Safety Research*, *70*, 1-11.

TALAFUSE, THOMAS P., Maj

Assistant Professor of Operations Research, Department of Operational Sciences, AFIT Appointment Date: 2017 (AFIT/ENS); BS, Operations Research and Mathematics, United States Air Force Academy, 2007; MS, Operations Research, Air Force Institute of Technology, 2011; PhD, Industrial Engineering, University of Arkansas, 2016. Maj Talafuse's research interests include reliability, reliability growth, optimization, stochastic processes, and design of experiments, applied statistics, and risk analysis. He is a member of the Institute for Operations Research and Management Science (INFORMS) and Institute for Industrial and Systems Engineers (IISE).

Refereed Journal Publications

Ledwith, M.C., Jackson, R.A., Reboulet, A.M., Talafuse, T.P., "Ethics and Education: A Markov Chain assessment of Civilian Education in Air Force Materiel Command," International Journal of Responsible Leadership and Ethical Decision-Making, Vol. 1, No. 1, pp. 25-37, 2019.

Refereed Conference Papers Accepted on the Basis of Abstract Review

Talafuse, T.P., Gilts, E.E., "A Simulation Approach to Address MQ-9 Flying Training Unit Manning Shortfalls," Military Operations Research Society Annual Symposium, Colorado Springs, CO, 17-20 Jun, 2019.

THORSEN, STEVEN N.

Adjunct Professor of Operations Research, Department of Operational Sciences, AFIT Appointment Date: 2019 (AFIT/ENS); Associate Director, Scientific Test and Analysis Techniques (STAT) for Test and Evaluation (T&E) Center of Excellence, Appointment Date: 2019; BA, Mathematics, Florida Atlantic University, 1991; MA, Mathematics, East Carolina University, 1997; PhD, Applied Mathematics, AFIT, 2005. Dr. Thorsen's research interests include optimization, information fusion, applied design of experiments, test and evaluation, software testing, information theory, and military operations research applications. Dr. Thorsen is a member of the Military Operations Research Society and the International Test and Evaluation Association. Tel. (937) 255-6565 x4486, email: steven.thorsen@afit.edu

Sponsor Funded Research Projects

"Joint Live Fire Test & Evaluation Analysis of Methodologies - Continuation of #2018-181." Sponsor: BFM. Funding: $80,000 - Thorsen 100%.

"Test Plan Design and Analysis for the Carbon Monoxide Catalyst (COCAT) Sensor on the F-35." Sponsor: 711 HPW. Funding: $50,000 - Thorsen 100%.

"DOE 320 Design of Experiments for Managers." Sponsor: AEDC. Funding: $9,000 - Thorsen 100%.

"Joint Live Fire Test & Evaluation Analysis of Methodologies - Continuation of #2018-181." Sponsor: DOT&E. Funding: $285,000 - Thorsen 100%.

"REL 220 and Custom Course Design and Delivery." Sponsor: PACOM. Funding: $12,500 - Thorsen 100%.

"T-6 Subject Matter Expertise Engineering Support (follow-on to #2019-124)." Sponsor: AFLCMC/WLZJ. Funding: $30,000 - Thorsen 50%, Ahner 50%.

"T-6 Subject Matter Expertise Engineering Support (follow-on to #2019-124)." Sponsor: AFLCMC/WLDJ. Funding: $540,600 - Thorsen 50%, Ahner 50%.

Significant Research Productivity

As Associate Director, Dr. Thorsen directly managed a $15M research portfolio, shaping and guiding research resulting in production of 4 Journal Articles, 9 best practices, 1 report, 1 case study, and 20 other research-related documents.

WALES, JESSE G., Lt Col
Assistant Professor of Operations Research, Department of Operational Sciences, AFIT Appointment Date: 2020; BS, Physics, University of Texas, 2002; MS, Operations Research, Air Force Institute of Technology, 2014; PhD, Operations Research with Engineering, Colorado School of Mines, 2020. Lt Col Wales' research interests include deterministic optimization, large-scale systems optimization, optimization under uncertainty, and renewable energy systems. Lt Col Wales is a member of the Institute for Operations Research and the Management Sciences, and the Military Operations Research Society. AFIT research center affiliation(s): Tel. (937) 255-3636 x4740, email: Jesse.Wales@adit.edu

Other Significant Research Productivity

Wales, J., Zolan, A., Newman, A., and Wagner, M. "Optimizing Mirror-washing Assignments for Concentrating Solar Power Central Receiver Plants," 2019 INFORMS Annual Meeting, Seattle, WA, 20-23 Oct 2019.

WEIR, JEFFERY D.
Professor of Operations Research and Interim Department Head, Department of Operational Sciences; AFIT Appointment Dates: 2002 (AFIT/ENS); BS, Electrical Engineering, Georgia Institute of Technology, 1988; MBA, Embry Riddle-Aeronautical University, 1992; MS, Operations Research, Air Force Institute of Technology, 1995; PhD, Industrial & Systems Engineering, Georgia Institute of Technology, 2002. Dr. Weir's research interests include decision analysis, deterministic optimization and applied statistics. Dr. Weir is a member of the Institute of Industrial

Engineers and the Decision Sciences Institute. AFIT research center affiliation(s): [COA.] Tel. (937) 255-3636 x4523, email: Jeffery.Weir@afit.edu

Sponsor Funded Research Projects

"Cost Capability Analysis AFIT Support to Headquarters Air Force A2 (HAF/A2)." Sponsor: HQ AFMC. Funding: $60,000 - Weir 100%. [COA]

"Cost Capability Analysis AFIT Support to Headquarters Air Force A2 (HAF/A2)." Sponsor: HQ AFMC. Funding: $365,000 - Weir 100%. [COA]

Refereed Journal Publications

Hanks, R, Lunday, B, and Weir, J D, "Robust Goal Programming for Multi-objective Optimization of Data-driven Problems: a Use Case for the United States Transportation Command's Liner Rate Setting Problem," Omega, vol 90, 2020, 101983 https://doi.org/10.1016/j.omega.2018.10.013.

Chu, X., Wu, T., Weir, J.D., Shi, Y., Niu, B., and Li, L., "Learning-Interaction-Diversification framework for swarm intelligence optimizers: A unified perspective," Neural Computing and Applications, vol 32, pp 1789-1809, 2020, https://doi.org/10.1007/s00521-018-3657-0.

Su, C., Weir, J.D., Zhang, F., Yan, H., Wu, T., "ENTRNA: a framework to predict RNA foldability," BMC bioinformatics, vol 20, article 373, 2019, https://doi.org/10.1186/s12859-019-2948-5.

Little, Z C, Weir, J D, Hill, R R, Stone, B B, and Freels, J K, "Batch sequential NOAB designs by way of simultaneous construction and augmentation," International Journal of Experimental Design and Process Optimization, vol 6, no 2, pp 127-146, 2019, https://doi.org/10.1504/IJEDPO.2019.101719.

Little, Z C, Weir, J D, Hill, R R, Stone, B B, and Freels, J K, "Second-order extensions to nearly orthogonal-and-balanced (NOAB) mixed-factor experimental designs," Journal of Simulation, vol 13, no 3, pp226-237, 2019 https://doi.org/10.1080/17477778.2018.1533794.

Gehret, G. H., Weir, J. D., Johnson, A. W. and Jacques, D. R., "Advancing stock policy on repairable, intermittently-demanded service parts," Journal of the Operational Research Society, vol 13, no 9, pp1437-1447, 2020 https://doi.org/10.1080/01605682.2019.1610206.

Refereed Conference Papers Accepted on the Basis of Abstract Review

Chalé, M, Weir, J D, Bastian, N, "Holistic Approach to Algorithm Selection," Military Operations Research Society Symposium, 16 – 19 June 2020, Virtual.

Editorships in Professional Journals

Associate Editor, Military Operations Research Journal

Associate Editor, IIE Transactions on Healthcare Systems Engineering

ZAWADZKI, MARCELO, Lt Col (BRAF)
Assistant Professor of Operations Research, Department of Operational Sciences; AFIT Appointment Date: 2018 (AFIT/ENS); BS, Aeronautical Sciences, Brazilian Air Force Academy, 1999; MS, Operations Research, Technological Institute of Aeronautics, 2009; MBA, Public Management, Universidade Federal Fluminense, 2011; PhD, Operations Research, Technological Institute of Aeronautics/London School of Economics and Political Science, 2014. Lt Col Zawadzki's research interests include resource allocations against emerging threats and multi-objective analysis. AFIT research center affiliation(s): Tel. (937) 255-3636 x4521, email: Marcelo.Zawadzki.BR@afit.edu

Refereed Conference Papers Accepted on the Basis of Abstract Review

Marcelo Zawadzki#, Supporting Efficient Resource Allocation to Mitigate Terrorism Risks during Sport Mega-events, INFORMS 2019, Seattle, WA, (city and state), 22/OCT/2019.

5.6. DEPARTMENT OF SYSTEMS ENGINEERING AND MANAGEMENT

Access Phone: (937) 255-2998, DSN 785-2998
Fax: (937) 656-4699, DSN 986-4699
Homepage: https://www.afit.edu/ENV/

5.6.1. DOCTORAL DISSERTATIONS

BEACH, PAUL, M., A Methodology to Identify Alternative Suitable NoSQL Data Models via Observation of Relational Database Interaction. AFIT-ENV-DS-20-S-056. Faculty Advisor: Dr. Brent T. Langhals. Sponsor: AFRL/AFOSOR/RTA.

SCHNEIDER, MICHAEL, F., Operationalized Intent for Improving Coordination in Human-Agent Teams. AFIT-ENV-DS-20-S-074. Faculty Advisor: Dr. Michael E. Miller. Sponsor: AFOSR. [ANT]

5.6.2. MASTER'S THESES

ALMANNAEI, LORY, Y., Design and test of an Autonomy Monitoring Service to Detect Divergent Behaviors on Unmanned Aerial Systems. AFIT-ENV-MS-20-J-059. Faculty Advisor: Dr. John M. Colombi. Sponsor: RHCCT. [ANT]

ANDREWS, JINAN, M., Human Performance Modeling: Analysis of the Effects of Loyal Wingman Technology On Pilot Workload and Mission Performance. AFIT-ENV-MS-20-M-185. Faculty Advisor: Dr. Michael E. Miller. Sponsor: N/A.

BARRY, KAITLYN, A Pareto Analysis of Expired Shelf-Life Material at Six Air Force Material Command Bases. AFIT-ENV-MS-20-M-186. Faculty Advisor: Dr. Jeremy M. Slagley. Sponsor: AFCEC/CZTQ.

BLAIR, MARC, J., Retrospective Cohort Study of Pure Tone Audiometry Threshold Shifts from Ototoxic Substance, Continuous Noise, and Impulse Noise Exposures at Tinker Air Force Base from 2005 to 2019. AFIT-ENV-MS-20-M-187. Faculty Advisor: Dr. Jeremy M. Slagley. Sponsor: N/A.

BLAKE, ETHAN, E., Determinants of Small Business Innovation Research Performance. AFIT-ENV-MS-20-189. Faculty Advisor: Lt. Col. Amy A. Cox. Sponsor: N/A.

BRAUNBERGER, TREVER, J., Providing Rationale for Further Finding Additive Manufacturing Efforts in the Air Force. AFIT-ENV-MS-20-M-190. Faculty Advisor: Maj. John X. Situ. Sponsor: N/A.

BUCKMAN, MILES, D., Development and Application of a Theory for Predicting the Detection of Closely Spaced Objects. AFIT-ENV-MS-20-J-080. Faculty Advisor: Lt. Col. Torrey J. Wagner. Sponsor: AFRLRDSS. [CDE]

CANFIELD, MICHAEL, E., A Life-Cycle Analysis of the Thermal Energy Transfer in Prototypical Air Force Office Building Construction using Best Value Insulation Standards. AFIT-ENV-MS-20-M-191. Faculty Advisor: Dr. Brent T. Langhals. Sponsor: AFCEC/CFTP.

CARR, KATHERINE, A., Development of Work Breakdown Structure (WBS) Cost Models for the Techno-Economic Analysis of PFAS Contaminant Removal. AFIT-ENV-MS-20-M-192. Faculty Advisor: Lt. Col. John E. Stubbs. Sponsor: USEPA.

CHENEY, KATHERINE, E., Development, Test and Evaluation of Autonomous Unmanned Aerial Systems in A Simulated Wide Area Search Scenario: An Implementation of the Autonomous Systems Reference Architecture. AFIT-ENV-MS-20-M-193. Faculty Advisor: Dr. John M. Colombi. Sponsor: N/A. [ANT]

COOLS, JACOB, G., Marine Corps Base Quantico Solid Waste Characterization. AFIT-ENV-MS-20-M-194. Faculty Advisor: Dr. Jeremy M. Slagley. Sponsor: NREA, ISWM, QRP.

CRANDALL, CONNOR, G., Vote Forecasting Using Multi-Objective Decision Analysis. AFIT-ENV-MS-20-M-195. Faculty Advisor: Lt. Col. Marcelo Zawadzki. Sponsor: N/A.

D'AMATO, CARLO, S., The Effects of Funding Gaps on Depot Maintenance Hours. AFIT-ENV-MS-20-M-196. Faculty Advisor: Lt. Col. Scott T. Drylie. Sponsor: N/A.

EDWARDS, JORDAN, S., Developing Standard Production Cost Factors for Major or Defense Acquisition Program (MDAP) Platforms. AFIT-ENV-MS-20-M-197. Faculty Advisor: Dr. Jonathan D. Ritschel. Sponsor: AFLCMC/FZCE.

EILERT, CLAYTON, S., Defense Contractor Profit. AFIT-ENV-MS-20-M-198. Faculty Advisor: Lt. Col. Clay M. Koschnick. Sponsor: N/A.

FARRELL, LUKE, J., A Reference Architecture for CubeSat Development. AFIT-ENV-MS-20-M-199. Faculty Advisor: Dr. David R. Jacques. Sponsor: N/A. [CSRA]

FENNELL, NEAL, S., Investigating Lifecycle Costs of Optimized Battery-Photovoltaic Systems on a Forward Operating Base. AFIT-ENV-MS-20-M-200. Faculty Advisor: Lt. Col. Torrey J. Wagner. Sponsor: N/A.

FILER, JAMIE, E., Optimizing the Environmental and Economic Sustainability of Contingency Base Infrastructure. AFIT-ENV-MS-20-M-201. Faculty Advisor: Maj. Steven J. Schuldt. Sponsor: AFCEC/DS.

FLAXINGTON, TAYLOR, F., Preliminary Study of Communication Network Characterization Towards Improved Organizational Behavior. AFIT-ENV-MS-20-M-202. Faculty Advisor: Lt. Col. Amy M. Cox. Sponsor: N/A.

GARDNER, SHANE, C., Using a Field Mill Climatology to Assess All Lightning Launch Commit Criteria. AFIT-ENV-MS-20-M-204. Faculty Advisor: Dr. Edward D. White. Sponsor: 45 WS/SYS.

GEISELMAN, ERIC, E., Evaluation of a Text-Based Information Portrayal and Access Techniques for Constrained Area Presentation: A Comparison of Human Performance. AFIT-ENV-MS-20-M-205. Faculty Advisor: Dr. Michael E. Miller. Sponsor: 711 HPW/RHCSR.

GIST, EVAN, A., A Comparison of SBIR Investment Methods: AFWERX Open Topics Versus Legacy. AFIT-ENV-MS-20-M-206. Faculty Advisor: Lt. Col. Amy M. Cox. Sponsor: N/A.

GUERIN, SCOTT, R., Civil Engineer Company Grade Officer Competency-Based Education Modeling. AFIT-ENV-MS-20-M-207. Faculty Advisor: Dr. Tay W. Johannes. Sponsor: AFIT/CE.

HARRIGER, SAM, B., Trade-Space Analysis of a Small Unmanned Vehicle System for Radiological Search Missions. AFIT-ENV-MS-20-M-210. Faculty Advisor: Dr. David R. Jacques. Sponsor: N/A. [ANT]

HERNANDEZ, NESTOR, An analysis of a hurricane loss model, validation from Tyndall AFB, and applications for the Air Force. AFIT-ENV-MS-20-J-063. Faculty Advisor: Lt. Col. Andrew J. Hoisington. Sponsor: AFCEC.

HOGAN, DAKOTAH, W., An Analysis of Learning Curve Theory & Diminishing Rates of Learning. AFIT-ENV-MS-20-M-212. Faculty advisor: Dr. John J. Elshaw. Sponsor: NPS.

HOLLIDAY, MATTHEW, D., Comparison of the PFAS Adsorption Capabilities of a Coconut Shell Based Granular Activated Carbon and a Bituminous Coal Based Granular Activated Carbon. AFIT-ENV-MS-20-M-213. Faculty Advisor: Lt. Col. John E. Stubbs. Sponsor: USEPA.

HOLMES, MATHEW, L., Pathways for Space-Based Technology Maturation. AFIT-ENV-MS-20-M-214. Faculty Advisor: Lt. Col. Amy M. Cox. Sponsor: SMC.

HOPKINS, CHRISTOPHER, E., Repairing Situation Awareness in Future Unmanned Aerial Vehicle Operations: A Case Study in Systems Modeling Language Using a Human-Artificial Agent Teaming Meta-Model. AFIT-ENV-MS-20-M-215. Faculty Advisor: Dr. Michael E. Miller. Sponsor: N/A. [ANT]

JAGODA, JENEE, A., An Analysis of the Viability of 3D-Printed Construction as an Alternative to Conventional Construction Methods in the Expeditionary Environment. AFIT-ENV-MS-20-M-217. Faculty Advisor: Maj. Steven J. Schuldt. Sponsor: AFCEC.

JOHNSON, JOHN, A., Three Views for Explaining and Resolving the Recruitment and Retention Challenges of The Explosive Ordinance Disposal (EOD) Carrer Fields. AFIT-ENV-MS-20-M-218. Faculty Advisor: Lt. Col. Scott T. Drylie. Sponsor: AFRL/FMC.

KING, DAVID, D., Development, Test, and Evaluation of Autonomous Unmanned Aerial Systems in a Simulated Wide Area Search Scenario: An Implementation of the Autonomous Systems Reference Architecture. AFIT-ENV-MS-20-M-220. Faculty Advisor: Dr. David R. Jacques. Sponsor: N/A. [ANT]

KNISTER, SIMON, R., Evaluation Framework for Cislunar Space Domain Awareness (SDA). AFIT-ENV-MS-20-M-221. Faculty Advisor: Lt. Col. Bryan D. Little. Sponsor: N/A. [CSRA]

KOHL, NATHANAEL, T., The Influence of Light in the Built Environment to Improve Mental Health Outcomes. AFIT-ENV-MS-20-M-222. Faculty Advisor: Lt. Col. Andrew J. Hoisingtion. Sponsor: MIRECC.

LEMMER, GEORGE, P., Survey of Airflow Around a Heated Manikin as a Simulated Aeromedical Evaluation Patient on a Litter with Computational Fluid Dynamics Models. AFIT-ENV-MS-20-S-070. Faculty Advisor: Dr. Jeremy M. Slagley. Sponsor: AFRL/RHBAF.

LEONARD, DAVID, G., Detection and Quantification of Bacterial Species Important to Mental and Physical Health. AFIT-ENV-MS-20-M-224. Faculty Advisor: Lt. Col. Andrew J. Hoisington. Sponsor: AFRL.

LUKETIC, DANA, P., The Utility of Self-Assessment in Predicting Program Office Estimate Accuracy. AFIT-ENV-MS-20-M-225. Faculty Advisor: Lt. Col. Scott T. Drylie. Sponsor: AFLCMC/FZCE.

MARSH, JUSTIN, R., The Impact of Changing the Size of Aircraft Radar Displays on Visual Attention in the Cockpit. AFIT-ENV-MS-20-M-226. Faculty Advisor: Dr. Michael E. Miller. Sponsor: AFLCMC/WWMA. [ANT]

MILLER, CHRISTOPHER, W., An Investigation into Subject Matter Expert Elicitation in Cost Risk Analysis. AFIT-ENV-MS-20-M-227. Faculty Advisor: Dr. Robert D. Fass. Sponsor: AFLCMC/FZCE.

MILLER, JEREMY, J., Electronic Image Detectability Under Varying Illumination Conditions. AFIT-ENV-MS-20-M-228. Faculty Advisor: Dr. Michael E. Miller. Sponsor: 480 ISRW/SG.

MYERS, BRADFORD, A., Quantifying the Effects of Aircraft Engine Upgrades on Operating and Support Costs. AFIT-ENV-MS-20-M-229. Faculty Advisor: Dr. Edward D. White. Sponsor: AFLCMC/FZCE.

OHMS, STEPHANIE, A., Development and Characterization of a Filter-Based Bio aerosol Sampler Capable of Integration into Small Unmanned Aerial Systems. AFIT-ENV-MS-20-M-230. Faculty Advisor: Dr. Jeremy M. Slagley. Sponsor: AFRL/711th/RHM.

PAQUETTE, RYLEY, R., Optimization of Airfield Parking and Fuel Asset Dispersal to Maximize Survivability And Mission Capability Level. AFIT-ENV-MS-20-M-231. Faculty Advisor: Maj. Steven. J. Schuldt. Sponsor: AFLCEC.

PARKS, IAN, Analyzing Cost Effectiveness of Photovoltaic Pavements. AFIT-ENV-MS-M-232. Faculty Advisor: Dr. Brent T. Langhals. Sponsor: AFLCEC.

PEARSON, JAY, F., Optimized Off-Grid Energy Systems Using Climate-Based Energy Demand for Soft Walled Facilities. AFIT-ENV-MS-20-M-233. Faculty Advisor: Maj. Steven J. Schuldt. Sponsor: N/A.

PLACK, ERIC, A., Improving Acquisitions in Science and Technology Programs through Factor Development and Program Analysis. AFIT-ENV-MS-20-M-234. Faculty Advisor: Dr. Jonathan D. Ritschel. Sponsor: AFRL.

SCHOEMAKER, MATTHEW, R., An Analysis of the Factors That Correlate with Transition Outcomes of Commercial Technology Prototype Projects. AFIT-ENV-MS-20-S-093. Faculty Advisor: Lt. Col. Amy M. Cox. Sponsor: DIU.

SILVERBUSH, AMY, E., An Analysis of Tinker Air Force Base Thermal Spray Hazardous Waste Stream from 2003-2019 and its Potential Reclamation. AFIT-ENV-MS-20-M-239. Faculty Advisor: Dr. Jeremy M. Slagley. Sponsor: AFCEC/CZTQ. [NEAT]

STAFFORD, RYAN, D., Analysis of Beta Distribution for Subjective Uncertainty Analysis in Cost Models. AFIT-ENV-MS-20-M-241. Faculty Advisor: Lt. Col. Clay M. Koschnick. Sponsor: N/A.

STEELE, MEGAN, L., Assessing Challenges Associated with Sampling Hexavalent Chromium Under New Consensus Guidelines. AFIT-ENV-MS-20-M-242. Faculty Advisor: Dr. Jeremy M. Slagley. Sponsor: N/A. [NEAT]

STRANG, MEGHAN, G., Recognizing Potential Cyberspace Warriors Through the Use of Suspicion Propensity Index. AFIT-ENV-MS-20-M-244. Faculty Advisor: Dr. Michael E. Miller. Sponsor: A2/6CX/A3CZ.

TABB, DANIELLE, Analysis of Construction Management at Risk Projects for Unites States Air Force Applicability. AFIT-ENV-MS-20-M-245. Faculty Advisor: Dr. Tay W. Joannes. Sponsor: AFCEC.

TAYLOR, WILLIAM, L., The Connection Between Indoor Air Quality and Mental Health Outcomes. AFIT-ENV-MS-20-M-248. Faculty Advisor: Lt. Col. Andrew J. Hoisington. Sponsor: N/A.

THOMSEN, NATHANAEL, J., Going off the Grid: Optimizing Solar Renewable Energy Systems at Remote Locations to Minimize Logistics Requirements, Increase Sustainability, and Strengthen Energy Assurance. AFIT-ENV-MS-20-M-247. Faculty Advisor: Maj. Steven J. Schuldt. Sponsor: AFCEC/CXAE.

TITUS, EMILY, M., Development of a Semi-Quantitative Methodology for Evaluation of Chemical, Biological, Radiological and Nuclear (CBRN) Decontamination Using an Ultraviolet Fluorescent Aerosol. AFIT-ENV-MS-20-S-081. Faculty Advisor: Dr. Jeremy M. Slagley. Sponsor: AFRL/RHBAF. [NEAT]

TRUVER, ROBERT, J., Optimizing UAS Power plants for Increased Endurance. AFIT-ENV-MS-20-M-249. Faculty Advisor: Lt. Col. Torrey J. Wagner. Sponsor: N/A.

WALLACE, LYNN, A., Steady State Visually Evoked Potentials from Simultaneous Dynamic Stimulo. AFIT-ENV-MS-20-M-251. Faculty Advisor: Dr. Michael E. Miller. Sponsor: AFRL/711th/HCSR. [ANT]

YIP, ALVIN, T., Examining Healthy Community Design Characteristics and Its Influence on Physical Health. AFIT-ENV-MS-20-M-252. Faculty Advisor: Lt. Col. Andrew J. Hoisington. Sponsor: AFCEC.

5.6.3. FACULTY BIOGRAPHIES & RESEARCH OUTPUT

Notes: Research Center affiliation is listed in [ ] if applicable.

BADIRU, ADEDEJI B.
Dean, Graduate School of Engineering and Management, AFIT Appointment Date: 2013 (AFIT/EN); BS, Tennessee Technological University, 1979; MS, Tennessee Technological University, 1981; PhD, Industrial Engineering, University of Central Florida, 1984. Dr. Badiru's research interests include Project Modeling, Analysis, Management and Control, Mathematical Modeling, Computer Simulation, Information Systems, and Economic Analysis. He is the author of several books and technical journals. Tel. (937) 255-3636 x4799, email: Adedeji.Badiru@afit.edu

Refereed Journal Publications

Badiru, Adedeji B. (2019), "Quality insights: Umbrella Theory for Innovation: A Systems Framework for Quality Engineering and Technology," Accepted, International Journal of Quality Engineering and Technology, currently in press (forthcoming)

Badiru, Adedeji B. (2018), "Quality insights: artificial neural network and taxonomical analysis of activity networks in quality engineering," International Journal of Quality Engineering and Technology, Vol. 7, No. 2, 2018, pp 99-107.

Books and Chapters in Books

Badiru, A. B. (2019), Project Management: Systems, Principles, and Applications, Second Edition, Taylor & Francis CRC Press, Boca Raton, FL.

Badiru, Adedeji B. (2019), Systems Engineering Models: Theory, Methods, and Applications, Taylor & Francis/CRC Press, Boca Raton, FL.

Badiru, Adedeji B., Oye Ibidapo-Obe, and Babs J. Ayeni (2019), Manufacturing and Enterprise: An Integrated Systems Approach, Taylor & Francis/CRC Press, Boca Raton, FL.

Badiru, Adedeji B., S. Abi Badiru, and I. Ade Badiru, (2019), Mechanics of Project Management: Nuts and Bolts of Project Execution, Taylor & Francis/CRC Press, Boca Raton, FL.

Badiru, Adedeji B. (2019), The Story of Industrial Engineering: The Rise from Shop-Floor Management to Modern Digital Engineering, Taylor & Francis/CRC Press, Boca Raton, FL, 2018.

Badiru, Adedeji B. and Cassie B. Barlow, editors (2019), Defense Innovation Handbook: Guidelines, Strategies, and Techniques, Taylor & Francis/CRC Press, Boca Raton, FL.

CHINI, CHRISTOPHER M.
Assistant Professor of Engineering Management, Department of Systems Engineering and Management; AFIT Appointment Date: 2019 (AFIT/ENV); BS, Civil Engineering, Texas A&M University, 2011; MS, Civil Engineering, University of Illinois at Urbana-Champaign, 2015, PhD, Civil Engineering, University of Illinois at Urbana-Champaign, 2018. Dr. Chini's research interests include resource management, installation resilience, life cycle analysis, energy-water nexus, asset management, and water resources planning and management. Dr. Chini is also interested in data management and visualization as well as geospatial information systems and scientific communication. Tel. (937) 255-3636 x4568, email: Christopher.Chini@afit.edu

Refereed Journal Publications

Chini, C.M. and Stillwell, A.S. (2019). Metabolism of U.S. Cities 2.0. Journal of Industrial Ecology. 23(6), 1353-1362. DOI: 10.1111/jiec.12923.

Djehdian, L.A., Chini, C.M., Marston, L., Konar, M., and Stillwell, A.S. (2019). Exposure of Urban Food-Energy-Water (FEW) Systems to Water Scarcity. Sustainable Cities and Society.50 (10), 101621. DOI: 10.1016/j.scs.2019.101621.

Chini, C.M. and Stillwell, A.S. (2020). Envisioning Blue Cities: Urban Water Governance and Water Foot printing. Journal of Water Resources Planning and Management, 146(3), 04020001.DOI: 10.1061/ (ASCE) WR.1943-5452.0001171.

Chini, C.M., and Stillwell, A.S. (2020) The changing virtual water trade network of the European electric grid. Applied Energy. 260, 114151. DOI: 10.1016/j.apenergy.2019.114151.

Roidt, M., Chini, C.M., Stillwell, A.S., and Cominola, A. (2020). Unlocking the Impacts of COVID-19 Lockdowns: Changes in Thermal Electricity Generation Water Footprint and Virtual Water Trade in Europe. Environmental Science & Technology Letters. DOI: 10.1021/acs.estlett.0c00381.

Chini, C.M., and Stillwell, A.S. (2020) One model does not fit all: Bottom-up indicators of residential water use provide limited explanation of urban water fluxes. Journal of Sustainable Water in the Built Environment, 6(3), 04020011. DOI: 10.1061/JSWBAY.00009.

Hastie, A.G., Chini, C.M., and Stillwell, A.S. (2020) A Mass Balance Approach to Urban Water Analysis Using Multi-resolution Data. Journal of Industrial Ecology. DOI: 10.1111/jiec.12995.

Delorit, J.D., Schuldt, S.J., and Chini, C.M. (2020) Evaluating an Adaptive Management Strategy for Organizational Energy Use under Climate Uncertainty. Energy Policy, 142, 111547. DOI:10.1016/j.enpol.2020.111547.

Siddik, M., Chini, C.M., and Marston, L.M. (2020). Urban water and carbon footprints of electricity are sensitive to geographical attribution method. *Environmental Science & Technology*. 54(12), 7533-7541. DOI: 10.1021/acs/est/0c00176.

COLOMBI, JOHN M.

Associate Professor and Program Chair of Systems Engineering**,** Department of Systems Engineering and Management, AFIT Civilian Appointment Date: 2008 (AFIT/ENV); AFIT Military Appointment Date: 2003 (AFIT/ENG). BSEE, University of Lowell, 1982; MSEE, Air Force Institute of Technology, 1992; PhD, Electrical Engineering, Air Force Institute of Technology, 1996. Dr. Colombi's research interests within the broad discipline of Systems Engineering include systems architecture and model-based systems engineering techniques, multi-vehicle unmanned/autonomous design, acquisition process modeling, optimal space constellation design, systems of systems analysis, complex adaptive systems and human systems integration. AFIT research center affiliation(s): [ANT] and [CSRA.] Tel. (937) 255-3636 x3347, email: John.Colombi@afit.edu

Sponsor Funded Research Projects

"Model-based Systems Engineering for WNS Acq Workforce." Sponsor: AFLCMC/WNS. Funding: $100,000 - Colombi 100%.

Refereed Journal Publications

Felten, M. S., Colombi, J.M, Cobb, R.G., & Meyer, D.W. (2018). Multi-objective optimization using parallel simulation for space situational awareness, Journal of Defense Modeling and Simulation Applications, Methodology, Technology. pp 1-33. DOI: 10.1177/1548512918803212.

Refereed Conference Papers Accepted on the Basis of Full Paper Review

Hertwig, Fred D., Colombi, John M., Cobb, Richard G. and David W. Meyer (2019). Search-Based vs. Task-Based Space Surveillance for Ground-Based Telescopes. Advanced Maui Optical and Space Surveillance Technologies Conference (AMOS). Maui, HI (17-19 September, 2019).

COOPER, CASEY W., Maj
Assistant Professor of Industrial Hygiene, Department of Systems Engineering and Management; AFIT Appointment Date: 2019 (AFIT/ENV); BS, Environmental Engineering, United States Air Force Academy, 2004; MBA, Tennessee Technological University, 2010, MS Environmental Engineering and Science, Air Force Institute of Technology, 2010; PhD, Occupational and Environmental Health, University of Oklahoma Health Science Center, 2019. Dr. Cooper's research interests include bioterrorism, bio aerosols, aerosol science, industrial hygiene, CBRN countermeasures, health physics, radiation, healthcare acquired infections Tel. (937) 255-3636 x4511, email: casey.cooper@afit.edu

Sponsor Funded Research Projects

"Evaluation of a Small Un-Manned Aerial System (SUAS) Air Sampler for the Collection of Biological Agents." Sponsor: 711 HPW/FESS. Funding: $32,000 - Cooper 80%, Slagley 20%. [ANT]

Refereed Journal Publications

Cooper, Casey W., et al. "Comparison and Evaluation of a High Volume Air Sampling System for the collection of Clostridioides difficile Endospore Aerosol in Healthcare Environments." American Journal of Infection Control (2020).

Burdsall, Adam C., Yun Xing, Casey W. Cooper, and Willie F. Harper Jr. "Bio aerosol emissions from activated sludge basins: Characterization, release, and attenuation." Science of the Total Environment (2020): 141852.

Refereed Conference Papers Accepted on the Basis of Abstract Review

Improved Occupational & Environmental Exposure Monitoring – Laboratory Demonstration of a Military High-Volume Air Sampling System in the Collection of Clostridium difficile Spore Aerosol. Military Health Systems Research Symposium, 2020 (Online only due to Covid-19)

Other Significant Research Productivity

2 Master's thesis committee member

COX, AMY M., Lt Col
Assistant Professor of Systems Engineering**,** Department of Systems Engineering and Management, AFIT Appointment Date: 2016 (AFIT/ENV); BS, Mechanical Engineering, University of Cincinnati, 1997; MS, Space Operations, Air Force Institute of Technology, 1999; AA French, Presidio of Monterey, 2005; Brevet, Flight Test Engineering, École du Personnel Navigant d'Essais et de Réception, 2006, PhD, Systems Engineering, George Washington University, 2017. Lt Col Cox's research interests include flexible design, system architecture, user innovation and open innovation. Tel. (937) 255-3636 x4352, email: Amy.Cox@afit.edu

Sponsor Funded Research Projects

"West Africa Logistics Network (WALN)." Sponsor: USAFRICOM. Funding: $24,500 - Cox 50%, Breitbach 50%.

DELORIT, JUSTIN D., Maj
Assistant Professor of Engineering Management, Department of Systems Engineering and Management; AFIT Appointment Date: 2019 (AFIT/ENV); BS, Civil Engineering, Michigan Technological University, 2005; MS, Air Force Institute of Technology, 2012, PhD, Civil and Environmental Engineering, University of Wisconsin-Madison, 2018. Maj Delorit's research interests include installation resilience, decision-making under risk and uncertainty, applied forecasting, engineering economics, and water resources planning and management. Tel. (937) 255-3636 x4648, email: Justin.Delorit@afit.edu

Refereed Conference Papers Accepted on the Basis of Full Paper Review

Cooper, C., Aithinne, K., Floyd, E. Johnson, D. (2019) A Comparison of Air Sampling Methods for Clostridium difficile Endospore Aerosol. Aerobiologia, 35(3): 411-420.

Aithinne, K., Cooper C., Lynch, R., Johnson, D. (2018) Toilet Plume Aerosol Generation Rate and Environmental Contamination Following Bowl Water Inoculation with Clostridium difficile spore. American Journal of Infection Control, 47(5): 515-520.

ELSHAW, JOHN J.
Assistant Professor of Systems Engineering, Department of Systems Engineering and Management; AFIT Appointment Date: 2013 (AFIT/ENV); BS, Accounting, University of Akron, 1991; MBA, Regis University, 1996, PhD, Krannert School of Management, Purdue University, 2010. Dr. Elshaw's research interests include organizational behavior, trust, leadership, human resource management, organizational causes of high-consequence errors, technology impact on individual and group behavior, social network analysis, cognition and emotions, organizational climate and culture, psychological influences on foreign audiences, cross-cultural leadership and communication, and hierarchical linear modeling. Tel. (937) 255-3636 x4650, email: John.Elshaw@afit.edu

Refereed Journal Publications

Elshaw, John J., Fass, Robert D., & Mauntel, Brian R.* (2018). Cognitive Mentorship: Protégé Behavior as a Mediator to Performance. Mentoring & Tutoring: Partnership in Learning, 26:4, 358-376.

Guinn, V.*, Langhals, B. & Elshaw, J. (2018). Evaluating Smartphones for Infrastructure Work Order Management. International Association of Online Engineering. Retrieved June 24, 2019 from https://www.learntechlib.org/p/207202/.

Gay, C., Horowitz, B., Elshaw, J. J., Bobko, P., & Kim, I. (2019). Operator Suspicion and Human-Machine Team Performance under Mission Scenarios of Unmanned Ground Vehicle Operation. IEEE Access, PP (99):1-1, 25 Feb 19.

Refereed Conference Papers Accepted on the Basis of Full Paper Review

Maestas, B.*#, Elshaw, J., Hoisington, A., & Ohlemacher, D. (2018) Defining Success in Air Force Infrastructure Asset Management Through Use of the Delphi Technique. The 13th World Congress on Engineering Asset Management, Stavanger Norway, (September 25, 2018).

Other Significant Research Productivity

Baker, J.*#, Ritschel, J. D., Elshaw, J. J., & Koschnick, C. (2019). Decision Support Panel Discussion. International Cost Estimation & Analysis Association (ICEAA) Dayton Chapter, AFIT Thesis Presentations: March 2019.

ENINGER, ROBERT M., Lt Col
Assistant Professor of Industrial Hygiene, AFIT Appointment Date: 2015 (AFIT/ENV); BS, Civil and Environmental Engineering, United States Air Force Academy, 1995; MS, Civil Engineering, University of Texas-San Antonio, 2000; MS, Health Science, Purdue University, 2002; PhD, Environmental Health, University of Cincinnati, 2008. Lt Col Eninger's research interests include aerosol science, exposure assessment, and respiratory protective devices.
email: Robert.Eninger@afit.edu

Refereed Journal Publications

Trawick, J., Slagley, J., Eninger R. (2019). Occupational Noise Dose Reduction via Behavior Modification Using In-Ear Dosimetry among United States Air Force Personnel Exposed to Continuous and Impulse Noise. Open Journal of Safety Science and Technology, 09 (2) 61 – 81.

Aurell, J., Barmes, M., Gullett, B., Holder, A., Eninger, R. Methodology for characterizing Emissions from small (0.5-2 MTD) batch-fed gasification systems using multiple waste compounds (2019) Waste Management, 87, pp398-406.

FASS, ROBERT D.
Assistant Professor of Systems Integration and Cost Analysis, Department of Systems Engineering and Management, AFIT Appointment Date: 2015 (AFIT/ENV); BA Economics, University of New Mexico, 1989; MBA, University of New Mexico, 1993, PhD, Business Administration and Management, New Mexico State University, 2008. Dr. Fass's research interests include cost analysis, decision analysis, risk analysis, operations research, behavioral economics, organizational behavior, organizational change, and government acquisition policy.
Tel. (937) 255-3636 x4388, email: Robert.Fass@afit.edu

Sponsor Funded Research Projects

"Pollution Prevention Cost Analysis." Sponsor: HQ AFMC. Funding: $13,000 - Fass 60%, Ritschel 20%, Elshaw 20%.

Refereed Journal Publications

Brown, M.J.*, Fass, R.D., and Ritschel, J.D. (2019). "A Case for Open Mission Systems in DOD Aircraft Avionics," *Air and Space Power Journal*, 33(4): 83-93.

Other Significant Research Productivity

Fass, R. David (2019). Keynote Speech/Workshop Leader. Ohio Career Development Association, National Career Development Month Event. Columbus, OH.

FELKER, DANIEL L.
Chemist GS-11, Department of Systems Engineering and Management, Appointment Date: 2006 (AFIT/ENV); PhD, Analytical Chemistry, Kansas State University, 2005, served in the United States Army from Dec 1986 to Aug 1997. Current research interests include: X-ray photoelectron spectroscopy of thin film surfaces with a focus on the surface absorption organophosphates; modeling the absorbent properties of nano-particles for remediation of toxic compounds; the mechanism of thermodeactivation of Bacillus Anthracis Spores; electrochemical biosensors for the detection of organophosphates; and environmental chemistry of wetlands. Tel. (937) 255-3636 x7410,
Email: Daniel.Felker@afit.edu

FORD, THOMAS C.
Assistant Professor of Systems Engineering**,** Department of Systems Engineering and Management (through Integrity Applications, Inc.), AFIT Appointment Date: 2014 (AFIT/ENV); BS, Electrical Engineering, Brigham Young University, 1994; BA, Chinese, Brigham Young University, 1994; MS, Engineering, Wright State University, 1998; PhD, Systems Engineering, Air Force Institute of Technology, 2008. Lt Col Ford's research interests include interoperability, resiliency, and system architecting. Tel. (937) 255-3636 x4747, email: Thomas.Ford@afit.edu

FREELS, JASON K., Maj
Assistant Professor of Systems Engineering, Department of Systems Engineering and Management, AFIT Appointment Date: 2013 (AFIT/ENV); BS, Auburn University, 2000; MS, Air Force Institute of Technology, 2006; PhD, Systems Engineering, Air Force Institute of Technology, 2013. Maj Freels' research interests include reliability growth testing, accelerated life testing, accelerated degradation testing, and competing risk analysis.
Tel. (937) 255-3636 x4676, email: Jason.Freels@afit.edu

GRIMAILA, MICHAEL R.
Professor and Head, Department of Systems Engineering and Management, AFIT Appointment Date: 2004 (AFIT/ENV); BS, Texas A&M University, 1993; MS, Texas A&M University, 1995; PhD, Computer Engineering, Texas A&M University, 1999. Dr. Grimaila's research interests include modeling and simulation, network management and security, quantum cryptography, quantum networking, and systems engineering. He is a member of the ACM, a Senior Member of the IEEE, and a Fellow of the ISSA. AFIT research center affiliation(s): [CCR] and [CSRA.] Tel. (937) 255-3636 x4800, email: Michael.Grimaila@afit.edu

Sponsor Funded Research Projects

"Modeling and Simulation of Quantum Networks." Sponsor: NSA. Funding: $100,000 - Grimaila 50%, Hodson 50%.

Refereed Journal Publications

Engle, R., Langhals, B. T., Grimaila, M. R., Hodson, D., "Evaluation Criteria for Selecting NoSQL Databases in a Single-Box Environment," International Journal of Database Management Systems, Vol 10, No 4, August 2018.

Span, M.T., Mailloux, L.O., Grimaila, M.R., "Cybersecurity Architectural Analysis for Complex Cyber-Physical Systems," The Cyber Defense Review, Army Cyber Institute, Vol. 3, No. 2, pp. 115-134, August 2018.

Okolica, J.S., Peterson, G., Mills, R.F., and Grimaila, M.R., "Sequence Pattern Mining with Variables," IEEE Transactions on Knowledge and Data Engineering, pp. 1-20, 19 November 2018, DOI: 10.1109/TKDE.2018.2881675.

Refereed Conference Papers Accepted on the Basis of Full Paper Review

Engle, D.L., Langhals, B.T., Grimaila, M.R., Hodson, D.D., "The Case for NoSQL on a Single Desktop," 17th International Conference on Information & Knowledge Engineering, July 30-August 2, 2018.

Refereed Conference Papers Accepted on the Basis of Abstract Review

Sigala, A., Langhals, B. T., Grimaila, M. R., Hodson, D., "USAF Applications of Unmanned Aerial Systems (UAS): A Delphi Study to Examine Current and Future UAS Autonomous Mission Capabilities" Proceedings of the 44th Dayton-Cincinnati Aerospace Sciences Symposium, Dayton, OH, March 5, 2019.

Editorships in Professional Journals

Editorial Board of Information System Security Association (ISSA) Journal.

Assistant Editor, the Defense Cyber Review, Army Cyber Institute, West Point.

HARPER, WILLIE F.,
Professor of Engineering and Environmental Management, Department of Systems Engineering and Management, AFIT Appointment Date: 2012 (AFIT/ENV); BS, Civil Engineering, University of California, Los Angeles, 1992; MENG, Civil and Environmental Engineering, Cornell University, 1993; PhD, Civil and Environmental Engineering, University of California, Berkeley, 2002. Dr. Harper's research interests include water quality, with a focus on environmental biotechnology, advanced oxidation, and sensing. Tel. (937) 255-3636 x4528,
email: Willie.Harper@afit.edu

Sponsor Funded Research Projects

"Sequencing Batch Reactors (SBR) for Fate of Bacillus Spores in Wastewater: Follow-on investigations." Sponsor: EPA. Funding: $80,595 - Harper 100%.

Refereed Journal Publications

Yun Xing, Ashlee Ellis, Matthew Magnuson, Willie F. Harper, Jr. (2019). Adsorption of bacteriophage MS2 to colloids: kinetics and particle interactions. Colloids and Surfaces A: Physicochemical and Engineering Aspects. Accepted (COLSUA-D-19-02383R1).

Sudarshan Kurwadkar, Timothy V Hoang, Kailas Malwade, Sushil Kanel, Willie F. Harper, Jr., Garrett Struckhoff. (2019). Application of Carbon Nanotubes for Removal of Emerging Contaminants of Concern in Engineered Water and Wastewater Treatment Systems. Nanotechnology for Environmental Engineering, 4(1), 12-27.

Mbonimpa, E., Blatchley, E., Applegate, B., and Harper, W. (2018). Ultraviolet A and B wavelength-dependent inactivation of viruses and bacteria in the water. Journal of Water and Health, Vol. 16 (5), 796-806.

Other Significant Research Productivity

"Addendum: The fate of emerging bio-contaminants in biological wastewater systems," US Environmental Protection Agency National Homeland Security Research Center, P.I., Jan 2020 – Mar 2021, $78,000 total awarded to AFIT.

"Advanced treatment of secondary wastewater effluents with ultraviolet light-emitting diodes," Ohio Water Development Authority, P.I., Jan 2020 – Dec 2020, $63,333 total awarded to AFIT.

HOISINGTON, ANDREW J., Lt Col

Assistant Professor and Curriculum Chair of Engineering Management**,** Department of Systems Engineering and Management, AFIT Appointment Date: 2017 (AFIT/ENV); BS, Civil Engineering, University of Michigan Ann Arbor 2001; MS, Environmental Engineering, University of Texas, Austin, 2007; PhD, Environmental Engineering, University of Texas, Austin 2013. Lt Col Hoisington's research interests include air quality in the built environment, microbiome of the built environment, and air quality or microbiome factors that influence mental health.
Tel. (937) 255-3636 x4826, email: Andrew.Hoisington@afit.edu

Refereed Journal Publications

Beemer CJ*, Stearns-Yoder K, Schuldt SJ, Kinney KA, Lowry CA, Postolache TT, Brenner LA, Hoisington AJ. (2019). "A brief review on mental health for select elements of the built environment," *Indoor and Built Environment*, accepted for publication.

Thomsen N[*], Wagner T, Hoisington A, Schuldt S. (2019). "A sustainable prototype for renewable energy: optimized prime-power generator solar array replacement," *International Journal of Energy Production and Management*, 4(1), 28-39, DOI https://doi.org/10.2495/EQ-V4-N1-28-39.

Hoisington AJ, Stearns-Yoder KA[3], Schuldt SJ[2], Beemer CJ*, Kinney KA[3], Postolache TT[3], Lowry CA[3], Brenner LA.[3] (2019). "Ten questions concerning the built environment and mental health," *Building and Environment*, 155, 58-69, DOI https://doi.org/10.1016/j.buildenv.2019.03.036.

Corona CC, Zhang M, Wadhawan A, Daue ML, Groer MW, Dagdag A, Lowry CA, Hoisington AJ, Ryan KA, Stiller JW, Fuchs D, Mitchell BD, Postolache TT. (2019). "Toxoplasma gondii IgG associations with sleepwake problems, sleep duration and timing," *Pteridines*, 30(1), 1-9, DOI https://doi.org/10.1515/pteridines-2019-0001.

Sharma A, Richardson M, Cralle L, Stamper C*, Maestre JP, Stearns-Yoder K, Bates K, Kinney K, Brenner L, Lowry C, Gilbert J, Hoisington A. (2018) "Longitudinal assessment of the influence of lifestyle homogenization on the microbiome in a cohort of United States Air Force Cadets," *Microbiome* 7(70), 1-17, DOI https://doi.org/10.1186/s40168-019-0686-6.

Brenner LA, Hoisington AJ, Stearns KE, Stamper C*, Heinz J, Postolache TT, Hoffmire C, Stanislawski M, Lowry CA. (2018). "Military-related exposures, normal physiology, dysbiosis, and disease: the United States-Veteran Microbiome Project (US-VMP)," *Frontiers in Cellular and Infection Microbiology*, 8, 400 DOI https://doi.org/10.3389/fcimb.2018.00400.

Refereed Conference Papers Accepted on the Basis of Full Paper Review

Spranger Z*, Ellis A*, Beemer C*, Plourde T[*], Jordan R*, Hoisington A. (2019). "Lessons learned in development of a model to reduce lifecycle costs for infrastructure assets," Full conference paper accepted at *2019 World Congress on Resilience, Reliability, and Asset Management*, Singapore, Jul 27 – Aug 1 2019.

Moore B*, Schuldt S, Hoisington A. (2019). "Transportation infrastructure performance: A systematic review of transportation performance assessments," Full conference paper accepted at *2019 World Congress on Resilience, Reliability, and Asset Management*, Singapore, Jul 27 – Aug 1 2019.

Refereed Conference Papers Accepted on the Basis of Abstract Review

Brenner LA, Stearns-Yoder KA, Forster JE, Hoisington AJ, Stamper CE, Postolache TT, Lowry CA. (2019) "Biological signature of an immunomodulatory probiotic intervention for Veterans with mild TBI and PTSD," Oral presentation at *2019 Tri-Services Microbiome Consortium Symposium,* Dayton OH, Oct 22-24 2019.

Sharma A, Stamper CE, Maestre JP, Stearns-Yoder KA, Bates KL, Postolache TT, Kinney KA, Brenner LA, Lowry CA, Gilbert JA, Hoisington AJ. (2019), "The microbiome of the built environment, an overview of what we know and what we hope to learn from it," Oral presentation at *2019 Tri-Services Microbiome Consortium Symposium*, Dayton OH, Oct 22-24 2019.

Taylor W*, Hoisington AJ. (2019). "The connection between indoor air quality and mental health outcomes," Poster to be presented at *2019 Tri-Services Microbiome Consortium Symposium*, Dayton OH, Oct 22-24 2019.

Kohl NT*, Hoisington AJ. (2019). "How the built environment can influence an individual's mental health," Poster to be presented at *2019 Tri-Services Microbiome Consortium Symposium*, Dayton OH, Oct 22-24 2019.

Leonard D*, Hoisington AJ. (2019), "Detection and quantification of immunomodulatory bacterial species important to health and performance," Poster to be presented at *2019 Tri-Services Microbiome Consortium Symposium*, Dayton OH, Oct 22-24 2019.

Stamper C, Hoisington A, Heinze J, Postolache T, Hadidi D, Hoffmire C, Stanislawski M, Lowry C, Brenner L. (2019) "Military-related exposures and the microbiome, the United States Veteran Microbiome Project (US-VMP)," Poster to be presented at *Neuroscience 2019*, Chicago IL, October 19-23 2019.

Brenner LA, Stearns-Yoder KA, Forster JE, Hoisington AJ, Stamper CE, Postolache TT, Lowry CA. (2019) "Biological signature of an immunomodulatory probiotic intervention for Veterans with mild TBI and PTSD," poster to be presented at *Neuroscience 2019*, Chicago IL, October 19-23 2019.

Leonard D*, Hoisington AJ. (2019), "Detection and quantification of immunomodulatory bacterial species important to health and performance," Poster presentation at *Military Health System Research Symposium*, Kissimmee FL, August 19-22 2019.

Sharma A, Stamper CE, Maestre JP, Stearns-Yoder KA, Bates KL, Postolache TT, Kinney KA, Brenner LA, Lowry CA, Gilbert JA, Hoisington AJ. (2019), "The microbiome of occupant's and the built environment at the United States Air Force Academy," Oral presentation at *Military Health System Research Symposium*, Kissimmee FL, August 19-22 2019.

Taylor W*, Hoisington AJ. (2019). "The connection between indoor air quality and mental health outcomes," Poster presentation at *ISES ISIAQ 2019*, Kaunas Lithuania, August 18-22 2019.

Kohl NT*, Hoisington AJ. (2019). "How the built environment can influence an individual's mental health," Poster presentation at *ISES ISIAQ 2019*, Kaunas Lithuania, August 18-22 2019.

Hernandez N*, Hoisington AJ. (2019) "Modification of the Air Force Base's Plant Replacement Value due to Hurricane Intensities," Poster presentation at *Enterprise and Infrastructure Resilience Workshop*, Cincinnati OH, Aug 12-13 2019.

Spencer R*, Hoisington A. (2019). "Integration of risk assessment techniques within business continuity management of civil infrastructure," Poster presentation at *Enterprise and Infrastructure Resilience Workshop*, Cincinnati OH, Aug 12-13 2019.

Spranger Z.*, Ellis A.*, Beemer C.*, Plourde T.*, Jordan R.*, Hoisington A. (2019). "Lessons learned in development of a model to reduce lifecycle costs for infrastructure assets," Oral presentation at *2019 World Congress on Resilience, Reliability, and Asset Management*, Singapore, Jul 27 – Aug 1 2019.

Moore B.*, Schuldt S., Hoisington A. (2019). "Transportation infrastructure performance: A systematic review of transportation performance assessments," Oral presentation at *2019 World Congress on Resilience, Reliability, and Asset Management*, Singapore, Jul 27 – Aug 1 2019.

Sharma A, Richardson M, Cralle L, Stamper C*, Maestre JP, Stearns-Yoder K, Bates K, Kinney K, Brenner L, Lowry C, Gilbert J, Hoisington A. (2018) "Longitudinal assessment of the influence of lifestyle homogenization on the microbiome in a cohort of United States Air Force Cadets," Oral presentation at *FEMS 2019*, Glasgow Scotland, July 7-11 2019.

Yip A.*, Hoisington A. (2019). "Efficiently altering a base community to improve physical health in the Air Force," Oral presentation at *Air Force Civil Engineering 2018 Community Planning Symposium*, San Antonio TX, Jun 24-26 2019.

Postolache TT, Corona CC, Zhang M, Wadhawan A, Daue ML, Groer MW, Dagdag A, Lowry CA, Hoisington AJ, Brenner LA, Ryan K, Stiller JW, Fuchs D, Mitchell BM. (2019) "Sleep duration and timing in relationship to *Toxoplasma gondii* IgG seropositivity and serointensity". Oral presentation at *38th International Winter-Workshop on Clinical, Chemical and Biochemical Aspects of Pteridines and Related Topics*, Vienna Austria, Feb 26 – Mar 1 2019, DOI https://doi.org/10.1093/sleep/zsz067.060.

Hoisington A, Lowry C, Stearns-Yoder K, Brenner L, Postolache T. (2018) "Biological signature of an immunomodulatory probiotic intervention for Veterans with mild TBI & PTSD," *Archives of Physical Medicine and Rehabilitation*, 99 (11), e130, Nov 2018, DOI https://doi.org/10.1016/j.apmr.2018.08.008.

Hoisington A, Lowry C, Stamper C, Henize J, Stearns-Yoder K, Brenner L. (2018) "Veteran microbiome and the application for those with TBI and co-occurring mental health conditions," *Archives of Physical Medicine and Rehabilitation*, 99 (11), e152, Nov 2018, DOI https://doi.org/10.1016/j.apmr.2018.08.074.

Other Significant Research Productivity

Hoisington A. (2019). "Altering the Microbiome for Improved Mental Health Outcomes – Exploring the premise, the progress, and the problems," Invited presentation to University of Leeds, Leeds England, Jul 16 2019.

Hoisington A. (2019). "Altering the Microbiome for Improved Mental Health Outcomes – Exploring the premise, the progress, and the problems," Invited presentation to St. Elizabeth Hospital and University of Maryland Baltimore, Washington DC, Jan 22 2019.

Hoisington A. (2019). "Understanding microbiome papers through data analysis and figure interpretation," Invited presentation to St. Elizabeth Hospital and University of Maryland Baltimore, Washington DC, Jan 22 2019.

Hoisington A. (2018). "Altering the Microbiome for Improved Mental Health Outcomes – Exploring the premise, the progress, and the problems," Invited presentation to Ohio State University Graduate School of Public Health, Columbus OH, Oct 22 2018.

JACQUES, DAVID R.
Professor of Systems Engineering, Department of Systems Engineering and Management, AFIT Appointment Date: 2017 (AFIT/ENV); BS, Mechanical Engineering, Lehigh University, 1983; MS, Aeronautical Engineering, AFIT, 1989; PhD, Aeronautical Engineering, AFIT, 1995. Dr. Jacques' research interests include development planning, architecture based evaluation, multi-objective or constrained optimal design, and cooperative behavior and control of autonomous vehicles. AFIT research center affiliation(s): [ANT] and [CSRA] Tel. (937) 255-3636 x3329, email: David.Jacques@afit.edu

Sponsor Funded Research Projects

"Measurement of Drag Savings Associated with Variable Camber Controlled Wing." Sponsor: AFRL/RQ. Funding: $28,000 - Jacques 80%, Cox 20%. [NEAT]

"Digital Engineering for Cooperative and Autonomous Munition Concept Evaluation." Sponsor: AFRL/RW. Funding: $10,000 - Jacques 100%. [ANT]

KOSCHNICK, CLAY M., Lt Col
Assistant Professor of Systems Engineering, Department of Systems Engineering and Management, AFIT Appointment Date: 2015 (AFIT/ENV); BS, United States Air Force Academy, 1998; MS, Georgia Institute of Technology, 2007; PhD, University of Florida, 2012. Lt Col Koschnick's research interests include engineering economy, decision analysis, and econometrics. Tel (937) 255-3636 x4638, email: Clay.Koschnick@afit.edu

Refereed Journal Publications

Clay Koschnick & Joseph C. Hartman (2019) Using performance-based warranties to influence consumer purchase decisions, The Engineering Economist, DOI: 10.1080/0013791X.2019.1642430.

Hines, P.A., Wagner, T.J., Koschnick, C.M., and Schuldt S.J. (2019). Analyzing the Efficiency of Horizontal Photovoltaic Cells in Various Climate Regions, Journal of Energy and Natural Resources, Vol. 8, Issue 1-2, 77-86.

Refereed Conference Papers Accepted on the Basis of Abstract Review

Kelly, Patrick. Colombi, John M., Koschnick, Clay M., Freels, Jason R. (2019). Methodology for Including Base Infrastructure in Conceptual Systems Analysis, 87th Military Operations Research Society Symposium, 17-20 June 2019, USAFA US Air Force Academy, CO, Presentation ID: 43324.

Other Significant Research Productivity

O'Connor, Sara K., Drylie, Scott T., Fass, R. David, White, Edward D., Koschnick, Clay M. (2019). An Analysis of Contractor Profit Margin Percentages. International Cost Estimation & Analysis Association (ICEAA) Dayton Chapter, AFIT Thesis Presentations: 19 March 2019.

KRISTBAUM, JOSEPH P., Maj
Assistant Professor of Systems Engineering, Department of Systems Engineering and Management,
AFIT Appointment Date: 2019 (AFIT/ENV); BS, Marquette University, 2007; MS, Oklahoma State University, 2013; PhD, Wright State University, 2019. Maj Kristbaum's research interests include organizational behavior, optimization, and judgement and decision making. Tel (937) 255-3636 x4520, email: Joseph.Kristbaum@afit.edu

Refereed Journal Publications (in revision)

Kristbaum, J., Ciarallo, F.W. (2019). Reducing Preference Bias through Information Presentation Mode: A Supporting Case for Numerical Anchoring. *European Journal of Decision Processes*.

LANGHALS, BRENT T.
Assistant Professor of Information Resource Management, Department of Systems Engineering and Management, AFIT Appointment Date: 2016 (AFIT/ENV); BS, United States Air Force Academy, 1995; MS, Air Force Institute of Technology, 2001; PhD, University of Arizona, 2011. Dr. Langhals' research interests include Data Analytics, "Big Data," Data Management, Human-Computer Interfaces, and Systems Engineering. Tel (937) 255-3636 x7402, email: Brent.Langhals@afit.edu

Sponsor Funded Research Projects

"Modernizing Database Architectures in Support of Dynamic Data Driven Application Systems." Sponsor: AFOSR. Funding: $59,709 - Langhals 40%, Hodson 40%, Grimaila 20%.

Refereed Journal Publications

Stout, T.*, Teston, A.*, Langhals, B.T., Delorit, J., Hendrix, C., Schuldt, S. (2020). *United States Department of Defense (DOD) Real Property Repair, Alterations, Maintenance, and Construction Project Contract Data: 2009--20219*. Elsevier: Data in Brief, Vol 32, October 2020

Sigala, A.*, Langhals, B.T. (2020). *Applications of Unmanned Aerial Systems (UAS): A Delphi Study Projecting Future UAS Missions and Relevant Challenges*, DRONES, Vol 4, Issue 1, 8.

Refereed Conference Papers Accepted on the Basis of Full Paper Review

Yavuz, A.*, Darville, J*. Celik, N., Xu, J., Chen, C. H., Langhals, B.T., Engle, R. "Advancing Self-healing Capabilities in Interconnected Micgrogrids via DDDAS with Relational Database Management." Proceedings of the INFORMS Winter Simulation Conference, Orlando, FL, Dec 13-16, 2020. (ACCEPTED)

Miller, J. R.*, Engle, R.D.L., Langhals, B.T., Grimaila, M. R., Hodson, D., "Modeling Unmanned Aircraft System Maintenance Using Agile Model-Based Systems Engineering." Proceedings of the 18th International Conference on Information and Knowledge Engineering, Las Vegas, NV, July 26 – August 1, 2020

Dimaapi, M. D.*, Engle, R.D.L., Langhals, B.T., Grimaila, M. R., Hodson, D., "A Dynamic Data and Information Processing Model for Unmanned Aircraft Systems." Proceedings of the 18th International Conference on Information and Knowledge Engineering, Las Vegas, NV, July 26 – August 1, 2020.

Other Significant Research Productivity

Langhals, B.T. (2020) Developing Data Architectures for Modern Dynamic Data and Information Processing, Invited Speaker, INFORMS Annual Conference, November 13, 2020.

Langhals, B.T. (2020) Modernizing Database Architectures in Support of Dynamic Data Driven Application Systems (DDDAS), Invited Speaker, University of Miami – Dept. of Systems and Industrial Engineering, Feb, 2020.

Langhals, B.T. (2019) Modernizing Database Architectures in Support of Dynamic Data Driven Application Systems, AFOSR Grant 18RT0095, PI Report Sep 2019.

LONG, DAVID S.
Assistant Professor of Systems Engineering (through SRISY), Department of Systems Engineering and Management, AFIT Appointment Date: 2016 (AFIT/ENV); BS, Industrial Engineering & Management, North Dakota State University, 1988; MS, Engineering, California State University Northridge; PhD, Engineering Systems, Massachusetts Institute of Technology, 2012. Dr. Long research interests include systems of systems, open systems architecture, model based systems engineering, wicked problems, human machine interfaces, automation and autonomy. Tel. (937) 255-3636 x4390, email: David.Long.ctr@afit.edu

MBONIMPA, ERIC G.
Assistant Professor of Engineering and Environmental Management, Department of Systems Engineering and Management, AFIT Appointment Date: 2014 (AFIT/ENV); BS, Civil Engineering, Kigali Institute of Science and Technology, 2004; MS, Environmental Engineering, University of Missouri-Columbia, 2007; PhD, Environmental Engineering, Purdue University, 2010. Dr. Mbonimpa's research interests include environmental sustainability, life cycle assessment, fate and transport of contaminants and water quality. Tel. (937) 255-3636 x7405, email: Eric.Mbonimpa@afit.edu

Refereed Journal Publications

Emery I., D. Kempisty, B. Fain*, E. Mbonimpa. Evaluation of treatment options for potable water impacted with perfluorinated alkyl substances using life cycle assessment" International Journal of Life Cycle Assessment 24, no. 1 (2019): 117-128

Mbonimpa E., E. Blatchley, B. Applegate, W. Harper. Ultraviolet A and B wavelength-dependent inactivation of viruses and bacteria in the water. Journal of Water and Health 16, no. 5 (2018): 796-806

Refereed Conference Papers Accepted on the Basis of Abstract Review

Jordan*, R., E. Mbonimpa. Fate And Transport Modeling of Perfluoroalkyl Substances (PFAS) in Groundwater from Aqueous Film Forming Foam (AFFF) Impacted Sites. SAME - Society of American Military Engineers, WPAFB, OH. February 14th, 2019

Glass*, J., E. Mbonimpa. Toxicity Impact Assessment of PFOS and PFOA. Water Management Association of Ohio (WMAO) conference, Cincinnati, Oct 31, 2018.

Jordan*, R., E. Mbonimpa. PFAS Fate and Transport Modeling Using Numeric and Analytic Models. Water Management Association of Ohio (WMAO) conference, Cincinnati, Oct 31, 2018.

MCGUIRL, JOHN M.
Assistant Professor of Systems Engineering (through Integrity Applications Incorporated), AFIT Appointment Date: 2018 (AFIT/ENV); BS, Electrical Engineering, University of Massachusetts, 1990; MS, Industrial and Systems Engineering, The Ohio State University, 2002; PhD, Industrial and Systems Engineering, The Ohio State University, 2008. Dr. McGuirl's research interests include Cognitive Systems, Human-Machine Teaming, Resilience Engineering, and System Dynamics. Tel. (937) 255-3636 x4747, email: John.McGuirl.ctr@afit.edu

Refereed Journal Publications

Miller, M.E., McGuirl, J.M., Schneider, M.F. and Ford, T.C. (2020). A Language and Method to Permit Modeling of Human-Agent Teams, *Systems Engineering*, *23(5),* 519-533. https://onlinelibrary.wiley.com/doi/abs/10.1002/sys.21546.

MILLER, MICHAEL E.
Professor of Systems Engineering, Department of Systems Engineering and Management, AFIT Appointment Date: 2010 (AFIT/ENV); BS, Ohio University, 1987; MS, Ohio University, 1989; PhD, Industrial and Systems Engineering, Virginia Tech., 1993. Dr. Miller's research interests include Human Systems Integration, Human-Automated Agent Interaction, and Application of Human Vision to Display, and Lighting Design. AFIT research center affiliation(s): [ANT.] Tel. (937) 255-3636 x4651, email: Michael.Miller@afit.edu

Sponsor Funded Research Projects

"Maintaining Human-Machine Shared Awareness in Distributed Operations with Degraded Communications." Sponsor: NextGen. Funding: $22,500 - Miller 100%. [ANT]

"Maintaining Human-Machine Shared Awareness in Distributed Operations with Degraded Communications." Sponsor: NextGen. Funding: $22,500 - Miller 100%. [ANT]

Refereed Journal Publications

Miller, M.E., Gerhardt, J., Yoo, H, and Akhavan, T. (2020). Model for Assessing Organic Light Emitting Diode Display Lifetime across Applications, *Journal of the Society for Information Display, 28(7),* 629-640. https://doi.org/10.1002/jsid.858

Geiselman, E.E., Heft, E., and Miller, M.E. (2020). Development and validation of a secondary task environment for assessing visual-psychomotor tasks, *Theoretical Issues in Ergonomics Science, 21(6),* 709-727. https://doi.org/10.1080/1463922X.2020.1729445.

Johnson, C., Miller, M.E., Rusnock, C.F. and Jacques, D.J. (2020). Applying Control Abstraction to the Design of Human-Agent Teams, *Systems*. https://www.mdpi.com/2079-8954/8/2/10. [ANT]

Miller, M.E., McGuirl, J.M., Schneider, M.F. and Ford, T.C. (2020). A Language and Method to Permit Modeling of Human-Agent Teams, *Systems Engineering*, *23(5),* 519-533. https://onlinelibrary.wiley.com/doi/abs/10.1002/sys.21546. [ANT]

Bindewald, J.M., Miller, M. E., and Peterson, G.L., "Creating Effective Automation to Maintain Explicit User Engagement," *International Journal of Human-Computer Interaction*, Vol. 36, Issue 4, July 2019.

Refereed Conference Papers Accepted on the Basis of Full Paper Review

Schneider, M.F., Miller, M.E. and McGuirl, J. (2020) Tracking Operator Intent in Tactical Operations, Proceedings of the IEEE International Conference on Systems, Man, and Cybernetics, Online. [ANT]

Andrews, J.M., Rusnock, C.F., Miller, M.E. and Meador, D.P. (2020) Simulation-Based Evaluation of the Effects of Varying Degrees of Control Abstraction for Manned-Unmanned Teaming on Mental Workload of Pilots, Proceedings of the IEEE International Conference on Systems, Man, and Cybernetics, Online. [ANT]

Editorships in Professional Journals

Miller, M.E. and Rusnock, C.F. (2020) Special Issue "Human Factors in Systems Engineering," *Systems*, https://www.mdpi.com/journal/systems/special_issues/HF_SE .

Patent Applications

Canzonetta, D.J., Schneider, M.F., Miller, M.E. (May 2020), Interactive Artificial Intelligence System with Adaptive Timing, Patent Application. [ANT]

Miller, M.E., Stephens, C.I., Kennedy, K.D., Pope, A.T., Borghetti, B. (Sept 2020), Display System Interface using Visually-Evoked Cortical Potentials, Patent Application.

REITH, MARK G.
Assistant Professor of Cyber Systems, Department of Systems Engineering and Management, AFIT Appointment Date: 2019 (AFIT/ENV); BS, Computer Science, University of Portland, 1999; MS, Computer Science, Air Force Institute of Technology, 2003; PhD, Computer Science, University of Texas at San Antonio, 2009. Research interests include cyber education, multi-domain operations, dynamic mission mapping, agile software engineering and model-based systems engineering.

Refereed Conference Papers Accepted on the Basis of Full Paper Review

Park, Y., Reith, M. and Mullins, B. (2019) "Operational Risk Assessment on Internet of Things: Mitigating Inherent Vulnerabilities," *18th European Conference on Cyber Warfare & Security*, Coimbra, Portugal.

Newlin, M., Reith, M. and DeYoung, M. (2019) "Synthetic Data Generation with Machine Learning for Network Intrusion Detection Systems," *18th European Conference on Cyber Warfare & Security*, Coimbra, Portugal.

Dukarm, C., Dill, M. and Reith, M. (2019) "Improving Phishing Awareness in the United States Department of Defense," *18th European Conference on Cyber Warfare & Security*, Coimbra, Portugal.

Flack, N. and Reith. (2019) "Self-Directed Learning Tools in USAF Multi-Domain Operations Education," *18th European Conference on Cyber Warfare & Security*, Coimbra, Portugal.

Tomcho, L., Reith, M., Long, D., Coggins, M. and Lin, A. (2019) "Applying Game Elements to Cyber eLearning," *14th International Conference on Cyber Warfare & Security*, Stellenbosch, South Africa.

Martin, S. and Reith, M. (2019) "Rethinking USAF Cyber Education and Training," *14th International Conference on Cyber Warfare & Security*, Stellenbosch, South Africa.

Pendleton, A. and Reith, M. (2019) "Quantifying Cyber Vulnerability Risk in Acquisitions," *14th International Conference on Cyber Warfare & Security*, Stellenbosch, South Africa.

Dillon, P. and Reith M. (2019) "Building Irrefutable Trust throughout Computer Networks using Blockchains," *14th International Conference on Cyber Warfare & Security,* Stellenbosch, South Africa.

RITSCHEL, JONATHAN D.
Assistant Professor of Cost Analysis, Department of Systems Engineering and Management, AFIT Appointment Date: 2011 (AFIT/ENV); BBA, Accountancy, University of Notre Dame, 1997; MS, Cost Analysis, Air Force Institute of Technology, Wright-Patterson AFB, OH, 2003; PhD, Economics, George Mason University, VA, 2011. Dr. Ritschel's research interests include public choice, the effects of acquisition reforms on cost growth in DOD weapon systems, research and development cost estimation, and economic institutional analysis. Tel. (937) 255-3636 x4484, email: Jonathan.Ritschel@afit.edu

Sponsor Funded Research Projects

"Improving Acquisitions in S&T Programs: Creating Unique Cost Factors to Improve Resource Allocation." Sponsor: NPS. Funding: $29,321 - Ritschel 50%, Koschnick 20%, Drylie 20%, and White 10%.

Refereed Journal Publications

Angell, E.E.*, White, E.D., Ritschel, J.D. and Thal, A.E. (2020). "Analysis of Military Construction Cost Growth in USAF Major Defense Acquisition Programs," *Defense Acquisition Research Journal*, 27(2): 168-193. DOI: https://doi.org/10.22594/dau.19-840.27.02

Brown, M.J.*, Fass, R.D., and Ritschel, J.D. (2019). "A Case for Open Mission Systems in DOD Aircraft Avionics," *Air and Space Power Journal*, 33(4): 83-93.

Elworth, C.J.*, White, E.D., Ritschel, J.D., and Brown, G.E. (2019). "Air Force Space Programs: Comparing Estimates to Final Development Budgets," *Defense Acquisition Research Journal,* 26(4): 348-379. DOI: https://doi.org/10.22594/dau.19-828.26.04

Kim, D.B.*, White, E.D., Ritschel, J.D., and Millette, C.A. (2019). "Reliability of Estimates at Completion for Department of Defense Contracts," *Journal of Public Procurement*, 19(3): 186-200. DOI: https://doi.org/10.1108/JOPP-02-2018-0006

Ritschel, J.D., Ritschel, T.L., and York, N. (2019). "Providing a Piece of the Puzzle: Insights into the Aircraft Availability Conundrum," *Journal of Defense Analytics and Logistics,* 3(1): 29-40. DOI: https://doi.org/10.1108/JDAL-09-2018-0015

Refereed Conference Papers Accepted on the Basis of Abstract Review

Plack, E.A.*#, Ritschel, J.D., White, E.D., and Koschnick, C.M. "Improving Acquisitions in Science and Technology Programs Through Factor Development and Program Analysis," 88th MORS Symposium, New London, CT, 15-18 June 2020.

Hogan, D.W.*#, Elshaw, J.J., Koschnick, C.M., and Ritschel, J.D. "Are Rates of Learning Constant? Exploring a Diminishing Rate of Learning Model," 88th MORS Symposium, New London, CT, 15-18 June 2020.

Hogan, D.W.*, Elshaw, J.J., Koschnick, C.M., Ritschel, J.D., and Badiru, A.B. "An Examination of Learning Curve Theory and Non-Linear Rates of Learning" 17th Annual Acquisition Research Symposium, Monterey, CA, 13-14 May 2020; paper only due to COVID-19.

Other Significant Research Productivity

Ritschel, J.D., White, E.D., and Markman, M.R. (2020). "Developing Standard EMD Cost Factors for Major Defense Acquisition Program (MDAP) Platforms," Technical Report F19-017, Naval Postgraduate School Acquisition Research Program.

Plack, E.A.*, Ritschel, J.D., White, E.D., and Koschnick, C.M. "A Long Time Ago in an MDAP Far, Far Away," International Cost Estimation & Analysis (ICEAA) Dayton Chapter, Thesis Presentation: 13 March 2020.

Hogan, D.W.*, Elshaw, J.J., Koschnick, C.M., and Ritschel, J.D. "Boone or Bust? Exploring a Diminishing Rate of Learning Model," International Cost Estimation & Analysis (ICEAA) Dayton Chapter, Thesis Presentation: 13 March 2020.

Myers, B.A.*, White, E.D., Ritschel, J.D., and Fass, R.D. "Are New Aircraft Engines Saving Money?" International Cost Estimation & Analysis (ICEAA) Dayton Chapter, Thesis Presentation: 13 March 2020.

Carr*#, Katherine A., Stubbs, John E., Fass, R. David, Ritschel, Jonathan, D. (2020). *Development of Work Breakdown Structure (WBS) Cost Models for the Techno-Economic Analysis of PFAS Contaminant Removal*. Air Force Cost Analysis Agency (AFCAA), AFIT Graduate Thesis Out brief: Date. March 27th, 2020.

SCHULDT, STEVEN J. Maj

Assistant Professor of Engineering Management and Director, Graduate Engineering Management Program, Department of Systems Engineering and Management, AFIT. Appointment Date: 2018 (AFIT/ENV); BS, Civil Engineering, University of Illinois at Urbana-Champaign, 2006; MS, Environmental Engineering and Science, Air Force Institute of Technology, 2012; PhD, Civil Engineering, University of Illinois at Urbana-Champaign, 2017. Maj Schuldt's research interests include installation resilience, project/ construction management, optimal resource/asset utilization, and sustainability. Tel. (937) 255-3636 x4645, email: Steven.Schuldt@afit.edu

Sponsor Funded Research Projects

"21M AFIT GEM Civil Engineer Research." Sponsor: AFCEC. Funding: $200,000 - Schuldt 40%, Delorit 30%, and Chini 30%.

"AFIT GEM Research to Support AFCEC Tyndall PMO." Sponsor: AFCEC. Funding: $400,000 - Schuldt 50%, Delorit 50%.

Refereed Journal Publications

Hines, P., Wagner, T., Koschnick, C., and Schuldt, S. (2019). "Analyzing the efficiency of horizontal photovoltaic cells in various climate regions." *Journal of Energy and Natural Resources,* Vol 8, No. 2.

Hoisington, A., Stearns-Yoder, K., Schuldt, S., Beemer, C., Maestre, J., Kinney, K., Postolache, T., Lowry, C., and Brenner, L. (2019). "Ten questions concerning the built environment and mental health." *Building and Environment*, 155, 58–69.

Filer, J. and Schuldt, S. (2019). "Quantifying the environmental and economic performance of remote communities." *European Journal of Sustainable Development,* 8, 4, 176-184.

Thomsen, N., Wagner, T., Hoisington, A., and Schuldt, S. (2019). "A sustainable prototype for renewable energy: Optimized prime-power generator solar array replacement." *International Journal of Energy Production and Management.* 4(1), 28-39.

Schuldt, S., El-Rayes, K., Soylemezoglu, A., and Garfinkle, N., "Minimizing Consequesnces of Explosive Attacks on Remote Construction Sites," *Journal of Performance of Constructed Facilities*, Vol. 34, Issue 1, Feb. 2020.

Filer, J.E., Deloritt, J.D., Hoisington, A.J., and Schuldt, S.J., "Optimizing the Environmental and Economic Sustainability of Remote Community Infrastructure," *Sustainability*, Vol. 12, Issue 6, March 2020.

Jagoda, J., Diggs-McGee, B., Kreiger, M., and Schuldt, S., "The Viability and Simplicity of 3D-Printed Construction: A Military Case Study," *Infrastructures*, Volume 5, Issue 4, April 2020.

Pearson, J., Wagner, T., Deloritt, J. and Schuldt, S., "Cost Analysis of Optimized Islanded Energy Systems in A Dispersed Air Base Conflict," Energies, Vol. 13, Issue 18, Sept. 2020.

Refereed Conference Papers Accepted on the Basis of Full Paper Review

Jagoda, J., Case, M., Diggs-McGee, B., Kreiger, E., Kreiger, M., and Schuldt, S. (2019). "The benefits and challenges of on-site 3d-printed construction: a case study." *3rd International Conference on Engineering Technology and Innovation*. Belgrade, Serbia. 17-21 Apr 2019.

Paquette, R., and Schuldt, S. (2019). "Defense of military installations from ballistic missile attack: doctrine, history, challenges, and future research." *7th International Conference on Military Technologies*. Brno, Czech Republic. 30-31 May 2019.

Thomsen, N., Wagner, T., Hoisington, A., and Schuldt, S. (2019). "A sustainable prototype for renewable energy: Optimized prime-power generator solar array replacement."*8th International Conference on Energy and Sustainability.* Coimbra, Portugal. 3-5 July 2019.

Moore, B., Schuldt, S., and Hoisington, A. (2019). "Systematic review of transportation performance assessments: a comparison of the ASCE Infrastructure Report Card model." *2019 World Congress on Resilience, Reliability and Asset Management.* Singapore. 28-31 July 2019.

Filer, J. and Schuldt, S. (2019). "Quantifying the environmental and economic performance of remote communities." 7th International Conference on Sustainable Development 2019. Rome, Italy. 4-5 Sep 2019.

Schuldt, S., El-Rayes, K., Soylemezoglu, A., and Garfinkle, N. (2019). "Quantifying physical and psychological impacts of explosive attacks on building occupants" *6th International Conference on Disaster Management and Human Health Risk*. Ancona, Italy. 25-27 Sep 2019.

SITU, JOHN X., Maj

Maj John Situ is an Assistant Professor of Systems Engineering at the Air Force Institute of Technology, Department of Systems Engineering and Management. Maj Situ's research interests include stochastic optimization, meta-heuristics, modeling & simulation, and dynamic programming. Maj Situ received his commission from the University of Texas at Austin in 2006. He's began his Operations Research Analyst career at Edwards Air Force Base, California, where he served as an operational flight test analyst and electronic warfare analyst. In 2010, he was selected to attend the Master of Science in Operations Research program at the Air Force Institute of Technology, Wright-Paterson Air Force Base, Ohio. Upon Graduation, he was transferred to the Air Force Personnel Center, Randolph Air Force Base, Texas, where he served as personnel analyst, Chief of Force Development Analysis and Chief, Analysis Branch. In 2015, he was selected for the Air Force Institute of Technology Faculty Training Program and attended George Mason University to earn his Doctor of Philosophy in Systems Engineering and Operations Research. Upon graduation, Maj Situ joined the Systems Engineering and Management faculty, Air Force Institute of Technology, Wright Patterson Air Force Base. He assumed his current position in September 2018.

SLAGLEY, JEREMY M.

Assistant Professor of Industrial Hygiene and Environmental Science, Department of Systems Engineering and Management, AFIT Appointment Date: 2016 (AFIT/ENV); BS, United States Military Academy, 1993; MS, University of Iowa, 2000; PhD, West Virginia University, 2006. Dr. Slagley's research interests include occupational stressor assessment and control, specifically for hazardous noise, aerosols, and exposure assessment. He is part of the research team that built the Multi-Use Research for Particulate Hazards and Environmental Exposures (MURPHEE) aerosol test chamber. The chamber is used to test CBRN casualty decontamination protocols. He also models deployed waste-to-energy systems for sustainability. Tel. (937) 255-3636 x4632, email: Jeremy.Slagley@afit.edu

Sponsor Funded Research Projects

"Maternal Aircrew Fetal Noise and Vibration Exposure Risk Model - Aim 1 Literature Search." Sponsor: 711 HPW/FESS. Funding: $80,727 - Slagley 34%, Miller 33%, Cooper 33%.

"Maternal Aircrew Fetal Noise and Vibration Exposure Risk Model - Aim 1 Literature Search." Sponsor: 711 HPW/FESS. Funding: $599 - Slagley 34%, Miller 33%, Cooper 33%.

“Maternal Aircrew Fetal Noise and Vibration Exposure Risk Model - Aim 1 Literature Search." Sponsor: 711 HPW/FESS. Funding: $5,797 - Slagley 100%.

"Dry Aerosol CBRN Decon Effectiveness for EMEDS (Decon Capabilities for Far Forward Med Team)." Sponsor: 711 HPW/RHM. Funding: $17,360 - Slagley 80%, Cooper 20%.

Refereed Journal Publications

Mukherjee, C., Denney, J., Mbonimpa, E. G., Slagley, J., & Bhowmik, R. (2020). A review on municipal solid waste-to-energy trends in the USA. *Renewable and Sustainable Energy Reviews*, *119*, 109512.

Titus, E., Lemmer, G., Slagley, J., & Eninger, R. (2019). A review of CBRN topics related to military and civilian patient exposure and decontamination. *American Journal of Disaster Medicine*, *14*(2), 137-149., DOI:10.5055/ajdm.2019.0324

Trawick, J., Slagley, J., and Eninger, R. (2019). Occupational Noise Dose Reduction via Behavior Modification Using In-Ear Dosimetry among United States Air Force Personnel Exposed to Continuous and Impulse Noise. *Open Journal of Safety Science and Technology*, 9:2, 61-81. Google impact factor 2.08. DOI: 10.4236/ojsst.2019.92005

Richburg, C., Slagley, J. (2019). Noise Concerns of Residents Living in Close Proximity to Hydraulic Fracturing Sites in Southwestern Pennsylvania. *Public Health Nursing*, 2019; 00:1-8. DOI: 10.1111/phn.12540.

Books and Chapters in Books

Winn, G. L., Slagley, J. M., Slagley, M. L., & Winn, L. (2019). Teaching Safety, Health, and Environment in Engineering Programs for Millennials: Ethics Is the Basis. In *Industry Integrated Engineering and Computing Education* (pp. 119-133). Springer, Cham.

Invention Disclosures

AFD 2073, “Disposable UAS-Compatible Biological Aerosol Sampler” Ohms, S., Eninger, R., & Slagley, J.

Other Significant Research Productivity

Slagley, Jeremy. "10 Total Exposure Hearing Health Preservation." *Total Exposure Health: An Introduction* (2020): 161.

Barry, K., Denney, J., and Slagley, J. (2020). Managing the Shelf Life of Type II Materials. *The Military Engineer*, Vol. 112, No. 729: 61-63.

Denney, J., Slagley, J., and Mbonimpa, E. (2020). Determining the Benefits of Gasification. *The Military Engineer*, Vol 112, No. 725: 49-50.

STUBBS, JOHN E., Lt Col

Deputy Department Head and Assistant Professor of Environmental Engineering and Science, Department of Systems Engineering and Management, AFIT Appointment Date: 2017 (AFIT/ENV); BS, North Carolina State University, 1998; MS, Air Force Institute of Technology, 2010; PhD, Air Force Institute of Technology, 2017. Lt Col Stubbs’

research interests include physical and chemical water treatment processes and environmental sustainability. Tel. (937) 255-3636 x4329, email: john.stubbs@afit.edu

Refereed Journal Publications

T. McWhirter*, T. Wagner, J. Stubbs, D. Rizzo, J. Williams, "Tracked vehicle physics-based energy modelling and series hybrid system optimization for the Bradley fighting vehicle," Int'l Journal of Electric & Hybrid Vehicles, Vol 12, No. 1 (to appear Jan 2020).

Refereed Conference Papers Accepted on the Basis of Abstract Review

T. McWhirter*#, T. Wagner, J. Stubbs, "Ground Vehicle Energy Requirement Modeling and System Optimization," Society of Automotive Engineers World Conference, Detroit, MI, April 2019.

Books and Chapters in Books

Dyson, Sean, Stubbs, John, Kempisty, David, Magnuson, Matthew. "A Preliminary Treatment Train Study: Removal of Per-fluorinated Compounds from Post-Emergency Wastewater by Advanced Oxidation Process and Granular Activated Carbon Adsorption". Textbook chapter. CRC Press. 2018.

Other Significant Research Productivity

"Advanced treatment of secondary wastewater effluents with ultraviolet light-emitting diodes," Ohio Water Development Authority, Co-P.I., Jan 2020 – Dec 2020, $63,333 total awarded to AFIT.

THAL, ALFRED E., Jr.
Assistant Professor of Engineering Management, Department of Systems Engineering and Management, AFIT Appointment Date: 1998 (AFIT/ENV); BS, Civil Engineering, Texas Tech University, 1981; MS, Engineering Management, AFIT, 1985; PhD, Environmental Engineering, University of Oklahoma, 1999. Dr. Thal's research interests include engineering and environmental management, groundwater flow and remediation technologies, facility and infrastructure management, product development, sustainability, and project management.
Tel. (937) 255-3636 x7401, email: Al.Thal@afit.edu

WAGNER, TORREY J., Lt Col
Assistant Professor of Systems Engineering, Department of Systems Engineering and Management, AFIT Appointment Date: 2017 (AFIT/ENV); BS, Electrical Engineering, University of Minnesota, 2000; MS, Aerospace Systems Engineering, Loughborough University, 2004; PhD, Electro-optics, Air Force Institute of Technology, 2010. Lt Col Wagner's primary interest is DOD-focused energy systems engineering, with research topics including air vehicle, ground vehicle, fixed installation and contingency base energy systems. Tel. (937) 255-3636 x4611,
Email: Torrey.Wagner@afit.edu

Refereed Journal Publications

J. Poole*, T. Wagner, D. Dudis, "8x Raven Small UAS Endurance with an Optimized Hybrid Solid Oxide Fuel Cell & Battery Energy System," Journal of Defense Research & Engineering, Vol. 1, No. 2 (2018).

D. Chester*, T. Wagner, D. Dudis, "36% Reduction in Fuel Resupply Using a Hybrid Generator & Battery System for an Austere Location," Marine Corps Gazette – the Professional Journal of the United States Marine Corps, Vol. 103, No. 3 (2019).

P. Ramsey*, D. Prigge V, T. Wagner, A. Thal, "Statistical Viability Analysis of United States Air Force Estimating Cost Factor for Sustainable Construction," Journal of Advances in Civil Engineering, Vol. 5, No. 2 (2019).

P. Hines*, T. Wagner, C. Koschnick, S. Schuldt, "Analyzing the Efficiency of Horizontal Photovoltaic Cells in Various Climate Regions," Journal of Energy and Natural Resources, Vol. 8, No. 2 (2019).

N. Thomsen*, T. Wagner, A. Hoisington, S. Schuldt, "A Sustainable Prototype for Renewable Energy: Optimized Prime-Power Generator Solar Array Replacement," International Journal of Energy Production and Management, Vol. 4, No. 1 (2019).

K. Meyer*, T. Wagner, J. Williams, "Using Wind and Hydro Power to Sustain the Off-Grid Power Supply for a 50' Cruising Sailboat," Journal of Fundamentals of Renewable Energy and Applications, Vol. 9, No. 1 (2019).

J. Kramer*, T. Wagner, "Developmental Test and Requirements Best Practices of Successful Information Systems Efforts using Agile Methods," Defense Acquisition Research Journal, accepted.

B. Bailey*, T. Wagner, J. Williams, "E700XD Portable Doppler Radar Energy Systems Analysis," International Journal of Electrical Energy, accepted.

T. McWhirter*, T. Wagner, D. Rizzo, J. Stubbs, J. Williams, "Tracked vehicle physics-based energy modelling and series hybrid system optimization for the Bradley fighting vehicle," Int'l Journal of Electric & Hybrid Vehicles, accepted.

L. Cowen*, T. Wagner, D. Dudis, "Optimized Wind, Battery & Generator Energy System for an Austere Location," International Journal of Renewable Energy Research, accepted.

Refereed Conference Papers Accepted on the Basis of Full Paper Review

J. Kramer*#, T. Wagner, "Developmental Test and Requirements Best Practices of Successful Information Systems Efforts using Agile Methods," Defense Acquisition University Symposium, Fort Belvoir, VA April 2019.

T. Wagner#, T. Ford, "'Metrics to Meet Security & Privacy Requirements with Agile Software Development Methods in a Regulated Environment," IEEE Conference on Computing, Networking and Communications, Kailua-Kona, HI, Feb 2020.

Refereed Conference Papers Accepted on the Basis of Abstract Review

N. Thomsen*#, T. Wagner, A. Hoisington, S. Schuldt, "A Sustainable Prototype for Renewable Energy: Optimized Prime-Power Generator Solar Array Replacement," 8th International Conference on Energy and Sustainability, Portugal, Jul 2019.

T. McWhirter*#, T. Wagner, "Ground Vehicle Energy Requirement Modeling and System Optimization," Society of Automotive Engineers World Conference, Detroit, MI, April 2019.

N. Thomsen*#, T. Wagner, A. Hoisington, R. Salavani, S. Schuldt, "A Sustainable Prototype for Renewable Energy," Dayton Area Engineering Sciences Symposium, Dayton, OH, USA, Oct 2019.

J. Pearson*#, T. Wagner, S. Schuldt, "Insulation Sensitivity Analysis for an Optimized Fabric Shelter Off-grid Hybrid Energy System," Dayton Area Engineering Sciences Symposium, Dayton, OH, USA, Oct 2019.

Other Significant Research Productivity

Created new course, *SENG 582A Aviation Energy Systems Engineering*, with co-instructors from the Air Force Research Laboratory Aerospace Systems Directorate.

J. Williams, T. Wagner, "Northern Hemisphere Horizontal Photovoltaic Power Output Data for 12 Sites," Mendeley Data, http://dx.doi.org/10.17632/hfhwmn8w24.5.

T. Wagner#, "Optimization of Airspeeds and Altitudes for F-15E and KC-135 Coronet Missions," Presentation to the Deputy Assistant Secretary of the Air Force for Operational Energy, Washington D.C., 10 Jun 2019.

T. Wagner#, “Optimization of Airspeeds and Altitudes for Coronet Missions,” Presentation to the Air Force Research Laboratory Aerospace Vehicles Directorate, Dayton OH, 18 Jun 2019

6. RESEARCH CENTER PUBLICATIONS AND FUNDING INFORMATION

The contents of this section are duplicated data, grouped by center. The information is previously listed within each project's specific academic department.

6.1. AUTONOMY AND NAVIGATION TECHNOLOGY CENTER

Autonomy and Navigation Technology (ANT) Center
Director (937) 255-3636 x4755
Executive Administrator (937) 255-3636 x4583
Laboratory Manager (937) 255-3636 x4911
Homepage: https://www.afit.edu/ANT

6.1.1. DOCTORAL DISSERTATIONS

PATEL, PRANAV, R., Direct Digital Synthesis: A Flexible Architecture for Advanced Signals Research for Future Satellite Navigation Payloads. AFIT-ENG-DS-20-M-014. Faculty Advisor: Dr. Richard K. Martin. Sponsor: N/A.

SCHNEIDER, MICHAEL, F., Operationalized Intent for Improving Coordination in Human-Agent Teams. AFIT - ENV-DS-20-S-074. Faculty Advisor: Dr. Michael E. Miller. Sponsor: AFOSR.

WESTING, NICHOLAS, M., Physics-Constrained Hyperspectral Data Exploitation Across Diverse Atmospheric Scenarios.AFIT-ENG-DS-20-S-021. Faculty Advisor: Dr. Richard K. Martin. Sponsor: NASIC/GSP.

6.1.2. MASTER'S THESES

ALMANNAEI, LOAY, Y., Design and test of an Autonomy Monitoring Service to Detect Divergent Behaviors on Unmanned Aerial Systems. AFIT-ENV-MS-20-J-059. Faculty Advisor: Dr. John M. Colombi. Sponsor: RHCCT.

BECKER, JUSTIN, A., Autonomous Constrained Spacecraft Inspection via Model Predictive Control. AFIT-ENY-MS-20-J-073. Faculty Advisor: Maj. Costantinos Zagaris. Sponsor: N/A.

BRUNS, RYAN, D., Simulation and Analysis of High Value Airborne Asset Defense Effectiveness with Kinetic Weapons and Noise Jamming. AFIT-ENS-MS-20-M-135. Faculty Advisor: Dr. Michael E. Miller. Sponsor: SDPE LM MFC.

CHENEY, KATHERINE, E., Development, Test and Evaluation of Autonomous Unmanned Aerial Systems in a Simulated Wide Area Search Scenario: An Implementation of the Autonomous Systems Reference Architecture. AFIT-ENV-MS-20-M-193. Faculty Advisor: Dr. JOHN M. Colombi. Sponsor: N/A.

CIARAVINO, MARK, A., Simulation and Analysis of Cyber Operations for A2AD using AFSIM. AFIT-ENS-MS-20-M-140. Faculty Advisor: Dr. Michael E. Miller. Sponsor: SDPE LM MFC.

CROWL, MICHAEL, R., Use of LiDAR in Automated Aerial Refueling To Improve Stereo Vision Systems. AFIT-ENG-MS-20-M-013. Faculty Advisor: Dr. Scott L. Nykl. Sponsor: AFRL/RQQC.

DANAHER, RICHARD, S., Hybrid Tri-Objective Optimization of F-15 Fleet Modernization Scheduling. AFIT-ENS-MS-20-M-142. FACULTY Advisor: Lt. Col. Amy M. Cox. Sponsor: AFLCMC.

FRANCOIS, JOHN, K., Simulation of High Value Airborne Asset Defense with AFSIM. AFIT-ENS-MS-20-M-148. Faculty Advisor: Dr. Michael E. Miller. Sponsor: SDPE LM MFC.

FRENCH, BRADELY, S., Determining Virtual Practicality From Physical Stereo Vision Images and GPS. AFIT-ENG-MS-20-M-020. Faculty Advisor: Dr. Scott L. Nykl. Sponsor: AFRL/RQQC.

HARRIGER, SAM, B., Trade-Space Analysis of a Small Unmanned Vehicle System for Radiological Search Missions. AFIT-ENV-MS-20-M-210. Faculty Advisor: Dr. David R. Jacques. Sponsor: N/A.

HOPKINS, CHRISTOPHER, E., Repairing Situation Awareness in Future Unmanned Aerial Vehicle Operations: A Case Study in Systems Modeling Language Using a Human-Artificial Agent Teaming Meta-Model. AFIT-ENV-MS-20-M-215. Faculty Advisor: Dr. Michael E. Miller. Sponsor: N/A.

HUFSTETLER, BRANDON, J., Heuristic Approaches for Near-Optimal Placement of GPS Based Multi-Static Radar Receivers in American Coastal Waters. AFIT-ENS-MS-20-M-154. Faculty Advisor: Lt. Col. Amy M. Cox. Sponsor: N/A.

KING, DAVID, D., Development, Test, and Evaluation of Autonomous Unmanned Aerial Systems in a Simulated Wide Area Search Scenario: An Implementation of the Autonomous Systems Reference Architecture. AFIT-ENV-MS-20-M-220. Faculty Advisor: Dr. David R. Jacques. Sponsor: N/A.

LANGLAND, ANDREW, L., Resource and Capability Allocation Insights for A2/AD. AFIT-ENS-MS-20-M-157. Faculty Advisor: Dr. Michael E. Miller. Sponsor: SDPE LM MFC.

LEE, ANDREW, T., Objects Detection with Deep Learning to Accelerate Pose Estimations for Automated Aerial Refueling. AFIT-ENG-MS- 20-M-035. Faculty Advisor: Dr. Scott L. Nykl. Sponsor: ARFL/RQQC.

MARSH, JUSTIN, R., The Impact of Changing the Size of Aircraft Radar Displays on Visual Attention in the Cockpit. AFIT-ENV-MS-20-M-226. Faculty Advisor: Dr. Michael E. Miller. Sponsor: AFLCMC/WWMA.

MATISSEK, KYLE, J., A Near-Real-Time Near-Optimal Shortest Path Solution for an Unmanned Aerial System (UAS) in a High Constrained Environment. AFIT-ENY-MS-20-M-271. Faculty Advisor: Dr. Richard G. Cobb. Sponsor: AFRLRQQA.

MORSE, KYLE, Detecting Ping1090i ADS-B Spoofing Devices Using DNA Fingerprinting. AFIT-ENG-MS-20-M-005. Faculty Advisor: Dr. Michael A. Temple. Sponsor: AFRL.

NAFZIGER, GRANT, T., Wireless Sensor Network Optimization for Radio Tomographic Imaging. AFIT-ENG-MS-20-M-047. Faculty Advisor: Dr. Richard K. Martin. Sponsor: N/A.

O'BRIEN, NICHOLAS, J., A Non-Destructive Evaluation application using Software Defined Radios and Bandwidth Expansion. AFIT-ENG-MS-20-M-049. Faculty Advisor: Dr. Peter J. Collins. Sponsor: N/A.

PATRICK, LATCHAM, R., Comparison of Visual Simultaneous Localization and Mapping Methods for Fixed Wing Aircraft Using Slam Bench 2. AFIT-ENG-MS-20-M-034. Faculty Advisor: Dr. Clark N. Taylor. Sponsor: N/A.

SARANTSEV, KIRILL, A., Maximizing Accuracy Through Stereo Vision Camera Positioning for Automated Aerial Refueling. AFIT-ENG-MS-20-M-059. Faculty Advisor: Dr. Clark N. Taylor. Sponsor: AFRL.

SPIEGEL, CONOR, S., Simulation and Analysis of Cruise Missile Autonomous Behaviors. AFIT-ENS-MS-20-M-173. Faculty Advisor: Dr. Michael E. Miller. Sponsor: SDPE LM MFC.

WALLACE, LYNN, A., Steady State Visually Evoked Potentials from Simultaneous Dynamic Stimulus. AFIT-ENV-MS-20-M-251. Faculty Advisor: Dr. Michael E. Miller. Sponsor: AFRL/711th/HCSR.

6.1.3. FACULTY RESEARCH OUTPUT

Notes: Faculty Bios can be found under their respective department listings. Shared credit for funding awards is indicated by the percentages shown for each faculty member associated with the project.

BETANCES, JOAN, A., MAJ, Department of Electrical and Computer Engineering

BORGHETT, BRETT, J., Department of Electrical and Computer Engineering

Refereed Journal Publications

Westing, Nicholas M., Gross, Kevin C., Borghetti, Brett, J., Martin, Jacob, and Meola, Joseph, "Learning Set Representations for LWIR In-Scene Atmospheric Compensation" *IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing*, 2 Apr 2020, Vol 13, pp 1438-1449
https://ieeexplore.ieee.org/document/9055124

Dickey, Joshua, T., Borghetti, Brett, J., Junek, William, and Martin, Richard "Beyond Correlation: A Path-invariant Measure for Seismogram Similarity" *Seismological Research Letters*, 6 Nov 2019,
DOI: 10.1785/0220190090 https://pubs.geoscienceworld.org/srl/article-pdf/doi/10.1785/0220190090/4862061/srl-2019090.1.pdf

Westing, Nicholas M., Borghetti, Brett, J., Gross, Kevin C., "Fast and Effective Techniques for LWIR Radiative Transfer Modeling: A Dimension Reduction Approach," *Remote Sensing (MDPI)*, 9 Aug 2019, Vol 11, issue 6, pp. 866-1886, DOI: 10.3390/rs11161866 https://www.mdpi.com/2072-4292/11/16/1866/htm

Refereed Conference Papers Accepted on the Basis of Full Paper Review

Crow, David R., Graham, Scott R., Borghetti, Brett J., Sweeney, Patrick J., "Empirical Dynamic Modeling as a Basis for an Intrusion Detection System" 14th International Conference on Critical Infrastructure Protection (IFIP), Arlington, VA, USA, Mar 2020.

Villarreal, Micah N., *Kamrud, Alexander J., Borghetti, Brett J., "Confirmation Bias Estimation from Electroencephalography with Machine Learning," Human Factors and Ergonomics Society (HFES) Annual Conference, 2019, Seattle, WA, 28 Oct-1 Nov 2019.

Refereed Conference Papers Accepted on the Basis of Abstract Review

Crow, David R., Graham, Scott R., Borghetti, Brett J., "Fingerprinting Vehicles with CAN Bus Data Samples," *15th International Conference on Cyber Warfare and Security (ICIW)*, Norfolk, VA, Feb 2020.

CLINTON, JUSTEN, A., Department of Engineering Physics

Refereed Journal Publications

Logan, J., Holland, D., Burggraf, L., Clinton, J., O'Day, B. 2019. "Monte Carlo and Experimental Analysis of a Novel Directional Rotating Scatter Mask Gamma Detection System." *Nuclear Instruments and Methods in Physics Research Section A: Accelerators, Spectrometers, Detectors and Associated Equipment*. **947**, pp. 162698. https://doi.org/10.1016/j.nima.2019.162698

COBB, RICHARD, G., Department of Aeronautics and Astronautics

Refereed Journal Publications

Thomas*, G., Cobb, R., Fiorino, S. and Hawks, M., "Daytime Cloudless Sky Radiance Quantification with Ground-based Aerosol and Meteorological Observations in the Short-Wave Infrared," *Journal of Atmospheric and Oceanic Technology*, 37(5) March 2020, DOI: 10.1175/JTECH-D-19-0157.1.

Spendel, D., Hess, J., Johnson, K., and Cobb, R., "Evaluating Orbital Defender Performance Trades Using Differential Game Theory" *Journal of Defense Research & Engineering*, Vol 3, Issue 1, March 2020, AD1092565.

Thomas, G., Cobb, R., Fiorino, S. and Hawks, M., "NIR and SWIR Observations for Daytime Satellite Custody," *Journal of Defense Research & Engineering*, Vol 3, Issue 1, March 2020, AD1093125.

Smith, N.E., Cobb, R.G., and W.P. Baker, "Incorporating Stochastics into Optimal Collision Avoidance Problems using Superquadrics," *AIAA Journal of Air Transportation*, February 2020, DOI: 10.2514/1.D0170.

Spendel, D.S., Hess, J.A., Cobb, R.G., Johnson, K. J., "Developing and Analyzing Strategies Using Pursuer-Evader-Defender Differential Game Theory for Orbital Engagements," Journal of DOD Research and Engineering, July 2020.

Refereed Conference Papers Accepted on Basis of Full Paper Review

Harris, W., Cobb R., and Taylor, C., "Visual Servoing for Final Approach Phase of Spacecraft Proximity Operations with Unknown Targets," 2020 IEEE/ION Position, Location and Navigation Symposium (PLANS), Portland, OR, USA, 2020, pp. 1606-1617, doi: 10.1109/PLANS46316.2020.9110218.

Harris, W., Linville, D., Hess J., and. Cobb, R., "Development of GNC for Optimal Relative Spacecraft Trajectories," 2020 IEEE/ION Position, Location and Navigation Symposium (PLANS), Portland, OR, USA, 2020, pp. 1476-1487, doi: 10.1109/PLANS46316.2020.9110153.

Weintraub, I., Cobb, R., Baker, W. and Pachter, M., "Direct Methods Comparison for the Active Target Defense Scenario," AIAA SciTech 2020 Forum, January 2020, DOI: 10.2514/6.2020-0612.

Other Significant Research Productivity

Harris, W., Cobb R., and Taylor, C., "Visual Servoing for Final Approach Phase of Spacecraft Proximity Operations with Unknown Targets," presented virtually to the AFRL/RVSW "RANGERS" symposium, 16 April, 2020.

Matissek, K., Cobb, R. Jacques, D., Grymin, D., and Zollars, M., "A Near-Real-Time Near-Optimal Shortest Path Solution for an Unmanned Aerial System (UAS) in a Highly Constrained Environment," AIAA 45th Dayton-Cincinnati Aerospace Science Symposium, 3 March 2020.

Matissek, K., Cobb, R. Jacques, D., Grymin, D., and Zollars, M., "A Near-Real-Time Near-Optimal Shortest Path Solution for an Unmanned Aerial System (UAS) in a Highly Constrained Environment," ASME 15th Dayton Engineering Sciences Symposium, 29 October 2019.

COLLINS, PETER, J., Department of Electrical and Computer Engineering

Sponsor Funded Research Projects

"FASTBALL: Frugal Atmospheric Sounder Test Bed Auto-pointing Luneburg Lens." Sponsor: Undisclosed. Funding: $17,500 - Collins 100%. [CSRA]

"Enabling Technologies for Radar Scattering Measurements." Sponsor: SAF/FBIB. Funding: $142,390 - Collins 100%.

"Enabling Technologies for Advanced Munitions." Sponsor: SAF/FBIB. Funding: $100,000 - Collins 50%, Hartsfield 25%, Lingenfelter 25%.

Refereed Journal Publications

John Lee, Peter J. Collins, and Julie Ann Jackson, "Sparse Representation of Targets with Mixed Scattering Primitives," Journal of the Applied Computational Electromagnetics Society, Volume: 35, Number: 6, 2020. Alex Paul, Collins P. J., Temple M., "Application of Machine Learning to Enhance Antenna Termination State Estimation Using Stimulated Unintended Radiated Emissions," IEEE Ant & Wireless Prop Letters, Volume: 18, Issue: 11, Nov. 2019.

Christopher Vergara, Richard K. Martin, Peter J. Collins, and James R. Lievsay, "Multi-Sensor Data Fusion between Radio Tomographic Imaging and Noise Radar," IET Radar, Sonar & Navigation, Volume: 14, Issue: 2, pp. 187-193, Feb. 2020.

Refereed Conference Papers Accepted on the Basis of Full Paper Review

Spencer R. Sellers, Peter J. Collins, and Julie Ann Jackson, "Augmenting Simulations for SAR ATR Neural Network Training," IEEE International Radar Conference, Washington D.C., 27 Apr – 1 May 2020.

COLOMBI, JOHN, M., Department of Systems Engineering and Management

Sponsor Funded Research Projects

"Model-based Systems Engineering for WNS Acq Workforce." Sponsor: AFLCMC/WNS. Funding: $100,000 - Colombi 100%.

Refereed Journal Publications

Felten, M. S., Colombi, J.M, Cobb, R.G., & Meyer, D.W. (2018). Multi-objective optimization using parallel simulation for space situational awareness, Journal of Defense Modeling and Simulation Applications, Methodology, Technology. pp 1-33. DOI: 10.1177/1548512918803212.

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Hertwig, Fred D., Colombi, John M., Cobb, Richard G. and David W. Meyer (2019). Search-Based vs. Task-Based Space Surveillance for Ground-Based Telescopes. Advanced Maui Optical and Space Surveillance Technologies Conference (AMOS). Maui, HI (17-19 September, 2019).

CURRO, JOSEPH, A., MAJ, Department of Electrical and Computer Engineering

Sponsor Funded Research Projects

"Android Sensor Framework for ATAK." Sponsor: AFRL/RI. Funding: $70,000 - Curro 100%.

"Artificial Intelligence Opponent for Contested Space (AIOCS) - AI Development." Sponsor: AFRL/RV. Funding: $34,500 - Curro 100%.

"Advanced Tactics Development through Deep Reinforcement Learning." Sponsor: AFRL/RH. Funding: $250,000 - Curro 100%.

"Deep Reinforcement Learning for Air Combat." Sponsor: AFRL/RQ. Funding: $30,000 - Curro 100%.

Refereed Conference Papers Accepted on the Basis of Abstract Review

Ellis, David, Curro, Joseph, "Localization and Navigation with Imagery and Pedestrian Inertial Measurements Utilizing Artificial Neural Networks," Proceedings of the 2020 International Technical Meeting of the Institute of Navigation, San Diego, California, January 2020, pp. 672-682. https://doi.org/10.33012/2020.17170.

Curro, J., Skouson, M., Introduction to a Deep Reinforcement Learning Solution for Various Simulation Environments, 88th Symposium – Military Operations Research Society MORS, 2020.

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GUNAWARDENA, SANJEEV, Department of Electrical and Computer Engineering

Sponsor Funded Research Projects

"SatNav Signal Monitoring and Analysis Technology Development." Sponsor: AFRL/RV. Funding: $214,900 - Gunawardena 100%.

"SatNav Signal Monitoring and Analysis Technology Development." Sponsor: AFRL/RV. Funding: $100,000 - Gunawardena 100%.

"Advanced GPS Technologies Development Experiment Support." Sponsor: AFRL/RV. Funding: $150,864 - Gunawardena 100%.

"SatNav Signal Monitoring and Analysis Technology Development." Sponsor: AFRL/RY. Funding: $351,870 - Gunawardena 100%.

Refereed Conference Papers Accepted on the Basis of Full Paper Review

Echeverry, N. C., Betances F, A., Gunawardena, S**.**, Temple F, M. A., Signal Quality Monitoring using a Chip Shape Deformation Metric for Global Navigation Satellite System Signals, Proceedings of the 33rd International Technical Meeting of the Satellite Division of the Institute of Navigation, Virtual, September 2020.

Gunawardena, S., A High Performance Easily Configurable Satnav SDR for Advanced Algorithm Development and Rapid Capability Deployment, Proceedings of the International Technical Meeting of the Institute of Navigation: ITM2021 Virtual, January 25-28, 2021.

Refereed Conference Papers Accepted on the Basis of Abstract Review

Gunawardena, S., A High Performance Easily Configurable SatNav SDR Architecture for Advanced Algorithm Development and Rapid Capability Deployment, Joint Navigation Conference of the Institute of Navigation, Cincinnati, OH, September 2020. (Conference postponed to September 2020, originally scheduled for June 2020).

Carroll, M., Hebert, J., Gunawardena, S., GPS Authentication Using Machine Learning, Joint Navigation Conference Of the Institute of Navigation, Cincinnati, OH, September 2020. (Conference postponed to September 2020, Originally scheduled for June 2020).

Zhu, Z., Gunawardena, S., A Software Defined Implementation of Time-differenced Carrier Phase Solution with Random Sample Consensus, Joint Navigation Conference of the Institute of Navigation, Cincinnati, OH, September 2020. (Conference postponed to September 2020, originally scheduled for June 2020).

Gunawardena, S., Rügamer, A., Hameed, M. S., Arizabaleta, M., Pany, T., Arriba, J., ION Software-Defined Radio Metadata Standard Final Report, *Proceedings of the 32nd International Technical Meeting of the Satellite Division of the Institute of Navigation (ION GNSS+ 2019)*, Miami, Florida, September 2019, pp. 3785-3800. https://doi.org/10.33012/2019.17027 .

Raquet, N., Gunawardena, S., Patel, P., Hinks, J., Phase Optimized Constant Envelope Transmission-Induced Pseudorange Biases and Mitigation, *Proceedings of the 2019 Joint Navigation Conference of the Military Division of The Institute of Navigation*, Long Beach CA, July 2019.

Braun, A., Gunawardena, S., High Fidelity Satellite Navigation Front-End for Signal Quality Monitoring and Advanced Authentication, *Proceedings of the 2019 Joint Navigation Conference of the Military Division of the Institute of Navigation*, Long Beach CA, July 2019.

HODSON, DOUGLAS, D., Department of Electrical and Computer Engineering

Refereed Journal Publications

Chris Weimer, J.O. Miller, Raymond Hill, Douglas D. Hodson, "Agent Scheduling in Opinion Dynamics: A Taxonomy and Comparison Using Generalized Models," Journal of Artificial Societies and Social Simulation (JASSS), Vol 22, No 4, 2019.

Refereed Conference Papers Accepted on the Basis of Full Paper Review

Joseph Tippit, Douglas Hodson, Michael Grimaila, "Julia and Singularity for High Performance Computing," The 18th International Conference on Scientific Computing (CSC'20), Las Vegas, NV, Jul 27-30, 2020.

Drew Campbell, Jake Hall, Iyanu Odebode, Douglas Hodson, Michael Grimaila, "Trojan Banker Simulation Using Python," the 18th International Conference on Scientific Computing (CSC'20), Las Vegas, NV, Jul 27-30, 2020.

Amber Modlin, Andres Gregory, Iyanu Odebode, Douglas Hodson, Michael Grimaila, "CovidLock a New Form of Ransomware," the 18th International Conference on Scientific Computing (CSC'20), Las Vegas, NV, Jul 27-30, 2020.

Braeden Bowen, Jeremy Ergybar, Iyanu Odebode, Douglas Hodson, Michael Grimaila, "The New Office Threat: A Simulation Environment of Watering Hole Cyber Attacks," the 18th International Conference on Scientific Computing (CSC'20), Las Vegas, NV, Jul 27-30, 2020.

Hai Vo, Raymond Kozlowski, Iyanu Odebode, #Douglas Hodson, Michael Grimaila, "Simulation of SYN Flood Attack and Counter-Attack Methods Using Average Connection Times," the 18th International Conference on Scientific Computing (CSC'20), Las Vegas, NV, Jul 27-30, 2020.

HOPKINSON, KENNETH. M., Department of Electrical and Computer Engineering

Sponsor Funded Research Projects

"Task-Oriented Dynamic Knowledge Graphs for Information Integration at Operation Centers." Sponsor: 711 HPW. Funding: $30,000 - Hopkinson 100%.

"Verifying and Validating Cyber-Physical Software Systems via Software Modeling." Sponsor: AFRL/RQ. Funding: $60,000 - Hopkinson 100%.

"Verifying and Validating Cyber-Physical Software Systems via Software Modeling." Sponsor: AFRL/RQ. Funding: $40,000 - Hopkinson 100%.

"Task-Oriented Dynamic Knowledge Graphs for Information Integration at Operation Centers." Sponsor: AFRL/RH. Funding: $30,000 - Hopkinson 100%.

Refereed Journal Publications

Heglund, J., Hopkinson, K., Tran, H.T., Social Sensing: Towards Social Media as a Sensor for Resilience in Power Systems and Other Critical Infrastructures, *Taylor and Francis Journal of Sustainable and Resilient Infrastructure*, 12 March 2020, pp. 1-13.

Becherer, N., Pecarina, J., Nykl, S., Hopkinson, K., Improving Optimization of Convolutional Neural Networks Through Parameter Fine-tuning, *Springer Neural Computing and Applications*, Volume 31, Issue 8, August 2019, pp. 3469-3479

JACQUES, DAVID, R., Department of Systems Engineering and Management

Sponsor Funded Research Projects

"Digital Engineering for Cooperative and Autonomous Munition Concept Evaluation." Sponsor: AFRL/RW. Funding: $10,000 - Jacques 100%. [ANT]

LEISHMAN, ROBERT, C., The department of Electrical and Computer Engineering

Sponsor Funded Research Projects

"ENG18-001 PNT Focused Distance Learning Electrical Engineering Master's Degree." Sponsor: 796 TSS. Funding: $80,000 - Leishman 50%, Canciani 25%, Gunawardena 25%.

"Scorpion Suite Development and Support." Sponsor: C5ISR CENTER. Funding: $200,000 - Leishman 50%, Taylor 50%.

"Expedited Up-close Visual Inspection of Aircraft Exteriors Using an Autonomous Multi-rotor Based System." Sponsor: AFRL/RX. Funding: $150,000 - Leishman 50%, Taylor 50%.

"ENG18-004 PNT Focused Distance Learning Electrical Engineering Master's Degree." Sponsor: C5ISR. Funding: $80,000 - Leishman 50%, Canciani 25%, Gunawardena 25%.

"PNT Focused Distance Learning Electrical Engineering Master's Degree." Sponsor: AFRL/RV. Funding: $60,000 - Leishman 25%, Canciani 25%, Curro 25%, Taylor 25%.

"Eglin Magnetic Survey & Data Collect." Sponsor: AFRL/RW. Funding: $150,000 - Leishman 100%.

"GNSS Antenna Characterization." Sponsor: Ohio State University. Funding: $148,000 - Leishman 100%.

Refereed Journal Publications

R. M. Watson, J. N. Gross, C. N. Taylor, and R. C. Leishman, "Enabling Robust State Estimation through Measurement Error Covariance Adaptation," *IEEE Trans. Aerosp. Electron. Syst.*, vol. 9, no. 19, pp. 1–13, 2019.

T. B. Bodin, J. M. Bindewald, R. C. Leishman, G. L. Peterson, and D. R. Jacques, "A Development Platform for Behavioral Flexibility in Autonomous UAS," *Int. J. Intell. Robot. Appl.*, vol. 4, no. 1, pp. 57–72, 2020.

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J. S. Gipson, R. C. Leishman, and C. M. Schubert-Kabban, "Swarm Control for Autonomous Navigation Support," in *Int. Conf. on Unmanned Aerial Systems*, Athen, Greece, April 2020 (postponed to Sept 2020).

Z. P. Friedel and R. C. Leishman, "Smart Features for Dynamic Vision Sensors," in *IEEE/ION PLANS*, Portland, OR Apr. 2020 (postponed until Sept 2020).

S. Mochocki, K. J. Kauffman, R. C. Leishman, and J. Racquet, "Relational Database for PNT Data," in *IEEE/ION PLANS*, Portland, OR Apr. 2020 (postponed until Sept 2020).

J. S. Gipson, C. M. Schubert-Kabban, R. C. Leishman, and J. D. Jurado, "Real-time Trajectory Optimization for Collaborative Self-Localization in Random Aircraft Formations," in *IEEE/ION PLANS*, Portland, OR Apr. 2020 (postponed until Sept 2020).

Kauffman, K., Marietta, D., Raquet, J., Carson, D. , Leishman, R. C., Canciani, A., Schofield, A., Caporellie, M. "Scorpion : A Modular Sensor Fusion Approach for Complementary Navigation Sensors," in *ION/IEEE PLANS*, Portland, OR Apr. 2020 (postponed until Sept 2020).

R. M. Watson, J. N. Gross, C. N. Taylor, and R. C. Leishman, "Uncertainty Model Estimation in an Augmented Data Space for Robust State Estimation," in *ION GNSS+*, 2020.

LIEVSAY, JAMES, R., MAJ, Department of Electrical and Computer Engineering

MARTIN, RICHARD, K., Department of Electrical and Computer Engineering

Sponsor Funded Research Projects

"Classification Methods and Passive Augm of Spectropolarmetric LADAR." Sponsor: AFRL/RW. Funding: $50,000 - Martin 100%.

MERKLE, LAURENCE, D., Department of Electrical and Computer Engineering

Refereed Conference Papers Accepted on the Basis of Abstract Review

T. Dontigney, L. Merkle, R. Cobb, J. Colombi, G. Lamont. Methodology for Comparison of Algorithms for Real-World Multi-objective Optimization Problems: Space Surveillance Network Design. Comparison of Multi-Objective Optimization Algorithms for GEO Space Surveillance Network Architecture Design. 20th Annual Advanced Maui Optical and Space Surveillance Technologies Conference, 2019.

L. Hsia, L. Merkle, D. Weeks, G. Vernizzi, M. Lanzerotti, D. Langley. Physically Unclonable Characteristics for Verification of Transmon-Based Quantum Computers. Government Microcircuit Applications and Critical Technology Conference, 2020.

MILLER, MICHAEL, E., Department of Systems Engineering and Management

Sponsor Funded Research Projects

"Maintaining Human-Machine Shared Awareness in Distributed Operations with Degraded Communications." Sponsor: NextGen. Funding: $22,500 - Miller 100%. [ANT]

Refereed Journal Publications

Miller, M.E., Gerhardt, J., Yoo, H, and Akhavan, T. (2020). Model for Assessing Organic Light Emitting Diode Display Lifetime across Applications, *Journal of the Society for Information Display, 28(7),* 629-640. https://doi.org/10.1002/jsid.858

Geiselman, E.E., Heft, E., and Miller, M.E. (2020). Development and validation of a secondary task environment for assessing visual-psychomotor tasks, *Theoretical Issues in Ergonomics Science, 21(6),* 709-727. https://doi.org/10.1080/1463922X.2020.1729445.

Johnson, C., Miller, M.E., Rusnock, C.F. and Jacques, D.J. (2020). Applying Control Abstraction to the Design of Human-Agent Teams, *Systems*. https://www.mdpi.com/2079-8954/8/2/10. [ANT]

Miller, M.E., McGuirl, J.M., Schneider, M.F. and Ford, T.C. (2020). A Language and Method to Permit Modeling of Human-Agent Teams, *Systems Engineering*, *23(5),* 519-533. https://onlinelibrary.wiley.com/doi/abs/10.1002/sys.21546. [ANT]

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Andrews, J.M., Rusnock, C.F., Miller, M.E. and Meador, D.P. (2020) Simulation-Based Evaluation of the Effects of Varying Degrees of Control Abstraction for Manned-Unmanned Teaming on Mental Workload of Pilots, Proceedings of the IEEE International Conference on Systems, Man, and Cybernetics, Online.

EDITORSHIPS IN PROFESSIONAL JOURNALS

Miller, M.E. and Rusnock, C.F. (2020) Special Issue "Human Factors in Systems Engineering," *Systems*, https://www.mdpi.com/journal/systems/special_issues/HF_SE .

Patent Applications

Canzonetta, D.J., Schneider, M.F., Miller, M.E. (May 2020), Interactive Artificial Intelligence System with Adaptive Timing, Patent Application.

Miller, M.E., Stephens, C.I., Kennedy, K.D., Pope, A.T., Borghetti, B. (Sept 2020), Display System Interface using Visually-Evoked Cortical Potentials, Patent Application.

NYKL, SCOTT, L., Department of Electrical and Computer Engineering

Sponsor Funded Research Projects

"Automated Aerial Refueling: Precise Relative Navigation Using Stereo Vision, Phase 3." Sponsor: AFRL/RQ. Funding: $40,000 - Nykl 100%.

"Automated Aerial Refueling: Precise Relative Navigation Using Stereo Vision, Phase 3." Sponsor: AFRL/RQ. Funding: $110,000 - Nykl 100%.

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K. Kim O, R. Leishman, and S. Nykl, "Virtual Testbed for Monocular Visual Navigation of Small Unmanned Aircraft Systems," The Journal of Defense Modeling and Simulation, vol. 0, no. 0, pp. 1–19, Sep 2020, URL: https://doi.org/10.1177/1548512920954545.

K. Graham, B. Heitmeyer, P. PatelO, J. AndersonS, S. Nykl, L. Merkle, and A. Lin, "Cyber Space Odyssey: A Competitive, Team-Oriented Serious Game in Computer Networking," IEEE Transactions on Learning Technologies, vol. 13, no. 3, pp. 502–515, Jul 2020, URL: https://doi.org/10.1109/TLT.2020.3008607.

A. Leighner, J. Roeber, P. Patel, J. Pecarina, and S. Nykl, "FPGA Accelerated Discrete-SURF for Vision based Aerial Navigation," Journal of DOD Research & Engineering (JDR&E), vol. 3, no. 1, pp. 1–13, 2020.

J. Roeber, S. Nykl, and S. Graham, "Assessment of Structure from Motion for Reconnaissance Augmentation and Bandwidth Usage Reduction," The Journal of Defense Modeling and Simulation, vol. 17, no. 2, pp. 213–225, 2020, URL: https: //doi.org/10.1177/1548512919844021.

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B. Burfeind, R. Mills, S. Nykl, J. Betances, and C. Sielski, "Confidential ADS-B: A Lightweight, Interoperable Approach," in 2019 IEEE Aerospace Conference, ser. IEEE Aerospace Conference. Big Sky, Montana: IEEE, 2019.

J. Anderson, S. Nykl, and T. WishgollE, "Augmenting Flight Imagery from Aerial Refueling with a Virtual Boom toTest Occlusion," in Advances in Visual Computing: 12th International Symposium, ISVC 2019, Lake Tahoe, UT, USA, October 7-9, 2019, Proceedings, ser. Lecture Notes in Computer Science, G. Bebis, Ed. Springer International Publishing, 2019, vol. 10073, pp. 605–615.

J. A. Vagedes, D. D. Hodson, S. L. Nykl, and J. R. Millar, "ECS Architecture for Modern Military Simulators," in Proceedings of the International Conference on Scientific Computing (CSC). The Steering Committee of the World Congress in Computer Science, 2019, pp. 118–122.

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R. Raettig and S. Nykl, "Aided Stereo Vision Calibration Process for Automated Aerial Refueling," in Proceedings of the Institute of Navigation (ION) Joint Navigation Conference (JNC), ser. ION JNC '20. Cincinnati, OH, USA: Institute of Navigation, Sept 2020.

J. Larson and S. Nykl, “Convolutional Neural Networks to Improve Pose Estimation in Automated Aerial Refueling,” in Proceedings of the Institute of Navigation (ION) Joint Navigation Conference (JNC), ser. ION JNC ’20. Cincinnati, OH, USA: Institute of Navigation, Sept 2020.

V. Bownes* and S. Nykl, “Using Augmented Reality to Test Boom Occlusion Mitigation Methods in AAR,” in Proceedings of the Institute of Navigation (ION) Joint Navigation Conference (JNC), ser. ION JNC ’20, Cincinnati, OH, USA: Institute of Navigation, Sept 2020.

Patent Applications

Nykl, Scott and Woolley, Brian and Pecarina, John. *Process for Stereo Vision Relative Navigation of Airborne Vehicles*. U.S. Patent Pending 62/886,550, August, 2019.

OXLEY, MARK, E., Department of Mathematics and Statistics

Sponsor Funded Research Projects

“MOA - AFTAC Endowed Term Chairs.” Sponsor: AFTAC/XPB. Funding: $30,000 - Oxley 100%. [NEAT]

Refereed Journal Publications

Cordeiro, J. D., Kharoufeh, J. P., and Oxley, M. E., “On the Ergodicity of a Class of Level-Dependent Quasi-Birth and-Death Processes,” *Applied Probability Trust*, Vol. 51, No. 4, pp. 1109-1128, Dec 2019.

Books and Chapters in Books

Hartman, H. and Oxley, M. E., “Individual Exposure Health Risk Profile (IEHRP) – Developing a Risk Profile Tool Beyond Dose Response.” *Total Exposure Health, an Introduction*. Boca Raton, FL, K. Phillips, D. Yamamoto,and L. Racz, eds., CRC Press, Taylor & Francis Group, 4 May 2020, pp, 31-40.

PACHTER, MEIR, Department of Electrical and Computer Engineering

Refereed Journal Publications

M. Pachter, A. Von Moll, E. Garcia, D. Casbeer and D. Milutinovic: “Two-on-One Pursuit,” AIAA Journal of Guidance, Control and Dynamics, Vol. 42, No. 7, 2019, pp. 1638-1644.

M. Pachter and P. Wasz, “On a Two Cutters and Fugitive Ship Differential Game,” IEEE Control Systems Letters (L-CSS), Vol. 3, No. 4, pp. 913-917, October 2019.

M. Pachter and S. Coats, “The Classical Homicidal Chauffeur Differential Game,” Dynamic Games And Applications, Vol. 9, September 2019, pp. 800-850.

E. Garcia, D. Casbeer and M. Pachter, “Pursuit in the Presence of a Defender,” Dynamic Games And Applications, Vol. 9, September 2019, pp. 652-670.

W. N. Caballaro, B. J. Lunday, R. F. Deckro and M. Pachter, “Informing National Security Policy by Modeling Adversarial Inducement and its Governance,” Socio-Economic Planning Sciences, Vol. 69, March 2020.

K. Kalyanam, D. Casbeer and M. Pachter, “Graph Search of a Moving Ground Target by a UAV Aided by Ground Sensors with Local Information,” Autonomous Robots (AURO), May 2020, 44, pp. 831-843.

K. Kalynam, D. Casbeer and M. Pachter, “A Sequential Partial Information Bomber-Defender Shooting Problem,” Naval Research Logistics, February 2020, Vol. 67, pp. 223-235.

Weintraub I., E. Garcia and M. Pachter: "An Optimal Guidance Strategy for the Defense of a Non-Maneuverable target in 3-D," IET Journal of Control Theory & Applications , Vol. 14, No. 11, 2020, pp. 1531-1538.

E. Garcia, D. Casbeer, and M. Pachter, "Optimal Strategies of the Differential Game in a Circular Region," IEEE Control systems Letters, L-CSS, Vol. 4, no. 2, pp. 492-497.

E. Garcia, D. Casbeer, and M. Pachter, "Optimal Strategies for a Class of Multi Player Reach-Avoid Differential Games in 3-D Space," Robotics and Automation Letters (RA-L), .Vol. 5, No. 3, pp. 4257-4264.

A. Von Moll, D. Casbeer, E. Garcia, D. Milutinovic and M. Pachter, "The Multiple Pursuer, Single Evader Game -- A Geometric Approach," Published electronically on 2 January 2019, Journal of Intelligent and Robotic Systems, Vol. 96, No. 2, pp. 193-207.

Von Moll, A., M. Pacter, E. Garcia, D. Casbeer and D. Milutinovic``Robust Policies for a Multiple Pursuer Single Evader Differential Game," published electronically on May 4, 2019, DOI 10.1007/s13235-019-00313-3, Dynamic Games and Applications, Vol. 10, No. 9, pp. 1-24.

M. Pachter, A. Von Moll and D. Casbeer, "Cooperative Pursuit by Multiple Pursuers of a Single Evader," AIAA Journal of Information Systems, Vol. 17, No. 8, pp. 371-389.

Refereed Conference Papers Accepted on the Basis of Full Paper Review

M. Vlassakis and M. Pachter, "Pure Pursuit of an Equal Speed Evader," Proceedings of the 60th Israel Annual Conference on Aerospace Sciences, Tel Aviv and Haifa, 4-5 March 2020.

I. Weintraub, R.Cobb, W. Baker and M. Pachter, "Direct Methods Comparison for the Active Target Defense Scenario," AIAA SciTech conference, Orlando, FL, January 6-10 2020.

Pachter, Meir and Patrick Wasz, "On a Two Cutters and Fugitive Ship Differential Game". Proceedings of the Conference on Decision and Control, Nice, France, December 11-13, 2019.

E. Garcia, A. Von Moll, D. Casbeer and M. Pachter, "Strategies for Defending a Coastline against Multiple Attackers". Proceedings of the Conference on Decision and Control, Nice, France, December 11-13, 2019

Eloy Garcia, David Casbeer and Meir Pachter, "Cooperative Two-Pursuer One-Evader Blocking Differential Game," American Control Conference, pp. 2702-2709, Philadelphia, PA, 10-12 July, 2019.

Patrick Wasz, Meir Pachter# and Khanh Pham, "Two-On-One Pursuit with a Non-Zero Capture Radius," Mediterranean Control Conference, Akko, Israel, July 1-4, 2019. Also chaired the session Guidance 2 - ThB01.

Meir Pachter, Eloy Garcia, Roger Anderson and David Casbeer, "Maximizing the Target's Longevity in the Active Target Defense Differential Game," European Control Conference, Naples, Italy, 25-28 June, 2019. Also chaired the Session.

E. Garcia, D. Casbeer and M. Pachter, "Capture the Flag -- A Differential Game," CCTA 2020 conference, 24-26 August 2020, Montreal, CA

M. Vlassakis* and M. Pachter, "Two-on-One Pursuit When the Pursuers Have the Same Speed as the Evader," IFAC Congress, July 12-17 2020, Berlin, Germany.

A. Von Moll, Z. Fuchs and M. Pachter, "Optimal Evasion against Dual Pure Pursuit," ACC 2020, 1-3 July, Denver, CO.

I. Weintraub, A. Von Moll, E. Garcia, D. Casbeer, Z. Demers and M. Pachter, "Maximum Observation of a Non-Maneuvering Target by a Slower Observer," ACC 2020, 1-3 July, Denver, CO.

I. Weintraub, M. Pachter and E. Garcia, “An Introduction to Pursuit-Evasion Games" (lecture), ACC 2020, 1-3 July, Denver, CO.

E. Garcia, I. Weintraub and M. Pachter and, “Introduction to Cooperative Pursuit-Evasion Differential Games," (Lecture), ACC 2020, 1-3 July, Denver, CO.

M. Pachter, “Multi-Player Pursuit-Evasion Differential Games" (lecture), ACC 2020, 1-3 July, Denver, CO

E. Garcia, D. Casbeer, M. Pachter, W. Curtiss and E. Doucette, “Two-team Linear-Quadratic Differential Game of Defending a Target,” ACC 2020, 1-3 July, Denver, CO.

PETERSON, GILBERT, L., Department of Electrical and Computer Engineering

Sponsor Funded Research Projects

"Autonomy Capability Design and Development." Sponsor: AFRL/RH. Funding: $275,000 - Peterson 100%. [CCR]

Refereed Journal Publications

J.M. Bindewald, M.E. Miller, and G. L. Peterson, “Creating Effective Automation to maintain explicit User Engagement,” *International Journal of Human-Computer Interaction*, pp. 1—14, 2019.
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(https://aaai.org/ocs/index.php/FLAIRS/FLAIRS20/paper/view/18432).

J.S. Okolica, A.C. Lin, and G.L. Peterson, “Gaming DevSecOps – A Serious Game Pilot Study,” 2020 National Cyber Summit Research Track, pp. TBD, 2020.

W.C. Henry, G.L. Peterson, “Exploring Provenance Needs in Software Reverse Engineering,” Systematic Approaches to Digital Forensic Engineering 2020, pp. TBD, 2020 (http://sadfe.org/papers/SADFE_2020_henry.pdf).

Books and Chapters in Books

K.-K. R. Choo, T. H. Morris, and G .L. Peterson (Eds.), *2020 National Cyber Summit (NCS) Research Track*, Advances in Intelligent Systems and Computing, Springer, 2020.

PIERCE, SCOTT, J., LT. COL. Department of Electrical and Computer Engineering

TAYLOR, CLARK, N., Department of Electrical and Computer Engineering

Sponsor Funded Research Projects

"GPS-Denied Localization of Daughter-Ships in a Mother-Daughter Ship Collaborative Environment." Sponsor: AFRL/RQ. Funding: $50,000 - Taylor 100%.

Refereed Journal Publications

"Robust Incremental State Estimation through Covariance Adaptation," *R. Watson, J. Gross, C.N. Taylor, and R. Leishman, in *IEEE Robotics and Automation Letters,* v. 5(2), April 2020, doi:10.1109/LRA.2020.2979655.

"Enabling Robust State Estimation through Measurement Error Covariance Adaptation," *R.M. Watson, J.N. Gross, C.N. Taylor, and R.C. Leishman, in *IEEE Transactions on Aerospace and Electronic Systems,* v. 56(3), June 2020, doi: 10.1109/TAES.2019.2941103.

Refereed Conference Papers Accepted on the Basis of Full Paper Review

"Covariance Estimation for Factor Graph Based Bayesian Estimation," A. Vainly and C.N. Taylor, accepted in Proceedings, IEEE International Conference on Information Fusion, 2020.

"A Variational Bayesian Approach for Estimating Colored Noise Parameters," H. Bai and C.N. Taylor, accepted in Proceedings, IEEE International Conference on Information Fusion, 2020.

"Visual Servoing for Final Approach Phase of Spacecraft Proximity Operations," W. Harris, R. Cobb, and C.N. Taylor, in Proceedings, ION/IEEE Position, Location and Navigation Symposium, 2020.

"Comparison of Visual Simultaneous Localization and Mapping Methods for Fixed-Wing Aircraft using SLAMBench2," P. Latcham, C.N. Taylor, in Proceedings, ION/IEEE Position, Location and Navigation Symposium, 2020.

"Invariant-EKF Design for a Unicycle Robot under Linear Disturbances," K. Coleman, H. Bai, and C.N. Taylor, in Proceedings, American Control Conference, 2020.

Refereed Conference Papers Accepted on the Basis of Abstract Review

"An Evaluation of Vision-aided Navigation Uncertainty," Rodenburg and C.N. Taylor accepted in Proceedings, ION GNSS+, 2020.

"Factor Graph-based Simultaneous Localization and Mapping using Magnetic Measurements," C.N. Taylor and A. Canciani, accepted in Proceedings, ION GNSS+, 2020.

"Uncertainty Model Estimation in an Augmented Data Space for Robust State Estimation," R.M. Watson, J.N. Gross, C.N. Taylor, and R.C. Leishman, accepted in Proceedings, ION GNSS+, 2020.

"Effects of Stereo Vision Camera Positioning on Relative Navigation Accuracy," K. Sarantsev, C.N. Taylor, and S.L. Nykl, in Proceedings, ION International Technical Meeting (ITM) 2020.

"An Evaluation of Vision-aided Navigation Uncertainty," E. Rodenburg and C.N. Taylor in Proceedings, ION GNSS+, 2020.

"Uncertainty Model Estimation in an Augmented Data Space for Robust State Estimation," R.M. Watson, J.N. Gross, C.N. Taylor, and R.C. Leishman, in Proceedings, ION GNSS+, 2020.

"Relative Magnetic Position Sensor Assisted Dual Foot IMU Pedestrian Dead Reckoning," Jordan Eldridge and C.N. Taylor, accepted in *ION International Technical Meeting, 2021.*

"Error Characterization of Iterative Closest Point Pose Estimation," Rick Yuan and C.N. Taylor, accepted in *ION International Technical Meeting, 2021.*

TEMPLE, MICHAEL, A., Department of Electrical and Computer Engineering

6.2. CENTER FOR CYBERSPACE RESEARCH

Center for Cyberspace Research (CCR)
Director (937) 255-6565 x4690
Executive Program Coordinator (937) 255-3636 x4602
Homepage: https://www.afit.edu/CCR

6.2.1. DOCTORAL DISSERTATIONS

DICKEY, JOSHUA, T., Neural Network Models for Nuclear Treaty Monitoring: Enhancing the Seismic Signal Pipeline with Deep Temporal Convolution.AFIT-ENG-DS-20-J-004. Faculty Advisor: Dr. Brett J. Borghetti. Sponsor: N/A.

PATEL, PRANAV, R., Direct Digital Synthesis: A Flexible Architecture for Advanced Signals Research for Future Satellite Navigation Payloads. AFIT-ENG-DS-20-S-014. Faculty Advisor: Dr. Richard K. Martin. Sponsor: N/A.

WESTING, NICHOLAS, M., Physics-Constrained Hyperspectral Data Exploitation Across Diverse Atmospheric Scenarios. AFIT-ENG-DS-20-S-021. Faculty Advisor: Dr. Richard K. Martin. Sponsor: NASIC/GSP.

6.2.2. MASTER'S THESES

BARKER, NATHAN, V., Development of a Drone Mounted Wireless Attack Platform. AFIT-ENG-MS-20-M-005. Faculty Advisor: Dr. Barry E. Mullins. Sponsor: N/A.

BURFEIND, BRANDON, C., Interoperable ADS-B Confidentiality. AFIT-ENG-MS-19-M-052. Faculty Advisor: Dr. Robert F. Mills. Sponsor: AF/A3OJ.

DUKARM, CHRISTOPHER, Mobile Data Analysis using Dynamic Binary Instrumentation and Static. AFIT-ENG-MS-20-M-016. Faculty Advisor: Maj. Richard Dill. Sponsor: N/A.

FLACK, NATHANIEL, W., Developing a Serious Game to Explore Joint All Domain and Control. AFIT-ENG-MS-20-M-19. Faculty Advisor: Dr. Mark G. Reith. Sponsor: AF CyTCoE.

GALLAHER, JOSHUA, T., Automated Detection and Mitigation of Inefficient Visual Searching Using Electroencephalography and Machine Learning. AFIT-ENG-MS-20-M-022. Faculty Advisor: Dr. Brett J. Borghetti. Sponsor: AFOSR.

LEPLEY, THOMAS, A., Met surface Antenna for Wideband Applications. AFIT-ENG-MS-20-M-036. Faculty Advisor: Dr. Peter J. Collins. Sponsor: NRTF.

MADISON, ZACHARY, D., Honey Hive: A Network Intrusion Detection System Framework Utilizing Distributed Internet of Things Honeypot Sensors. AFIT-ENG-MS-20-M-038. Faculty Advisor: Dr. Barry E. Mullins. Sponsor: DHS.

NAFZIGER, GRANT, T., Wireless Sensor Network Optimization for Radio Tomographic Imaging. AFIT-ENG-MS-20-M-047. Faculty Advisor: Dr. Richard K. Martin. Sponsor: N/A.

O'BRIEN, NICHOLAS, J., A Non-Destructive Evaluation application using Software Defined Radios and Bandwidth Expansion. AFIT-ENG-MS-20-M-049. Faculty Advisor: Dr. Peter J. Collins. Sponsor: N/A.

OENER, JACOB, Q., Applying Data Organizational Techniques to Enhance Air Force Learning. AFIT-ENG-MS-20-M-052. Faculty Advisor: Maj. Richard Dill. Sponsor: N/A.

PARK, YOUNGJUN, Development and Evaluation of a Security Agent for Internet of Things. AFIT-ENG-MS-20-M-053. Faculty Advisor: Dr. Barry E. Mullins. Sponsor: DHS.

ROSARIO-MOREL, LUSI, Joint 1D and 2D Neural Networks for Automatic Modulation Recognition. AFIT-ENG-MS-20-S-016. Faculty Advisor: Dr. Richard K. Martin. Sponsor: N/A.

6.2.3. FACULTY RESEARCH OUTPUT

Notes: Faculty Bios can be found under their respective department listings. Shared credit for funding awards is indicated by the percentages shown for each faculty member associated with the project.

BETANCES, JOAN, A., MAJ, Department of Electrical and Computer Engineering

BORGHETT, BRETT, J., Department of Electrical and Computer Engineering

Refereed Journal Publications

Westing, Nicholas M., Gross, Kevin C., Borghetti, Brett, J., Martin, Jacob, and Meola, Joseph, "Learning Set Representations for LWIR In-Scene Atmospheric Compensation" *IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing*, 2 Apr 2020, Vol 13, pp 1438-1449
https://ieeexplore.ieee.org/document/9055124

Dickey, Joshua, T., Borghetti, Brett, J., Junek, William, and Martin, Richard "Beyond Correlation: A Path-invariant Measure for Seismogram Similarity" *Seismological Research Letters*, 6 Nov 2019, DOI: 10.1785/0220190090
https://pubs.geoscienceworld.org/srl/article-pdf/doi/10.1785/0220190090/4862061/srl-2019090.1.pdf

Westing, Nicholas M., Borghetti, Brett, J., Gross, Kevin C., "Fast and Effective Techniques for LWIR Radiative Transfer Modeling: A Dimension Reduction Approach," *Remote Sensing (MDPI)*, 9 Aug 2019, Vol 11, issue 6, pp.1866-1886, DOI: 10.3390/rs11161866 https://www.mdpi.com/2072-4292/11/16/1866/htm

Refereed Conference Papers Accepted on the Basis of Full Paper Review

Crow, David R., Graham, Scott R., Borghetti, Brett J., Sweeney, Patrick J., "Empirical Dynamic Modeling as a Basis for an Intrusion Detection System" *14th International Conference on Critical Infrastructure Protection (IFIP)*, Arlington, VA, USA, Mar 2020.

Villarreal, Micah N., *Kamrud, Alexander J., Borghetti, Brett J., "Confirmation Bias Estimation from Electroencephalography with Machine Learning," *Human Factors and Ergonomics Society (HFES) Annual Conference, 2019,* Seattle, WA, 28 Oct-1 Nov 2019.

Refereed Conference Papers Accepted on the Basis of Abstract Review

Crow, David R., Graham, Scott R., Borghetti, Brett J., "Fingerprinting Vehicles with CAN Bus Data Samples," *15th International Conference on Cyber Warfare and Security (ICIW)*, Norfolk, VA, Feb 2020.

CLINTON, JUSTEN, A., Department of Engineering Physics

Refereed Journal Publications

Logan, J., Holland, D., Burggraf, L., Clinton, J., O'Day, B. 2019. "Monte Carlo and Experimental Analysis of a Novel Directional Rotating Scatter Mask Gamma Detection System." *Nuclear Instruments and Methods in Physics Research Section A: Accelerators, Spectrometers, Detectors and Associated Equipment*. **947**, pp. 162698. https://doi.org/10.1016/j.nima.2019.162698

COLLINS, PETER, J., Department of Electrical and Computer Engineering

Sponsor Funded Research Projects

"FASTBALL: Frugal Atmospheric Sounder Test Bed Auto-pointing Luneburg Lens." Sponsor: Undisclosed. Funding: $17,500 - Collins 100%.

"Enabling Technologies for Radar Scattering Measurements." Sponsor: SAF/FBIB. Funding: $142,390 - Collins 100%.

"Enabling Technologies for Advanced Munitions." Sponsor: SAF/FBIB. Funding: $100,000 - Collins 50%, Hartsfield 25%, Lingenfelter 25%.

Refereed Journal Publications

John Lee, Peter J. Collins, and Julie Ann Jackson, "Sparse Representation of Targets with Mixed Scattering Primitives," Journal of the Applied Computational Electromagnetics Society, Volume: 35, Number: 6, 2020.

Alex Paul, Collins P. J., Temple M., "Application of Machine Learning to Enhance Antenna Termination State Estimation Using Stimulated Unintended Radiated Emissions," IEEE Ant & Wireless Prop Letters, Volume: 18, Issue: 11, Nov. 2019.

Christopher Vergara, Richard K. Martin, Peter J. Collins, and James R. Lievsay, "Multi-Sensor Data Fusion between Radio Tomographic Imaging and Noise Radar," IET Radar, Sonar & Navigation, Volume: 14, Issue: 2, pp. 187-193, Feb. 2020.

Refereed Conference Papers Accepted on the Basis of Full Paper Review

Spencer R. Sellers, Peter J. Collins, and Julie Ann Jackson, "Augmenting Simulations for SAR ATR Neural Network Training," IEEE International Radar Conference, Washington D.C., 27 Apr – 1 May 2020.

DEYOUNG, MARK, E., LT. COL., Department of Electrical and Computer Engineering

GRAHAM, SCOTT, R., Department of Electrical and Computer Engineering

Sponsor Funded Research Projects

"Cyber Resiliency at the Component Level." Sponsor: AFLCMC/XZZ. Funding: $200,000 - Graham 50%, Betances 50%.

"Cyber Resiliency at the Component Level." Sponsor: AFLCMC/XZZ. Funding: $50,000 - Graham 60%, Martin 20%, Mullins 20%.

Refereed Journal Publications

Pettit, D.M., Graham, S.R., Sweeney, P.J., "Searching for Stars: Analyzing and Defining UAV Cyber Risk Assessments*," IARIA International Journal on Advances in Security*, vol 13, no 1&2, Jun 2020.

Hamilton, N.S., Graham, S.R., Carbino, T.J., Petrosky, J.C., Betances, J.A., "Adaptive-Hybrid Redundancy with Error Injection," *MDPI Journal of Electronics*, Vol 8, no.11, Nov 2019.

Refereed Conference Papers Accepted on the Basis of Full Paper Review

Hamilton, N.S., Graham, S.R., Carbino, T.J., Petrosky, J.C., Betances, J.A., "Adaptive-Hybrid Redundancy for Rad-Hardening," Proceedings of the IEEE 2019 National Aerospace and Electronics Conference (NAECON), I EEE, 15-19 Jul 2019.

Pettit, D.M., Graham, S.R., Dill, R., "Zero Stars: Analysis of Cybersecurity Risk of Small COTS UAVs," IARIA SECUREWARE 19, Nice, France, Oct 2019.

Crow, D.R., Graham, S.R., Borghetti, J.B., Sweeney, P.J., "Empirical Dynamic Modeling as a Component of an Intrusion Detection System," 14th International Conference on Critical Infrastructure Protection, Arlington, VA, USA, Mar 2020.

Hayden, M.J, Graham, S.R., Betances, J.A., Mills, R.M., "Multi-Channel Security through Data Fragmentation," 14th International Conference on Critical Infrastructure Protection, Arlington, VA, USA, Mar 2020.

Mireles, L.E., Graham, S.R., Dunlap, S.J., Sweeney, P.J., Dallmeyer M.J., "Implications of Securing and Infiniband Network," 14th International Conference on Critical Infrastructure Protection, Arlington, VA, USA, Mar 2020.

Pettit, D.M., Graham, S.R., "Cybersecurity Risk Assessment for Small Unmanned Aerial Vehicles," 14th International Conference on Critical Infrastructure Protection, Arlington, VA, USA, Mar 2020.

Refereed Conference Papers Accepted on the Basis of Abstract Review

Crow, D.R., Graham, S.R., Borghetti, J.B., "Fingerprinting Vehicles with CAN Bus Data Samples," *15th International Conference on Cyber Warfare and Security (ICCWS 2020)*, Norfolk, VA, Feb 2020.

Books and Chapters in Books

Cintron, L.A., Graham, S.R., Hodson, D.D., Mullins, B.E., "Modeling Liability Data Collection Systems for Intelligent Transportation Infrastructure using Hyperledger Fabric," *Critical Infrastructure Protection XIII,* Springer,q Cham, Switzerland, pp. 137-156, 2019.

Lassiter, R. M., Graham, S.R., Carbino, T.J., Dunlap S.J., "Electronic Control Unit Discrimination Using Wired Signal Distinct Native Attributes (WS-DNA)," *Critical Infrastructure Protection XIII,* Springer, Cham, Switzerland, pp. 103-121, 2019.

Hacker, K.L., Graham, S.R., Dunlap, S.J., Vehicle Identification and Route Reconstruction via TPMS Data Leakage, *Critical Infrastructure Protection XIII*, Springer, Cham, Switzerland, pp. 123-136, 2019.

Schmitt, D.J., Graham, S.R., Sweeney, P.J., Mills, R.M., "Vulnerability Assessment of Infiniband Networking," *Critical Infrastructure Protection XIII,* Springer, Cham, Switzerland, pp. 179-205, 2019.

GRIMAILA, MICHAEL, R., Department of Systems Engineering and Management

Sponsor Funded Research Projects

"Modeling and Simulation of Quantum Networks." Sponsor: NSA. Funding: $100,000 - Grimaila 50%, Hodson 50%.

Refereed Journal Publications

Engle, R., Langhals, B. T., Grimaila, M. R., Hodson, D., "Evaluation Criteria for Selecting NoSQL Databases in a Single-Box Environment," International Journal of Database Management Systems, Vol 10, No 4, August 2018.

Span, M.T., Mailloux, L.O., Grimaila, M.R., "Cybersecurity Architectural Analysis for Complex Cyber-Physical Systems," The Cyber Defense Review, Army Cyber Institute, Vol. 3, No. 2, pp. 115-134, August 2018.

Okolica, J.S., Peterson, G., Mills, R.F., and Grimaila, M.R., "Sequence Pattern Mining with Variables," IEEE Transactions on Knowledge and Data Engineering, pp. 1-20, 19 November 2018, DOI: 10.1109/TKDE.2018.2881675.

Refereed Conference Papers Accepted on the Basis of Full Paper Review

Engle, D.L., Langhals, B.T., Grimaila, M.R., Hodson, D.D., "The Case for NoSQL on a Single Desktop," 17th International Conference on Information & Knowledge Engineering, July 30-August 2, 2018.

Refereed Conference Papers Accepted on the Basis of Abstract Review

Sigala, A., Langhals, B. T., Grimaila, M. R., Hodson, D., "USAF Applications of Unmanned Aerial Systems (UAS) A Delphi Study to Examine Current and Future UAS Autonomous Mission Capabilities" Proceedings of the 44th Dayton-Cincinnati Aerospace Sciences Symposium, Dayton, OH, March 5, 2019.

Editorships in Professional Journals

Editorial Board of Information System Security Association (ISSA) Journal.

Assistant Editor, The Defense Cyber Review, Army Cyber Institute, West Point.

GUNAWARDENA, SANJEEV, Department of Electrical and Computer Engineering

HODSON, DOUGLAS, D., Department of Electrical and Computer Engineering

Refereed Journal Publications

Chris Weimer, J.O. Miller, Raymond Hill, Douglas D. Hodson, "Agent Scheduling in Opinion Dynamics: A Taxonomy and Comparison Using Generalized Models," Journal of Artificial Societies and Social Simulation (JASSS), Vol 22, No 4, 2019.

Refereed Conference Papers Accepted on the Basis of Full Paper Review

Joseph Tippit, Douglas Hodson, Michael Grimaila, "Julia and Singularity for High Performance Computing," The 18th International Conference on Scientific Computing (CSC'20), Las Vegas, NV, Jul 27-30, 2020.

Drew Campbell, Jake Hall, Iyanu Odebode, Douglas Hodson, Michael Grimaila, "Trojan Banker Simulation Using Python," The 18th International Conference on Scientific Computing (CSC'20), Las Vegas, NV, Jul 27-30, 2020.

Amber Modlin, Andres Gregory, Iyanu Odebode, Douglas Hodson, Michael Grimaila, "CovidLock a New Form of Ransomware," The 18th International Conference on Scientific Computing (CSC'20), Las Vegas, NV, Jul 27-30, 2020.

Braeden Bowen, Jeremy Ergybar, Iyanu Odebode, Douglas Hodson, Michael Grimaila, "The New Office Threat: A Simulation Environment of Watering Hole Cyber Attacks," The 18th International Conference on Scientific Computing (CSC'20), Las Vegas, NV, Jul 27-30, 2020.

Hai Vo, Raymond Kozlowski, Iyanu Odebode, #Douglas Hodson, Michael Grimaila, "Simulation of SYN Flood Attack and Counter-Attack Methods Using Average Connection Times," The 18th International Conference on Scientific Computing (CSC'20), Las Vegas, NV, Jul 27-30, 2020.

HOPKINSON, KENNETH. M., Department of Electrical and Computer Engineering

LIN, ALAN, C., LT. COL., Department of Electrical and Computer Engineering

MAGNUS, AMY, L., Department of Mathematics and Statistics

MARTIN, RICHARD, K., Department of Electrical and Computer Engineering

Sponsor Funded Research Projects

"Classification Methods and Passive Augm of Spectropolarmetric LADAR." Sponsor: AFRL/RW. Funding: $50,000 - Martin 100%.

MAYBECK, PETER, S., Department of Electrical and Computer Engineering

MERKLE, LAURENCE, D., Department of Electrical and Computer Engineering

MILLS, ROBERT, F., Department of Electrical and Computer Engineering

Refereed Journal Publications

Beach, P.M., Mailloux, L.O., Langhals, B.T., and Mills, R.F., "Analysis of Systems Security Engineering Design Principles for the Development of Secure and Resilient Systems," IEEE Access, Vol 7, 24 Jul 2019, doi:10.1109/ACCESS.2019.2930718.

Sibiga, M., Mills, R., Rice, M., and Dunlap, S., "Applying Cyber Threat Intelligence to Industrial Control Systems," CSIAC Journal, Cyber Security & Information Systems Analysis Center, Vol 7, No 2, Aug 2019, pp 46-54.

Refereed Conference Papers Accepted on the Basis of Full Paper Review

Wargo, T.W., Boggs, B.N., Temple, M.A., and Mills, R.F., "DNA Fingerprinting Ping 2020i ADS-B Beacons," IEEE Military Communications Conference, 12-14 Nov 2019.

Mailloux, L.O., and Mills, R.F. "Autonomous Space Resupply Vehicle Systems Security Design Principle Case Study," IEEE Workshop on Cyber Physical Systems (CPS-Sec) 2020, Virtual Conference, 29 June-1 July 2020.

Hayden, M., Graham, S., Betances, J., Mills, R., "Multi-Channel Security through Data Fragmentation," 14th International Conference on Critical Infrastructure Protection, Arlington, VA, USA, Mar 2020.

Books and Chapters in Books

Schmitt, D., Graham, S., Sweeney, P., and Mills, R., "Vulnerability Assessment of Infiniband Networking," Critical Infrastructure Protection XIII, Sringer, Cham, Switzerland, pp 179-205, 2019.

NYKL, SCOTT, L., Department of Electrical and Computer Engineering

Sponsor Funded Research Projects

"Automated Aerial Refueling: Precise Relative Navigation Using Stereo Vision, Phase 3." Sponsor: AFRL/RQ. Funding: $40,000 - Nykl 100%.

"Automated Aerial Refueling: Precise Relative Navigation Using Stereo Vision, Phase 3." Sponsor: AFRL/RQ. Funding: $110,000 - Nykl 100%.

Refereed Journal Publications

K. Kim, R. Leishman, and S. Nykl, "Virtual Testbed for Monocular Visual Navigation of Small Unmanned Aircraft Systems," The Journal of Defense Modeling and Simulation, vol. 0, no. 0, pp. 1–19, Sep 2020, URL: https://doi.org/10.1177/1548512920954545.

K. Graham, B. Heitmeyer, P. Patel, J. Anderson, S. Nykl, L. Merkle, and A. Lin, "Cyber Space Odyssey: A Competitive, Team-Oriented Serious Game in Computer Networking," IEEE Transactions on Learning Technologies, vol. 13, no. 3, pp. 502–515, Jul 2020, URL: https://doi.org/10.1109/TLT.2020.3008607.

A. Leighner, J. Roeber, P. Patel, J. Pecarina, and S. Nykl, "FPGA Accelerated Discrete-SURF for Vision based Aerial Navigation," Journal of DOD Research & Engineering (JDR&E), vol. 3, no. 1, pp. 1–13, 2020.

J. Roeber, S. Nykl, and S. Graham, “Assessment of Structure from Motion for Reconnaissance Augmentation and Bandwidth Usage Reduction,” The Journal of Defense Modeling and Simulation, vol. 17, no. 2, pp. 213–225, 2020, URL: https: //doi.org/10.1177/1548512919844021.

Refereed Conference Papers Accepted on the Basis of Full Paper Review

B. Burfeind, R. Mills, S. Nykl, J. Betances, and C. Sielski, “Confidential ADS-B: A Lightweight, Interoperable Approach,” in 2019 IEEE Aerospace Conference, ser. IEEE Aerospace Conference. Big Sky, Montana: IEEE, 2019.

J. Anderson, S. Nykl, and T. Wishgolle, “Augmenting Flight Imagery from Aerial Refueling with a Virtual Boom to Test Occlusion,” in Advances in Visual Computing: 12th International Symposium, ISVC 2019, Lake Tahoe, UT, USA, October 7-9, 2019, Proceedings, ser. Lecture Notes in Computer Science, G. Bebis, Ed. Springer International Publishing, 2019, vol. 10073, pp. 605–615.

J. A. Vagedes, D. D. Hodson, S. L. Nykl, and J. R. Millar, “ECS Architecture for Modern Military Simulators,” in Proceedings of the International Conference on Scientific Computing (CSC). The Steering Committee of the World Congress in Computer Science, 2019, pp. 118–122.

Refereed Conference Papers Accepted on the Basis of Abstract Review

R. Raettig and S. Nykl, “Aided Stereo Vision Calibration Process for Automated Aerial Refueling,” in Proceedings of the Institute of Navigation (ION) Joint Navigation Conference (JNC), ser. ION JNC ’20. Cincinnati, OH, USA: Institute of Navigation, Sept 2020.

J. Larson and S. Nykl, “Convolutional Neural Networks to Improve Pose Estimation in Automated Aerial Refueling,” in Proceedings of the Institute of Navigation (ION) Joint Navigation Conference (JNC), ser. ION JNC ’20. Cincinnati, OH, USA: Institute of Navigation, Sept 2020.

V. Bownes* and S. Nykl, “Using Augmented Reality to Test Boom Occlusion Mitigation Methods in AAR,” in Proceedings of the Institute of Navigation (ION) Joint Navigation Conference (JNC), ser. ION JNC ’20 Cincinnati, OH, USA: Institute of Navigation, Sept 2020.

Patent Applications

Nykl, Scott and Woolley, Brian and Pecarina, John. *Process for Stereo Vision Relative Navigation of Airborne Vehicles*. U.S. Patent Pending 62/886,550, August, 2019.

PACHTER, MEIR, Department of Electrical and Computer Engineering

Sponsor Funded Research Projects

"UAV Optimal Control." Sponsor: AFRL/RQ. Funding: $40,000 - Pachter 100%.

"Intelligent Control in Adversarial and Stochastic Environments." Sponsor: AFOSR. Funding: $48,800 - Pachter 100%.

"Swarm and Counter swarm Tactics for Autonomous Space Vehicles." Sponsor: AFRL/RV. Funding: $40,000 - Pachter 100%. [CSRA]

Refereed Journal Publications

M. Pachter, A. Von Moll, E. Garcia, D. Casbeer and D. Milutinovic, “Two-on-One Pursuit,” AIAA Journal of Guidance, Control and Dynamics, Vol. 42, No. 7, 2019, pp. 1638-1644.

M. Pachter and P. Wasz, “On a Two Cutters and Fugitive Ship Differential Game,” IEEE Control Systems Letters (L-CSS), Vol. 3, No. 4, pp. 913-917, October 2019.

M. Pachter and S. Coats, “The Classical Homicidal Chauffeur Differential Game,” Dynamic Games And Applications, Vol. 9, September 2019, pp. 800-850.

E. Garcia, D. Casbeer and M. Pachter: "Pursuit in the Presence of a Defender,” Dynamic Games And Applications, Vol. 9, September 2019, pp. 652-670.

W. N. Caballaro, B. J. Lunday, R. F. Deckro and M. Pachter, “Informing National Security Policy by Modeling Adversarial Inducement and its Governance,” Socio-Economic Planning Sciences, Vol. 69, March 2020.

K. Kalyanam, D. Casbeer and M. Pachter, “Graph Search of a Moving Ground Target by a UAV Aided by Ground Sensors with Local Information,” Autonomous Robots (AURO), May 2020, 44, pp. 831-843.

K. Kalyanam, D. Casbeer and M. Pachter, “A Sequential Partial Information Bomber-Defender Shooting Problem,” Naval Research Logistics, February 2020, Vol. 67, pp. 223-235.

Weintraub I., E. Garcia and M. Pachter: “An Optimal Guidance Strategy for the Defense of a Non-Maneuverable target in 3-D,” IET Journal of Control Theory & Applications , Vol. 14, No. 11, 2020, pp. 1531-1538.

E. Garcia, D. Casbeer, and M. Pachter, “Optimal Strategies of the Differential Game in a Circular Region". IEEE Control systems Letters, L-CSS, Vol. 4, no. 2, pp. 492-497.

E. Garcia, D. Casbeer, and M. Pachter, “Optimal Strategies for a Class of Multi Player Reach-Avoid Differential Games in 3-D Space,” Robotics and Automation Letters (RA-L), .Vol. 5, No. 3, pp. 4257-4264.

A. Von Moll, D. Casbeer, E. Garcia, D. Milutinovic and M. Pachter, “The Multiple Pursuer, Single Evader Game -- A Geometric Approach,” Published electronically on 2 January 2019, Journal of Intelligent and Robotic Systems, Vol. 96, No. 2, pp. 193-207.

Von Moll, A., M. Pacter, E. Garcia, D. Casbeer and D. Milutinovic` `Robust Policies for a Multiple Pursuer Single Evader Differential Game,” published electronically on May 4, 2019, DOI 10.1007/s13235-019-00313-3, Dynamic Games and Applications, Vol. 10, No. 9, pp. 1-24.

M. Pachter, A. Von Moll and D. Casbeer, “Cooperative Pursuit by Multiple Pursuers of a Single Evader,” AIAA Journal of Information Systems, Vol. 17, No. 8, pp. 371-389.

Refereed Conference Papers Accepted on the Basis of Full Paper Review

M. Vlassakis and M. Pachter, “Pure Pursuit of an Equal Speed Evader,” Proceedings of the 60th Israel Annual Conference on Aerospace Sciences, Tel Aviv and Haifa, 4-5 March 2020.

I. Weintraub, R.Cobb, W. Baker and M. Pachter, “Direct Methods Comparison for the Active Target Defense Scenario,” AIAA SciTech conference, Orlando, FL, January 6-10 2020.

Pachter, Meir and Patrick Wasz, “On a Two Cutters and Fugitive Ship Differential Game". Proceedings of the Conference on Decision and Control, Nice, France, December 11-13, 2019.

E. Garcia, A. Von Moll, D. Casbeer and M. Pachter, “Strategies for Defending a Coastline against Multiple Attackers". Proceedings of the Conference on Decision and Control, Nice, France, December 11-13, 2019

Eloy Garcia, David Casbeer and Meir Pachter, “Cooperative Two-Pursuer One-Evader Blocking Differential Game,” American Control Conference, pp. 2702-2709, Philadelphia, PA, 10-12 July, 2019.

Patrick Wasz, Meir Pachter# and Khanh Pham, "Two-On-One Pursuit with a Non-Zero Capture Radius," Mediterranean Control Conference, Akko, Israel, July 1-4, 2019. Also chaired the session Guidance 2 - ThB01.

Meir Pachter, Eloy Garcia, Roger Anderson and David Casbeer, "Maximizing the Target's Longevity in the Active Target Defense Differential Game," European Control Conference, Naples, Italy, 25-28 June, 2019. Also chaired the Session.

E. Garcia, D. Casbeer and M. Pachter, "Capture the Flag -- A Differential Game," CCTA 2020 conference, 24-26 August 2020, Montreal, CA

M. Vlassakis* and M. Pachter, "Two-on-One Pursuit When the Pursuers Have the Same Speed as the Evader," IFAC Congress, July 12-17 2020, Berlin, Germany.

A. Von Moll, Z. Fuchs and M. Pachter, "Optimal Evasion against Dual Pure Pursuit," ACC 2020, 1-3 July, Denver, CO.

I. Weintraub, A. Von Moll, E. Garcia, D. Casbeer, Z. Demers and M. Pachter, "Maximum Observation of a Non-Maneuvering Target by a Slower Observer," ACC 2020, 1-3 July, Denver, CO.

I. Weintraub, M. Pachter and E. Garcia, "An Introduction to Pursuit-Evasion Games" (lecture), ACC 2020, 1-3 July, Denver, CO.

E. Garcia, I. Weintraub and M. Pachter and, "Introduction to Cooperative Pursuit-Evasion Differential Games" (lecture), ACC 2020, 1-3 July, Denver, CO.

M. Pachter, "Multi-Player Pursuit-Evasion Differential Games" (lecture), ACC 2020, 1-3 July, Denver, CO

E. Garcia, D. Casbeer, M. Pachter, W. Curtiss and E. Doucette, "Two-team Linear-Quadratic Differential Game of Defending a Target," ACC 2020, 1-3 July, Denver, CO.

PETERSON, GILBERT, L., Department of Electrical and Computer Engineering

Sponsor Funded Research Projects

"Autonomy Capability Design and Development." Sponsor: AFRL/RH. Funding: $275,000 - Peterson 100%. [CCR]

Refereed Journal Publications

J.M. Bindewald, M.E. Miller, and G. L. Peterson, "Creating Effective Automation to maintain explicit User Engagement," *International Journal of Human-Computer Interaction*, pp. 1—14, 2019. doi: 10.1080/10447318.2019.1642618.

T.B. Bodin, J.M. Bindewald, R.C. Leishman, G.L. Peterson, and D.R. Jacques, "A Development Platform for Behavioral Flexibility in autonomous Unmanned Aerial Systems," International Journal of Intelligent Robotics and Applications, vol. 4, pp. 57-72, 2020. doi: 10.1007/s41315-020-00120-9.

Refereed Conference Papers Accepted on the Basis of Full Paper Review

J.S. Okolica, G.L. Peterson, and M.J. Mendenhall, "Middleware Unifying Framework for Independent Nodes System" Proceedings of the 33rd International FLAIRS Conference, pp. 205-208, 2020. (https://aaai.org/ocs/index.php/FLAIRS/FLAIRS20/paper/view/18432).

J.S. Okolica, A.C. Lin, and G.L. Peterson, "Gaming DevSecOps – A Serious Game Pilot Study," 2020 National Cyber Summit Research Track, pp. TBD, 2020.

W.C. Henry, G.L. Peterson, “Exploring Provenance Needs in Software Reverse Engineering,” Systematic Approaches to Digital Forensic Engineering 2020, pp. TBD, 2020 (http://sadfe.org/papers/SADFE_2020_henry.pdf).

Books and Chapters in Books

K.-K. R. Choo, T. H. Morris, and G .L., Peterson (Eds.), *2020 National Cyber Summit (NCS) Research Track*, Advances in Intelligent Systems and Computing, Springer, 2020.

TEMPLE, MICHAEL, A., Department of Electrical and Computer Engineering

Sponsor Funded Research Projects

"RF-EW Systems Support." Sponsor: AFRL/RY. Funding: $25,000 - Temple 100%.

Refereed Journal Publications

Bihl, Pacienci, Bauer, Temple, “Cyber-Physical Security with RF Fingerprint Classification through Distance Measure Extensions of GRLVQ,” Jour of Security and Comm Nets (SCN), Vol. 2020, ID: 3909763, Hindawi, Feb 2020.

Voetber, Temple, Carbino, Bukohl, Glavi†, Deneault, “Using Active DNA Fingerprinting to Discriminate AJP Conductive Ink Elements Embedded in ICs,” Jour of DOD Rsrch & Engr (JDR&E), Vol. 2, No. 2, pp. 2-12, Aug 2019.

Paul, Collins, Temple, “Enhancing Microwave System Health Assessment Using ANNs,” IEEE Antenna & Wireless Propagation Letters, DOI: 10.1109/LAWP.2019.2926932, Jul 2019.

Rondeau, Temple, Betances, Schubert Kabban, “Extending Critical Infrastructure Element Longevity Using Constellation-Based ID Verification,” Jour of Computers & Security, Vol. 100, ID: 102073, Jan 2021.

Rondeau, Temple, Betances, Schubert Kabban, “Protection of Critical Infrastructure COTS Elements Using CB-DNA Fingerprints,” Jour of DOD Rsrch & Engr (JDR&E), Vol. 3(2), pp. 2-19, Jul 2020.

Refereed Conference Papers Accepted on the Basis of Full Paper Review

Rondeau, Temple, Betances, “DNA Feature Selection for Discriminating Wireless HART IIoT Devices,” 53rd Hawaii Int’l Conf. on System Sciences (HICSS), pp. 6387-6396, 7-10 Jan 2020.

Wargo, Boggs, Temple, Mills, “DNA Fingerprinting Ping2020i ADS-B Beacons,” 2019 Military Communications Conf. (MILCOM19), Norfolk VA, 12-14 Nov 2019.

Refereed Conference Papers Accepted on the Basis of Abstract Review

Rondeau, Temple, “PHY-Based DNA Fingerprinting to Discriminate Wireless HART Sensor Network Devices,” 2019 Security Week ICS Cyber Security Conference, Atlanta Georgia, 21-24 Oct 2019.

Patent Applications

Rondeau, Temple, Lopez, "Passive Physical Layer Distinct Native Attribute Cyber Security Monitor," Application Serial No. 63/031,132, Submitted: 28 May 2020.

6.3. CENTER FOR DIRECTED ENERGY

Center for Directed Energy (CDE)
Director (937) 255-3636 x4506
Executive Administrator (937) 255-3636 x4551
Homepage: http://www.afit.edu/CDE

6.3.1. DOCTORIAL DISSERTATIONS

N/A

6.3.2. MASTERS THESES

BISHOP, MICHAEL, W., Enhanced BRDF Modeling Using Directional Volume Scatter Terms. AFIT-ENP-MS-20-M-081. Faculty Advisor: Lt. Col. Samuel D. Butler. Sponsor: AFOSR.

BOECKENSTEDT, ALEXANDER, S., Validation of HTS Optical Turbulence Profiling via Sonic Anemometry. AFIT-ENP-MS-20-M-082. Faculty Advisor: Dr. Jack E. McCrae Jr. Sponsor: DEJTO.

BOETTIGER, JAMES, P., A Comparative Evaluation of the Detection and Tracking Capability Between Novel Event-Based and Conventional Frame-Based Sensors. AFIT-ENG-MS-20-M-007. Faculty Advisor: Dr. Michael A. Marciniak. Sponsor: N/A.

BUCKMAN, MILES, D., Development and Application of a Theory for Predicting the Detection of Closely Spaced Objects. AFIT-ENV-MS-20-J-080. Faculty Advisor: Dr. Richard G. Cobb. Sponsor: AFRL/RDSSE.

GOLDIN, ANDREW, W., Structural Dynamic and Inherent and Damping Characterization of Additively Manufactured Airfoil Components. AFIT-ENY-MS-20-M-263. Faculty Advisor: Dr. Richard G. Cobb. Sponsor: AFRL/RX.

GROSSNICKLE, JULIE, Determining Bulk Aerosol Absorption from Off-Axis Backscattering using Rayleigh Beacon Laster Pulses. AFIT-ENP-MS-20-M-097. Faculty Advisor: Dr. Steven T. Fiorino. Sponsor: DEJTO.

GUERRERO, NICHOLAS, J., Solving Combinatorial Optimization Problems Using the Quantum Approximation Optimization Algorithm. AFIT-ENP-MS-20-M-098. Faculty Advisor: Dr. David E. Weeks. Sponsor: AFRL/RI.

JAGODA, DANIEL, B., A Method for Routine PM2.5 Observation and Incorporation into Numerical Weather Prediction. AFIT-ENP-MS-20-M-102. Faculty Advisor: Dr. Steven T. Fiorino. Sponsor: DEJTO.

MATISSEK, KYLE, J., A Near-Real-Time Near-Optimal Shortest Path Solution for an Unmanned Aerial System (UAS) in a High Constrained Environment. AFIT-ENY-MS-20-M-271. Faculty Advisor: Dr. Richard G. Cobb. Sponsor: AFRL/RQQA.

TASSOS, NICHOLAS, Colony II CubeSat Component Reutilization for Future Experimental Platforms. AFIT-ENY-MS-20-M-282. Faculty Advisor: Dr. Richard G. Cobb. Sponsor: AFIT/ENY.

WOLFGANG, RACHEL, L., Comparison of the Accuracy of Rayleigh-Rice Polarization Factors to Improve Micro facet BRDF Models. AFIT-ENP-MS-20-M-123. Faculty Advisor: Lt. Col. Samuel D. Butler. Sponsor: AFOSR.

ZUCKER, ADAM, B., Detection of Damage on Charge Coupled Device by Optical Cross Section Analysis. AFIT-ENP-MS-20-M-125. Faculty Advisor: Dr. Michael A. Marciniak. Sponsor: AFRL/RX.

6.3.3. FACULTY RESEARCH OUTPUT

Notes: Faculty Bios can be found under their respective department listings. Shared credit for funding awards is indicated by the percentages shown for each faculty member associated with the project.

AKERS, BENJAMIN, F., Department of Mathematics and Statistics

Sponsor Funded Research Projects

"Applications of Radial Basis Functions." Sponsor: AFOSR. Funding: $41,738 - Akers 50%, Reeder 50%. [CDE]

Refereed Journal Publications

Akers, B. F., Ambrose, D. M., and Sulon, D. W., "Periodic Hydro elastic Waves with or without Mass II: Multiple Bifurcations and Ripples," *European Journal of Applied Mathematics*, Vol 30, No. 4, pp. 756-790, 2019.

Refereed Conference Papers Accepted on the Basis of Full Paper Review

Akers, B. F. and Seiders, M., "Numerical Simulation of Overturned Traveling Waves," *Nonlinear Water Waves – An Interdisciplinary Interface*, pp. 119-122, 2019.

Editorships in Professional Journals

Topics Editor, *Fluids*

Other Significant Research Productivity

Akers, B. F., "Dimension Breaking and Numerical Continuation," University of Washington webinar, Feb 2020.

BOSE-PILLAI, SANTASRI, R., Department of Engineering Physics

Refereed Journal Publications

Steven T. Fiorino, Santasri R. Bose-Pillai, Jaclyn Schmidt, Brannon Elmore and Kevin Keefer, "Implications of four-dimensional weather cubes for improved cloud-free line-of-sight assessments of free-space optical communications link performance," *Optical Engineering*, vol. 59, no. 8, 081808 (18 pp.), Jul 2020, doi: 10.1117/1.OE.59.8.081808.

Jack E. McCrae, Santasri R. Bose-Pillai, Steven T. Fiorino, Aaron J. Archibald, Joel Meoak, Brannon J. Elmore, Thomas Kesler, Christopher A. Rice, "Measurements of optical turbulence over 149-km path," *Optical Engineering*, vol. 59, no. 8, 081808 (18 pp.), Jun 2020, doi: 10.1117/1.OE.59.8.081806.

Refereed Conference Papers Accepted on the Basis of Full Paper Review

Jack E. McCrae, Christopher A. Rice, Steven T. Fiorino, Santasri R. Bose-Pillai and Aaron J. Archibald, "Wave optics simulations of a dual beacon Hartmann Turbulence Sensor," 2020 IEEE Aerospace Conference, Big Sky, MT, 8-15 Mar 2020.

Benjamin Wilson, Santasri Bose-Pillai, Jack McCrae, and Steven Fiorino, "Profiling of atmospheric turbulence using time-lapse imagery of non-cooperative targets from multiple cameras," in *Optical Sensors and Sensing Congress, OSA Technical Digest* (Optical Society of America, 2020), paper PTu4F.3.

Santasri Bose-Pillai, Benjamin Wilson, Jack McCrae, Alexander Boeckenstedt, Aaron Archibald, Kevin Keefer, and Steven Fiorino, "Profiling of atmospheric turbulence from dual-camera time-lapse imagery of a LED array," in *Optical Sensors and Sensing Congress*, *OSA Technical Digest* (Optical Society of America, 2020), paper PTu4F.2.

Refereed Conference Papers Accepted on the Basis of Abstract Review

Alexander S. Boeckenstedt, Jack E. McCrae, Santasri R. Bose-Pillai, Benjamin G. Wilson and Steven T. Fiorino, "Validation of HTS optical turbulence profiling via sonic anemometry," Proc. SPIE 11508, Unconventional Imaging and Adaptive Optics 2020, 1150805 (Sep 2020).

Jack E. McCrae Jr., Santasri Bose-Pillai, Alexander Boeckenstedt, Ben Wilson, Kevin Keefer and Steven T. Fiorino, "Turbulence profiling with a dual beacon Hartmann turbulence sensor using simulation derived weighting function," Proc. SPIE 11508, Unconventional Imaging and Adaptive Optics 2020, 1150805 (Sep 2020).

Santasri Bose-Pillai, Benjamin Wilson, Jonathan Krone, Aaron Archibald, Brannon Elmore, Jack McCrae and Steven Fiorino, "Profiling atmospheric turbulence using dual-camera imagery of non-cooperative targets," Proc. SPIE 11506, Laser Communication and Propagation through the Atmosphere and Oceans IX, 115060J (Aug 2020).

Patent Applications

Santasri Bose-Pillai, Jack McCrae, Steven Fiorino and Christopher Rice, "Estimation of atmospheric turbulence parameters using differential motion of extended features in time-lapse": provisional patent application filed, application number: 62/924,745, filing date: Oct 23, 2019.

Other Significant Research Productivity

Gave an invited talk in June, 2020 at the Optical Society of America's Propagation through and Characterization of Atmospheric and Oceanic Phenomena (pcAOP): "Profiling of atmospheric turbulence from dual-camera time-lapse imagery of a LED array".

Gave an invited talk in August, 2020 at SPIE Optics and Photonics, *Laser Communication and Propagation through the Atmosphere and Oceans IX*: ""Profiling atmospheric turbulence using dual-camera imagery of non-cooperative targets".

Gave a talk at DEPS Annual S+T Symposium in March, 2020: "Atmospheric Turbulence Profiling with Dual- Camera Time-Lapse Imagery and Validation with Sonic Anemometers".

Contributed to DEPS talk: "Validation of Hartmann Turbulence Sensor Optical Turbulence Profiling via Sonic Anemometry" by 2nd Lt. Alex Boeckenstedt.

Submitted proposal for Phase II of a Naval Undersea Warfare Center funded STTR: Marine Atmospheric Modeling, Data Collection, Visualization & Metrological Toolset for Submarine Electromagnetic (EM) Maneuverability.

Submitted proposal to AFRL/ RDLE: Extension of HELEEOS' Capabilities to Include Guide star Compensation Effects and Different Focusing Ranges.

Submitted a proposal to AFOSR under the AFRL/ AFIT MOA Small Grant Program: Profiling of Atmospheric Turbulence using Time-Lapse Imagery of Non-Cooperative Targets from Multiple Spatially Separated Cameras

Served a reviewer for OSA and SPIE Optical Engineering journals.

BURGI, KENNETH, W., LT. COL., Department of Engineering Physics

Sponsor Funded Research Projects

"Dynamic Data Driven Phase Optimization for Controlling Light Scattered by a Rough Surface." Sponsor: AFOSR. Funding: $151,881 - Burgi 75%, Marciniak 15%, Oxley 10%.

BUTLER, SAMUEL, D., LT. COL., Department of Engineering Physics

Sponsor Funded Research Projects

"Analysis of Modified Micro facet BRDF Models for Polarimetric Optical Scatter." Sponsor: AFOSR. Funding: $147,262 - Butler 75%, Marciniak 25%.

COBB, RICHARD, G., Department of Aeronautics and Astronautics

Refereed Journal Publications

Thomas*, G., Cobb, R., Fiorino, S. and Hawks, M., "Daytime Cloudless Sky Radiance Quantification with Ground-based Aerosol and Meteorological Observations in the Short-Wave Infrared," *Journal of Atmospheric and Oceanic Technology*, 37(5) March 2020, DOI: 10.1175/JTECH-D-19-0157.1.

Spendel, D., Hess, J., Johnson, K., and Cobb, R., "Evaluating Orbital Defender Performance Trades Using Differential Game Theory" *Journal of Defense Research & Engineering*, Vol 3, Issue 1, March 2020, AD1092565.

Thomas, G., Cobb, R., Fiorino, S. and Hawks, M., "NIR and SWIR Observations for Daytime Satellite Custody," *Journal of Defense Research & Engineering*, Vol 3, Issue 1, March 2020, AD1093125.

Smith, N.E., Cobb, R.G., and W.P. Baker, "Incorporating Stochastics into Optimal Collision Avoidance Problems using Superquadrics," *AIAA Journal of Air Transportation*, February 2020, DOI: 10.2514/1.D0170.

Spendel, D.S., Hess, J.A., Cobb, R.G., Johnson, K. J., "Developing and Analyzing Strategies Using Pursuer-Evader-Defender Differential Game Theory for Orbital Engagements," Journal of DOD Research and Engineering, July 2020.

Refereed Conference Papers Accepted on Basis of Full Paper Review

Harris, W., Cobb R., and Taylor, C., "Visual Servoing for Final Approach Phase of Spacecraft Proximity Operations with Unknown Targets," 2020 IEEE/ION Position, Location and Navigation Symposium (PLANS), Portland, OR, USA, 2020, pp. 1606-1617, doi: 10.1109/PLANS46316.2020.9110218.

Harris, W., Linville, D., Hess J., and. Cobb, R., "Development of GNC for Optimal Relative Spacecraft Trajectories," 2020 IEEE/ION Position, Location and Navigation Symposium (PLANS), Portland, OR, USA, 2020, pp. 1476-1487, doi: 10.1109/PLANS46316.2020.9110153.

Weintraub, I., Cobb, R., Baker, W. and Pachter, M., "Direct Methods Comparison for the Active Target Defense Scenario," AIAA SciTech 2020 Forum, January 2020, DOI: 10.2514/6.2020-0612.

Other Significant Research Productivity

Harris, W., Cobb R., and Taylor, C., "Visual Servoing for Final Approach Phase of Spacecraft Proximity Operations with Unknown Targets," presented virtually to the AFRL/RVSW "RANGERS" symposium, 16 April, 2020.

Matissek, K., Cobb, R. Jacques, D., Grymin, D., and Zollars, M., "A Near-Real-Time Near-Optimal Shortest Path Solution for an Unmanned Aerial System (UAS) in a Highly Constrained Environment," AIAA 45th Dayton-Cincinnati Aerospace Science Symposium, 3 March 2020.

Matissek, K., Cobb, R. Jacques, D., Grymin, D., and Zollars, M., "A Near-Real-Time Near-Optimal Shortest Path Solution for an Unmanned Aerial System (UAS) in a Highly Constrained Environment," ASME 15th Dayton Engineering Sciences Symposium, 29 October 2019.

FERDINANDUS, MANUEL, R., Department of Engineering Physics

Sponsor Funded Research Projects

"Mid-IR Nonlinear Measurements of Optical Materials." Sponsor: AFRL/RX. Funding: $60,000 - Ferdinandus 100%.

Refereed Journal Publications

Ferdinandus, M. R., et al. (2020). “Nonlinear optical measurements of CdSiP2 at near and mid-infrared wavelengths.” Optical Materials Express **10**(9): 2066.

Refereed Conference Papers Accepted on the Basis of Abstract Review

Barrette, A. G., et al. (2020). Super continuum generation in single-crystal YAG fibers. *Photonic Fiber and Crystal Devices: Advances in Materials and Innovations*, Online only, SPIE.

Ferdinandus, M.R. et. al. (2020). Z-Scan Measurements of CdSiP2 at OPA Pumping Wavelengths. *Conference on Lasers and Electro-Optics*, San Jose, California, Optical Society of America.

FIORINO, STEVEN, T., Department of Engineering Physics

Sponsor Funded Research Projects

"Atmospheric Effects Inputs for HELJWS and JLaSE." Sponsor: JTCG/ME. Funding: $110,000 - Fiorino 100%.

"AFIT Research in Support of ONR’s US-India OSD-DRDO Collaborations." Sponsor: ONR. Funding: $25,000 Fiorino 100%.

"AFIT CDE Support to the DEPS Directed Energy Education Initiative." Sponsor: AFRL/RD. Funding: $110,000 - Fiorino 40%, Marciniak 15%, Perram 15%, McCrae 15%, Rice 15%.

"AFIT CDE Support to NATO SCI 316." Sponsor: ONR. Funding: $60,000 - Fiorino 100%.

"Free Space Optical Communications Planning Tool Phase II SBIR with Guide star Optical Systems." Sponsor: AFRL/SBRK. Funding: $150,000 - Fiorino 100%.

"2020 AFIT Center for Directed Energy DoD HPCMP HPC Internship Program (HIP)." Sponsor: CEERD-IZP. Funding: $25,000 - Fiorino 80%, Akers 20%.

"Extension of HELEEOS' Capabilities to Include Guide star Compensation Effects." Sponsor: SAF/FMBIB. Funding: $100,000 - Fiorino 100%.

"CY2020 DE JTO AP TAWG Research and Analysis." Sponsor: AFRL/RD. Funding: $400,000 - Fiorino 100%.

"CY2020 DE JTO M&S TAWG Research Analysis." Sponsor: AFRL/RD. Funding: $400,000 - Fiorino 100%.

"SDPE Field Test Support & Predictive / Post-Test Diagnostic HEL Performance Analyses." Sponsor: AFRL/SDPE. Funding: $134,000 - Fiorino 100%. [

"CY2020 DE JTO AP TAWG Research and Analysis." Sponsor: AFRL/RD. Funding: $25,000 - Fiorino 100%.

Refereed Journal Publications

Fiorino, S.T, S.R. Bose-Pillai, J.E. Schmidt, B.J. Elmore, K.J. Keefer, 2020: "Implications of 4D weather cubes for improved cloud free line of sight assessments of free space optical communications link performance," *Opt. Eng*. **59**(8), 081808, doi: 10.1117/1.OE.59.8.081808.

McCrae, J.E., S.R. Bose-Pillai, S.T. Fiorino, A. Archibald, J. Meoak, B. Elmore, T. Kesler, and C. Rice, 2020, “Measurements of Optical Turbulence over 149 km Path,” *Opt. Eng*. **59**(8), 081806, doi: 10.1117/1.OE.59.8.081806.

Zuraski, S.M., E. Beecher, J.E. McCrae, and S.T. Fiorino, 2020, "Turbulence profiling using pupil plane wave front data derived Fried parameter values for a dynamically ranged Rayleigh beacon," *Opt. Eng.* **59**(8), 081807, doi: 10.1117/1.OE.59.8.081807.

Thomas, G., R. Cobb, S. Fiorino, and M. Hawks, 2020: "Daytime Cloudless Sky Radiance Quantification with Ground-Based Aerosol and Meteorological Observations in the Shortwave Infrared," *J. Atmos. Oceanic Technol*., **37**, 777–788, doi.org/10.1175/JTECH-D-19-0157.1.

Refereed Conference Papers Accepted on the Basis of Full Paper Review

Boeckenstedt, A., J. McCrae, S. Bose-Pillai, B. Wilson, and S. Fiorino, "Validation of HTS optical turbulence profiling via sonic anemometry," Proc. SPIE. 11508, Unconventional Imaging and Adaptive Optics 2020 (8 September 2020).

Bose-Pillai, S., B. Wilson*, J. Krone*, A. Archibald, B. Elmore, J. McCrae, and S. Fiorino, "Profiling atmospheric turbulence using dual-camera imagery of non-cooperative targets," Proc. SPIE. 11506, Laser Communication and Propagation through the Atmosphere and Oceans IX (22 August 2020).

Zuraski, S., J. McCrae, and S.T. Fiorino, "Focal anisoplanatism influence on dynamically ranged Rayleigh beacon measurements," Proc. SPIE. 11508, Unconventional Imaging and Adaptive Optics 2020 (20 August 2020).

#McCrae, J., S. Bose-Pillai, A. Boeckenstedt*, B. Wilson*, K.J. Keefer, and S.T. Fiorino, "Turbulence profiling with a dual beacon Hartmann turbulence sensor using simulation derived weighting functions," Proc. SPIE. 11508, Unconventional Imaging and Adaptive Optics 2020 (20 August 2020).

Fiorino, S.T., K.J. Keefer, and J.C. Grossnickle*, "Comparison of NOAA's CLAP Measurements to Aerosol Absorption from Number Concentration," in Propagation through and Characterization of Atmospheric and Oceanic Phenomena (pcAOP), (JTu5F.2), OSA Optical Sensors and Sensing Congress, Virtual Event, 23 June 2020.

Bose-Pillai, S., B. Wilson*, J. McCrae, A. Boeckenstedt*, A. Archibald, K. Keefer, and S. Fiorino, "Profiling of atmospheric turbulence from dual-camera time-lapse imagery of a LED array," in Propagation through and Characterization of Atmospheric and Oceanic Phenomena (pcAOP), (PTu4F.2), OSA Optical Sensors and Sensing Congress, Virtual Event, 23 June 2020.

Wilson, B., S. Bose-Pillai, J. McCrae, and S. Fiorino, "Profiling of atmospheric turbulence using time-lapse imagery of non-cooperative targets from multiple cameras," in Propagation through and Characterization of Atmospheric and Oceanic Phenomena (pcAOP), (PTu4F.3), OSA Optical Sensors and Sensing Congress, Virtual Event, 23 June 2020.

McCrae, J.E., S.R. Bose-Pillai, C.A. Rice, A. Archibald, and S.T. Fiorino, "Wave Optics Simulations of a Dual Beacon Hartmann Turbulence Sensor," 2020 IEEE Aerospace Conference, Big Sky, MT, 7-14 Mar 2020.

Refereed Conference Papers Accepted on the Basis of Abstract Review

Fiorino, S.T., D. Narcisse, and J.E. Schmidt, "Development of a 3-Category Weather Effects Assessment Tool for DEW Test and/or Employment," 2020 Annual DEPS S&T Symposium, West Point, NY, 9-13 March 2020.

Bose-Pillai, S., B. Wilson*, J.E. McCrae, A. Boeckenstedt*, A. Archibald, C. Rice, K.J. Keefer, and S.T. Fiorino, "Atmospheric Turbulence Profiling with Dual- Camera Time-Lapse Imagery and Validation with Sonic Anemometers," 2020 Annual DEPS S&T Symposium, West Point, NY, 9-13 March 2020.

Grossnickle, J., S.T. Fiorino# , K.J. Keefer, H.R. Tseng, and R.C. Tournay, "Determining Bulk Aerosol Absorption from Off-Axis Backscattering using Rayleigh Beacon Laser Pulses," 2020 Annual DEPS S&T Symposium, West Point, NY, 9-13 March 2020.

Jagoda, D., S.T. Fiorino, S. Peckham, K.J. Keefer, R. Tournay, and J.E. Schmidt, "A Method for Routine PM2.5 Observation and Incorporation into Numerical Weather Prediction," 2020 Annual DEPS S&T Symposium, West Point, NY, 9-13 March 2020.

Boeckenstedt, A., J.E. McCrae, S.R. Bose-Pillai, and S.T. Fiorino, "Validation of Hartmann Turbulence Sensor Optical Turbulence Profiling via Sonic Anemometry," 2020 Annual DEPS S&T Symposium, West Point, NY, 9-13 March 2020.

Schmidt, J.E., J. Burley, B. Fourman*, and S.T. Fiorino, "Global Cloud Free Line of Sight (CFLOS) Characterizations Using Numerical Weather Prediction Data," 2020 Annual DEPS S&T Symposium, West Point, NY, 9-13 March 2020.

Grossnickle, J., S.T. Fiorino , K.J. Keefer, H.R. Tseng, and R.C. Tournay, "Determining Bulk Aerosol Absorption from Off-Axis Backscattering using Rayleigh Beacon Laser Pulses," 24th Conference on Integrated Observing and Assimilation Systems for the Atmosphere, Oceans, and Land Surface (IOAS-AOLS), 100th Annual American Meteorological Society Meeting, Boston, MA, Jan 2020. (Poster and web posting): https://ams.confex.com/ams/2020Annual/meetingapp.cgi/Paper/370190.

Jagoda, D., S.T. Fiorino, S. Peckham, K.J. Keefer, and J.E. Schmidt, "Assessment of Improved WRF-Chem PM2.5 Characterization via Implementation of an Aerosol Measurement Network," 12th Symposium on Aerosol - Cloud - Climate Interactions, 100th Annual American Meteorological Society Meeting, Boston, MA, Jan 2020. (Poster and web posting: https://ams.confex.com/ams/2020Annual/meetingapp.cgi/Paper/370208.

Schmidt, J.E., J. Burley, B. Fourman*, and S.T. Fiorino, "Global Cloud Free Line of Sight (CFLOS) Characterizations Using Numerical Weather Prediction Data," 20th Conference on Aviation, Range, and Aerospace Meteorology, 100th Annual American Meteorological Society Meeting, Boston, MA, Jan 2020. (Poster and web posting: https://ams.confex.com/ams/2020Annual/meetingapp.cgi/Paper/369796.

Fiorino, S.T., J. Schmidt, B. Elmore, and B. Fourman*, "Global Cloud Free Line of Sight (CFLOS) Characterizations for Air Force SDPE Sites," 14th Annual Directed Energy Systems Symposium, San Diego, CA, 20 November 2019.

Schmidt, J., S.T. Fiorino, B. Elmore, and K.J. Keefer, "Expected HEL Performance Quantification for Air Force SDPE Sites and Systems using Weather Cubes," 14th Annual Directed Energy Systems Symposium, San Diego, CA, 20 November 2019.

Editorships in Professional Journals

Guest Editor, Atmospheric Propagation Special Section of *Optical Engineering* (Vol 59, Issue 8).

Editor, *Journal of Directed Energy* (2020)

Patent Applications

Zuraski, S.M., E.A. Beecher, S.T. Fiorino, J.D. Schmidt, J.E. McCrae, N.M. Figlewski, “Design for an electro-optic testbed utilizing a dynamic range gated Rayleigh beacon for atmospheric turbulence profiling,” AFD-1721. Application filed on 31 January 2020, with the U.S. Patent and Trademark Office. The application was accorded U.S. Serial No. 16/778,424.

Bose-Pillai, S.R., J.E. McCrae, C.A. Rice, and S.T. Fiorino, “Estimation of Atmospheric Turbulence Parameters using Differential Motion of Extended Features in Time-lapse Imagery,” AFD-1920. Filed as an application for Letters Patent of the United States (Application Serial Number 62/924,745, filed 23-October-2019 and Application Serial Number 17/077,323, filed 22-October-2020).

Other Significant Research Productivity

Ward, D. J. Bowers*, S. Sanyal, T. Vo, S. Fiorino and N. Flores, 2020: "Empirical Derivation of Power Measurement Scaling Factor for Beam Irradiance on Target System (BITS) utilizing Novel in-situ Primary Standard," accepted *Journal of Directed Energy*.

Fiorino, S, A. van Eijk, S. Hammel, and A. Berk, 2020: "Special Section Guest Editorial: Atmospheric Propagation," *Opt. Eng*. 59(8).

HAWKS, MICHAEL, E., Department of Engineering Physics

Refereed Journal Publications

Thomas, G., R. Cobb, S. Fiorino, and M. Hawks, 2020: "Daytime Cloudless Sky Radiance Quantification with Ground-Based Aerosol and Meteorological Observations in the Shortwave Infrared," *J. Atmos. Oceanic Technol*., **37**, 777–788, doi.org/10.1175/JTECH-D-19-0157.1

HYDE, MILO, W., LT. COL., Department of Engineering Physics

Refereed Journal Publications

Yongtao Zhang, Chaoliang Ding, Milo W. Hyde IV, and Olga Korotkova, "Non-stationary pulses with complex-valued temporal degree of coherence," *Journal of Optics*, vol. 22, 105607 (10 pp.), Sep 2020, doi: 10.1088/2040-8986/abb3a5.

Milo W. Hyde IV, "Twisted space-frequency and space-time partially coherent beams," *Scientific Reports*, vol. 10, 12443 (12 pp.), Jul 2020, doi: 10.1038/s41598-020-68705-9.

Neil Rogers, Michael Havrilla, Milo Hyde, and Alexander Knisely, "Nondestructive electromagnetic characterization of uniaxial sheet media using a two-flanged rectangular waveguide probe," *IEEE Transactions on Instrumentation and Measurement*, vol. 69, no. 6, pp. 2938-2947, Jun 2020, doi: 10.1109/TIM.2019.2925408.

Milo W. Hyde IV, "Comment on 'Modified Bessel-correlated vortex beams and their propagation properties'," *Optics and Laser Technology*, vol. 127, 106191 (1 p.), Mar 2020, doi: 10.1016/j.optlastec.2020.106191.

Milo W. Hyde IV, "Synthesizing general electromagnetic partially coherent sources from random, correlated complex screens," *Optics*, vol. 1, no. 1, pp. 97-113, Mar 2020, doi: 10.3390/opt1010008.

Milo W. Hyde IV, "Stochastic complex transmittance screens for synthesizing general partially coherent sources," *Journal of the Optical Society of America A*, vol. 37, no. 2, pp. 257-264, Feb 2020, doi: 10.1364/JOSAA.381772.

Milo W. Hyde IV, "Generating electromagnetic dark and antidark partially coherent sources," *Journal of Physics Communications*, vol. 4, no. 1, 015025 (8 pp.), Jan 2020, doi: 10.1088/2399-6528/ab6ed3.

Milo W. Hyde IV, Xifeng Xiao, and David G. Voelz, "Generating electromagnetic nonuniformly correlated beams," *Optics Letters*, vol. 44, no. 23, pp. 5719-5722, Dec 2019, doi: 10.1364/OL.44.005719.

Milo W. Hyde IV, "Generating electromagnetic Schell-model sources using complex screens with spatially varying auto- and cross-correlation functions," *Results in Physics*, vol. 15, 102663 (9 pp.), Dec 2019, doi: 10.1016/j.rinp.2019.102663.

Svetlana Avramov-Zamurovic, Charles Nelson, and Milo Hyde, "Scintillation experiments with non-uniformly and uniformly correlated spatially partially coherent laser beams propagating underwater," *Journal of Modern Optics*, vol. 66, no. 20, pp. 1998-2007, Nov 2019, doi: 10.1080/09500340.2019.1686547.

Refereed Conference Papers Accepted on the Basis of Full Paper Review

Milo W. Hyde IV, "Generating genuine partially coherent sources using complex transmittance screens," OSA Imaging and Applied Optics Congress: Propagation Through and Characterization of Atmospheric and Oceanic Phenomena, PM2D.3 (2 pp.), Virtual Conference (Vancouver, British Columbia, Canada), Jun 2020. Invited.

JAMES, ROYCE, W., CDR, US COASTGUARD, Department of Engineering Physics

Sponsor Funded Research Projects

"2020 STEM coding / AFIT Summer Teacher Fellowship." Sponsor: CEERD-IZP. Funding: $25,000 - James 100%.

Refereed Conference Papers Accepted on the Basis of Full Paper Review

K. Young-McLear, S. Zelmanowitz, R. W. James, D. Brunswick, T. DeNucci, "Beyond Buzzwords and Bystanders: A Framework for Systematically Developing a Diverse, Mission Ready, and Innovative Coast Guard Workforce," ASEE's 2020 Collaborative Network for Engineering and Computing Diversity 3rd Annual Meeting, Washington, DC (Crystal City); (2020).

Refereed Conference Papers Accepted on the Basis of Abstract Review

B. Kay, R. W. James, R. W. Freeman, L. A. Allen, E. Tejero, "CGA Impedance Probe and CGA VSIR Sensor," Annual Directed Energy Science and Technology Symposium, West Point NY, March 2020.

C. Baxter, J. Frey, K. Poole, R. W. James, "High Power Microwave Directed Energy Protection for USCG Vessels: Design Research," Annual Directed Energy Science and Technology Symposium, West Point NY, March 2020.

J. Moll, R. Wolfgang, R. W. James, "A Systems Approach to Stopping Non-Compliant Vessels with HPM Devices on USCGC FRC," Annual Directed Energy Science and Technology Symposium, West Point NY, March 2020.

James, R.W. "Progress on Development of Low Pressure High Density Plasmas on the Helicon Plasma Experiment (HPX)," American Physical Society's 61st Annual Meeting of the Division of Plasma Physics, Fort Lauderdale, FL; November, 5 - October, 24, (2019).

Freeman, R.W, James, R.W., Allen, L.A., Tejero, E., Daeffler, M. "CGA/NRL Impedance Probe as a ThinSat Spacecraft Payload" American Physical Society's 61st Annual Meeting of the Division of Plasma Physics, Fort Lauderdale, FL; November, 5 - October, 24, (2019).

James, R.W. "Progress on Development of Low Pressure High Density Plasmas on the Helicon Plasma Experiment (HPX)," American Physical Society's 61th Annual Meeting of the Division of Plasma Physics, Ft. Lauderdale, FL; October, 21 - October, 25, (2019).

Freeman, R. W., James, R. W., Allen, L, Tejero, E, "Impedance Probe as a ThinSat Spacecraft Payload," American Physical Society's 61th Annual Meeting of the Division of Plasma Physics, Ft. Lauderdale, FL; 21-25 October (2019).

James, R. W., Freeman, R. W., L. A. Allen, Tejero, E, Kang, J. S., B. Kay," SmallSat Platform Development for Coast Guard Academy Collaborative Space-Based Research," Small Satellite Annual Meeting, (Online); (2020).

R. W. James, L. A. Allen, R. W. Freeman, E. Tejero, B. Kay, "Building an Academic Community SmallSat Program," Small Satellite Annual Meeting, (Online); (2020).

Other Significant Research Productivity

CGAPL (AFRL, DOE): Helicon plasmas in a high-pressure regime and a discharge plasma in the standard temperature and plasma (STP) regime are being explored with typical magnetic, particle, optical, and emissive probes and other diagnostics that will be developed as learning tools and for use in experiments. We utilize a Quantel 2.5 J high energy laser for Thomson Scattering, as we continue to expand our data collection ability. These purchases are the forward

along the development of invaluable diagnostics on the Helicon plasma Experiment (HPX) to yield real-time, simultaneous measurements of electron plasma temperature and density can be measured with a high degree of accuracy using a high energy laser beam pulse. We have also continued our working relationship with Princeton Plasma Physics Laboratory (PPPL), Navy Research Lab (NRL), and Air Force Institute of Technology (AFIT). These initiatives will continue to be funded by DE-JTO, PPPL, the Coast Guard, and other funding agencies. A new student will continue to follow in this progression this fiscal year to work on the new polychromator and Langmuir probes.Schedules: HPX (3-Phases)

Phase 1: particle & optical probes measure plasma edge & global temp & density profiles [Winter 21']
Phase 2: measure plasma's internal temp & density w/ Thomson Scattering diagnostic [Fall 21']
Phase 3: energy solution investigations; develop innovative 'intelligent' diagnostics, & spacecraft propulsion design/engineering. [Ongoing]

MSIHL: Military Service Institutions of Higher Learning is launching 2 ThinSat spacecraft this winter on the NG-15 launch through our VaSpace partnership. We will explore the ionosphere and LEO space environment with a SWIR optical sensor and cutting-edge impedance probe with a never before utilized surface mounted antenna. Another CubeSat launch will follow on the NG-16 with enhanced senor capabilities and other funded research payloads. Costs for both launches are covered by VaSpace. Thin/CubeSats
Phase 1: Polar Scout/1st ThinSat Launch & Ground Station Construction [2018/19] – Complete!
Phase 2: Visual & Impedance Probe NG-15 Launch [Fall 20']
Phase 3: CubeSat Visual Payload NG-16 Launch [Fall 21']

Pulse Laser Plasmoid (NSF): The interaction of plasma with liquid water at 1 Atm is currently being investigated for a range of technical applications ranging from environmental remediation (e.g. water purification) to healthcare (wound healing). Additionally, material processing applications such as etching, discharges to solid surfaces, plus texturing and surface functionalization are being investigated. 3-year grant (with option to renew) as Co-PI's. Total grant is ~$240,000 per year. CGA portion is ~$95,000 per year. One Ph.D. student to attend AFIT and do research at the CGA Plasma Lab (CGAPL) & Air Force Institute of Technology (AFIT) with the Air Force Research Lab (AFRL), Princeton Plasma Physics Lab (PPPL), and UMich collaborations on the sub award to CGA. Total Ph.D. student costs ~$65,000 – this is the anticipated portion of the grant that SPRI can assert overhead on at a rate of 26%. CGA/SPRI will source funds to AFIT for them to hire the civilian student as an AD21 for salary and benefits while tuition will be covered under the CGA/AFIT MOA. UMich will submit and administer the full grant with CGA as a subaward to SPRI.

MARCINIAK, MICHAEL, A., Department of Engineering Physics

Sponsor Funded Research Projects

"2D photonic crystals from birefringent nanorod thin-films for nanophotonic component applications." Sponsor: AFOSR. Funding: $117,241 - Marciniak 100%.

Refereed Journal Publications

C.D. Diaz,* A.L. Franz, and M.A. Marciniak, "Spatial resolution comparison of a diffractive plenoptic camera and an intermediate image diffractive plenoptic camera," Optical Engineering 58(12), 123102(1-13) (Dec 2019).

Refereed Conference Papers Accepted on the Basis of Abstract Review

C.D. Diaz,* B.M. Adomanis, D.B. Burckel and M.A. Marciniak, "Simulation and modeling of fabricated metasurface optical device measured via polarimetric scatterometer," Proc. SPIE 11467, (11467-18) (2020).

T.V. Small,* S.D. Butler and M.A. Marciniak, "Augmenting CASI® BRDF measurement device to measure out-of-plane scatter with CCD pixel array," Proc. SPIE 11485, (11485-9) (2020).

R.L. Wolfgang,* S.D. Butler and M.A. Marciniak, "Comparison of the accuracy of Rayleigh-Rice polarization factors to improve microfacet pBRDF models," Proc. SPIE 11485, (11485-15) (2020).

M.W. Bishop,* S.D. Butler and M.A. Marciniak, “Analysis of hybrid directional volumetric scatter terms for enhanced microfacet BRDF modeling,” Proc. SPIE 11485, (11485-16) (2020).

Other Significant Research Productivity

C.D. Diaz,*# M.A. Marciniak, M. Miller,* A.M. Urbas, D.B. Burckel, E.B. Whiting, S.D. Campbell and D.H. Werner, “Measurement of an infrared plasmonic out-of-plane 3D thin-film meta-surface beam-steerer,” presented at Metamaterials 2020 held on 28 September-1 October 2020 in New York, NY (on line).

MCCRAE, JACK, E., JR., Department of Engineering Physics

Refereed Journal Publications

McCrae, J.E., S.R. Bose-Pillai, S.T. Fiorino, A. Archibald, J. Meoak, B. Elmore, T. Kesler, and C. Rice, 2020, “Measurements of Optical Turbulence over 149 km Path,” Opt. Eng. 59(8), 081806, doi: 10.1117/1.OE.59.8.081806.

Zuraski, S.M., E. Beecher, J.E. McCrae, and S.T. Fiorino, 2020, “Turbulence profiling using pupil plane wave front data derived Fried parameter values for a dynamically ranged Rayleigh beacon," Opt. Eng. 59(8), 081807, doi: 10.1117/1.OE.59.8.081807.

Refereed Conference Papers Accepted on the Basis of Full Paper Review

Boeckenstedt, A., J. McCrae, S. Bose-Pillai, B. Wilson, and S. Fiorino, "Validation of HTS optical turbulence profiling via sonic anemometry," Proc. SPIE. 11508, Unconventional Imaging and Adaptive Optics 2020 (8 September 2020).

McCrae, J., S. Bose-Pillai, A. Boeckenstedt*, B. Wilson*, K.J. Keefer, and S.T. Fiorino, "Turbulence profiling with a dual beacon Hartmann turbulence sensor using simulation derived weighting functions," Proc. SPIE. 11508, Unconventional Imaging and Adaptive Optics 2020 (20 August 2020).

Bose-Pillai, S., B. Wilson, J. McCrae, A. Boeckenstedt, A. Archibald, K. Keefer, and S. Fiorino, “Profiling of atmospheric turbulence from dual-camera time-lapse imagery of a LED array,” in Propagation through and Characterization of Atmospheric and Oceanic Phenomena (pcAOP), (PTu4F.2), OSA Optical Sensors and Sensing Congress, Virtual Event, 23 June 2020.

Wilson, B., S. Bose-Pillai, J. McCrae, and S. Fiorino, “Profiling of atmospheric turbulence using time-lapse imagery of non-cooperative targets from multiple cameras,” in Propagation through and Characterization of Atmospheric and Oceanic Phenomena (pcAOP), (PTu4F.3), OSA Optical Sensors and Sensing Congress, Virtual Event, 23 June 2020.

McCrae, J.E., S.R. Bose-Pillai, C.A. Rice, Archibald, A. J., and S.T. Fiorino, “Wave Optics Simulations of a Dual Beacon Hartmann Turbulence Sensor,” 2020 IEEE Aerospace Conference, Big Sky, MT, 7-14 Mar 2020.

Refereed Conference Papers Accepted on the Basis of Abstract Review

Alexander S. Boeckenstedt, Jack E. McCrae, Santasri R. Bose-Pillai, Benjamin G. Wilson, Steven T. Fiorino, "Validation of HTS optical turbulence profiling via sonic anemometry," Proc. SPIE 11508, Unconventional Imaging and Adaptive Optics 2020, 1150805 (8 September 2020); https://doi.org/10.1117/12.2568595.

Santasri Bose-Pillai, Benjamin Wilson, Jonathan Krone, Aaron Archibald, Brannon Elmore, Jack McCrae, Steven Fiorino, "Profiling atmospheric turbulence using dual-camera imagery of non-cooperative targets," Proc. SPIE 11506, Laser Communication and Propagation through the Atmosphere and Oceans IX, 115060J (22 August 2020); https://doi.org/10.1117/12.2569048.

Jack E. McCrae Jr., Santasri Bose-Pillai, Alexander Boeckenstedt, Ben Wilson, Kevin Keefer, Steven T. Fiorino, "Turbulence profiling with a dual beacon Hartmann turbulence sensor using simulation derived weighting functions," Proc. SPIE 11508, Unconventional Imaging and Adaptive Optics 2020, 1150806 (20 August 2020); https://doi.org/10.1117/12.2568822.

Steven M. Zuraski, Jack E. McCrae, Steven T. Fiorino, "Focal anisoplanatism influence on dynamically ranged Rayleigh beacon measurements," Proc. SPIE 11508, Unconventional Imaging and Adaptive Optics 2020, 1150802 (20 August 2020); https://doi.org/10.1117/12.2568831.

Patent Applications

Zuraski, S.M., E.A. Beecher, S.T. Fiorino, J.D. Schmidt, J.E. McCrae, N.M. Figlewski, "Design for an electro-optic testbed utilizing a dynamic range gated Rayleigh beacon for atmospheric turbulence profiling," AFD-1721. Application filed on 31 January 2020, with the U.S. Patent and Trademark Office. The application was accorded U.S. Serial No. 16/778,424.

Bose-Pillai, S.R., J.E. McCrae, C.A. Rice, and S.T. Fiorino, "Estimation of Atmospheric Turbulence Parameters using Differential Motion of Extended Features in Time-lapse Imagery," AFD-1920. Filed as an application for Letters Patent of the United States (Application Serial Number 62/924,745, filed 23-October-2019 and Application Serial Number 17/077,323, filed 22-October-2020).

MORRILL, DANA, F., MAJ., Department of Mathematics and Statistics

PAK, MICHAEL, V., Department of Engineering Physics

Refereed Journal Publications

E.Ilin, M.Marchevsky, I.Burkova, M.V.Pak, A.Bezryadin "Nanometer-Scale Deformations of Berea Sandstone under Moisture-Content Variations," Phys. Rev. Applied, 13, 024043, 2020.

E.Ilin, I.Burkova, X.Song, M.V.Pak, S.Golubev, A.Bezryadin "Superconducting phase transition in inhomogeneous chains of superconducting islands," Phys. Rev. B 102, 134502, 2020.

PERRAM, GLEN, P., Department of Engineering Physics

Sponsor Funded Research Projects

"Diode Pumped Alkali Laser Kinetics: Rb-He System Scaling." Sponsor: MDA. Funding: $260,000 - Perram 50%, Rice 50%.

"Diode Pumped Alkali Laser Kinetics: Rb-He System Scaling." Sponsor: MDA. Funding: $97,724 - Perram 50%, Rice 50%.

Refereed Journal Publications

N.D. Haluska, G. P. Perram, and Christopher A. Rice, "Efficient cascade lasing on over 17 wavelengths from two-photon excitation of cesium 62D" Optics Communications, 476, 126328, August 2020.

T.A. Van Woerkom, G.P. Perram, C.D. Phelps, B.D. Dolasinski, and P.A. Berry, "Picosecond laser ablation of metals and semiconductors with low transverse order gaussian beams" Opt. Eng. 60(3), 031002, Mar 2021.

Timothy True, Christopher Rice and Glen P. Perram "The cesium 6 2P3/2 to 8 2S1/2line shape broadened by He, Ar, and Kr" Journal of Quantitative Spectroscopy and Radiative Transfer, 250 107010, May 2020.

Douglas E. Thornton, Mark F. Spencer, Christopher A. Rice, and Glen P. Perram "Impacts of Laboratory Vibrations and Laser Flicker Noise on Digital Holography" IEEE Journal of Quantum Electronics, 56, 1400107, Oct 2020.

David E. Weeks, Charlton D. Lewis, L.A. (Vern) Schlie and Glen. P. Perram, "Temperature dependence of the fine structure mixing induced by 4He and 3He in K and Rb Diode Pumped Alkali Lasers," Applied Physics B, 126, 79 Apr 2020.

James Caplinger and Glen P. Perram, "The importance of cascade emission and metastable excitation in modeling strong atomic oxygen lines in laboratory plasmas" Plasma Sources Science and Technology, 29, 015011, 1-11, Jan 2020.

Douglas E. Thornton, Davin Mao, Mark F. Spencer, Christopher A. Rice, and Glen P. Perram "Digital holography experiments with degraded temporal coherence" Optical Engineering, 59 102606-1, Oct 2019.

Douglas E. Thornton, Mark F. Spencer, Christopher A. Rice, and Glen P. Perram "Digital holography efficiency measurements with excess noise" Applied Optics, 58, G19, December 2019.

Refereed Conference Papers Accepted on the Basis of Abstract Review

Davin Mao, Douglas Thornton, Christopher Rice, Mark Spencer, and Glen Perram, "Effects of sinusoidal phase modulation on the signal-to-noise ratio in a digital holographic system," Proc SPIE 111350E, Optical Engineering and Applications, Sep 2019.

Other Significant Research Productivity

Glen P. Perram, Douglas E. Thornton, Davin Mao, and Mark F. Spencer, "Digital Holography for Laser Weapons and Remote Sensing" Laser Applications to Chemical, Security and Environmental Analysis 2020, Optical Society of America, June 2020, Vancouver, Canada. (Invited).

PHILLIPS, GLADY, T., Department of Engineering Physics

Other Significant Research Productivity

Predicted performance of a high power, transverse flow, diode-pumped alkali laser system using a nine-level Rb –He rate package in support of a MDA STTR to develop a high-energy laser analysis tool.

RICE, CHRISTOPHER, A., Department of Engineering Physics

Sponsor Funded Research Projects

"Marine Atmospheric Modeling." Sponsor: University of New Hampshire. Funding: $14,999 - Rice 100%. [CDE]

Refereed Journal Publications

D. E. Thornton, D. Mao, M. F. Spencer, C. A. Rice, and G. P. Perram, "Digital holography experiments with degraded temporal coherence," Opt. Eng., vol. 59, no. 10, p. 1, Jan. 2020.

D. E. Thornton, M. F. Spencer, C. A. Rice, and G. P. Perram, "Impacts of Laboratory Vibrations and Laser Flicker Noise on Digital Holography," IEEE J. Quantum Electron, vol. 56, no. 5, Oct. 2020.

J. E. McCrae et al., "Measurements of optical turbulence over 149-km path," Opt. Eng., vol. 59, no. 08, p. 1, Jun. 2020.

N. D. Haluska, G. P. Perram, and C. A. Rice, "Efficient cascade lasing on over 17 wavelengths from two-photon excitation of the cesium 62D states," Opt. Commun., vol. 476, p. 126328, Dec. 2020.

T. M. True, C. A. Rice, and G. P. Perram, "The cesium 62P3/2 to 82S1/2 line shape broadened by He, Ar, and Kr," J. Quant. Spectrosc. Radiat. Transf., vol. 250, p. 107010, Jul. 2020.

D. E. Thornton, M. F. Spencer, C. A. Rice, G. P. Perram, and G. P. Perram, "Digital holography efficiency measurements with excess noise," Appl. Opt., vol. 58, no. 34, p. G19, Dec. 2019.

Rice, C. A., Lapp, K., Rapp, A., Miller, W. S., & Perram, G. P. (2019). Rubidium D1 and D2 far wing line shapes induced by rare gases. Journal of Quantitative Spectroscopy and Radiative Transfer, 224, 550–555.

Refereed Conference Papers Accepted on the Basis of Abstract Review

J. E. McCrae, C. A. Rice, S. T. Fiorino, S. R. Bose-Pillai, and A. J. Archibald, "Wave Optics Simulations of a Dual Beacon Hartmann Turbulence Sensor," in IEEE Aerospace Conference Proceedings, 2020.

D. Mao, D. E. Thornton, C. A. Rice, M. F. Spencer, and G. P. Perram, "Effects of sinusoidal phase modulation on the signal-to-noise ratio in a digital holography system," in Unconventional and Indirect Imaging, Image Reconstruction, and Wave front Sensing 2019, 2019, vol. 11135, p. 14.

D. E. Thornton, M. F. Spencer, C. Rice, and G. P. Perram, "Laser linewidth measurements using digital holography," in Unconventional and Indirect Imaging, Image Reconstruction, and Wave front Sensing 2019, 2019, vol. 11135, p. 15.

Patent Applications

Bose-Pillai, S.R., J.E. McCrae, C.A. Rice, and S.T. Fiorino, "Estimation of Atmospheric Turbulence Parameters using Differential Motion of Extended Features in Time-lapse Imagery," provisional application filed in Jun 2019.

Haluska, Rice, Perram, "Diode pumped alkali laser extended to novel wavelengths via two-photon pumping." provisional application filed in Sept 2017.

TERZUOLI, ANDREW, J., JR, Department of Electrical and Computer Engineering

Refereed Conference Papers Accepted on the Basis of Full Paper Review

Andrew Knisely, Andrew Terzuoli, "Numerical Dispersion Reduction in the Parabolic Wave Equation," Proceedings of the 2019 International Conference on Electromagnetics in Advanced Applications (ICEAA 2019), Granada, SP, 9-13 Sept 2019.

Andrew J. Knisely and Andrew J. Terzuoli, Jr, "Phase Screen Scintillation Model Accuracy Assessment Using FDM, FEM, and Spectral Techniques to solve the Parabolic Wave Equation," Proceedings of the 2020 IEEE International Conference on Communications (ICC 2020), Dublin, IR, 7-11 June 2020.

Andrew J. Knisely, Andrew J. Terzuoli, "Wideband SATCOM Model: Evaluation of Numerical Accuracy and Efficiency," Proceedings of the XXIVth International Society for Photogrammetry and Remote Sensing Congress (ISPRS 2020), Nice, FR, 14-20 June 2020.

Andrew J. Knisely, Andrew J. Terzuoli, "First Principle Scintillation Characterization of Natural and Artificial Disturbances on V/W Band Signals in the Ionosphere Using the Multiple Phase Screen Technique," Proceedings of the XXXIII General Assembly and Scientific Symposium (GASS) of the International Union of Radio Science (Union Radio Scientifique Internationale-URSI), Rome, IT, 29 Aug – 5 Sept, 2020.

Andrew J. Knisely, Andrew J. Terzuoli, "First Principle EMI Model of Wideband Signal Temporal Delay Induced by A HANE in the Ionosphere," Proceedings of the International Symposium on Electromagnetic Compatibility (EMC 2020), Rome, IT, 7-11 Sept 2020.

WEEKD, DAVID, E., Department of Engineering Physics

Refereed Journal Publications

Loper, R. D., and Weeks, D. E., "A fully quantum calculation of broadening and shifting coefficients of the D1 and D2 spectral lines of alkali-metal atoms colliding with noble-gas atoms," Journal of Physics B: Atomic, Molecular and Optical Physics, Vol. 53, No. 20, p. 205403, 15 Sep 2020.

D.E. Weeks, C.D. Lewis, L.A. Schlie, and G.P. Perram, "Temperature dependence of the fine structure mixing induced by ^{4}He and ^{3}He in K and Rb Diode Pumped Alkali Lasers," Appl. Phys. B, 126, 79 (2020).

L.T. Belcher, G.S. Kedziora, and D.E. Weeks, "Analytic non-adiabatic derivative coupling terms for spin-orbit MRCI wavefunctions. I. Formalism," J. Chem. Phys. 151, 234104 (2019).

L.T. Belcher, C.D. Lewis, G.S. Kedziora, and D.E. Weeks, "Analytic non-adiabatic derivative coupling terms for spin-orbit MRCI wavefunctions. II. Derivative coupling terms and coupling angle for KHe ($A^2\Pi_{1/2}$) ⇔KHe ($B^2\Sigma_{1/2}$)," J. Chem. Phys. 151, 234109 (2019).

D.J. Emmons, D.E. Weeks, "Effect of $Ar(3p^5 4p; 2p)+M \rightarrow Ar(3p^5 4s; 1s)+M$ branching ratio on optically pumped rare gas laser performance," Opt. Express 27, 35689-35699 (2019).

Patents Awarded

Superconducting levitation bearing with an optically switched electromagnetic driver. (U.S. patents 5,061,679 and 5,120,706).

6.4. CENTER FOR OPERATIONAL ANALYSIS

Center for Operational Analysis (COA)
Director (937) 255-3636 x4251
Deputy Director (937) 255-3636 x4523
Homepage: http://www.afit.edu/COA

6.4.1. DOCTORAL DISSERTATIONS

N/A

6.4.2. MASTER'S THESES

BRAKEVILLE, ADAM, J., A Random Forest Approach to Classify a Fixed Wallet Consumer. AFIT-ENS-MS-20-M-133. Faculty Advisor: Dr. Lance E. Champagne. Sponsor: N/A.

CHALE, MARC, W., Algorithm Selection Framework: A Holistic Approach to the Algorithm Selection Problem. AFIT-ENS-MS-20-M-137. Faculty Advisor: Dr. Jeffery D. Weir. Sponsor: N/A.

CHOO, NATHANIEL, The Effects of Aircraft Use and Available Repair Spares on Aircraft Sortie Generation: A Long-Duration Logistical War gaming Simulation Tool. AFIT-ENS-MS-20-D-069. Faculty Advisor: Dr. Darryl K. Ahner. Sponsor: HQ AFMC/A5R.

HARVEY, TRAVIS, C., Increasing Airlift Availability through Optimization of Presidential Support Missions. AFIT-ENS-MS-20-J-038. Faculty Advisor: Dr. Darryl K. Ahner. Sponsor: AMC/A9.

LEE, STEPHEN, M., Ground Weather RADAR Signal Characterization through Application of Convolutional Neural Networks. AFIT-ENS-MS-20-M-158. Faculty Advisor: Dr. Lance E. Champagne. Sponsor: 45 WS/SYR.

MALONEY, JOSEPH, B., Simulating a Hypersonic Intelligence Surveillance and Reconnaissance (ISR) Aircraft's Military Utility in an Anti-Access Area Denial (A2AD) Environment. AFIT-ENS-MS-20-M-161. Faculty Advisor: Dr. Lance E. Champagne. Sponsor: SDPE.

SCHROEDER, MARIA, N., Reconciliation of Hierarchical Time-Series Forecasting of Restaurant Attendance. AFIT-ENS-MS-20-M-170. Faculty Advisor: Dr. Lance E. Champagne. Sponsor: N/A.

WILLIAMS, CLARENCE, O., Meta Learning Recommendation System for Classification. AFIT-ENS-MS-20-M-181. Faculty Advisor: Dr. Jeffery D. Weir. Sponsor: N/A.

WOODS, MEGAN, K., A Metamodel Recommendations systems using Meta-Learning. AFIT-ENS-MS-20-M-182. Faculty Advisor: Dr. Jeffery D. Weir. Sponsor: N/A.

6.4.3. FACULTY RESEARCH OUTPUT

Notes: Faculty Bios can be found under their respective department listings. Shared credit for funding awards is indicated by the percentages shown for each faculty member associated with the project.

BORGHETT, BRETT, J., Department of Electrical and Computer Engineering

Refereed Journal Publications

Westing, Nicholas M., Gross, Kevin C., Borghetti, Brett, J., Martin, Jacob, and Meola, Joseph, "Learning Set Representations for LWIR In-Scene Atmospheric Compensation" *IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing*, 2 Apr 2020, Vol 13, pp 1438-1449 https://ieeexplore.ieee.org/document/9055124

Dickey, Joshua, T., Borghetti, Brett, J., Junek, William, and Martin, Richard "Beyond Correlation: A Path-invariant Measure for Seismogram Similarity" *Seismological Research Letters*, 6 Nov 2019, DOI: 10.1785/0220190090 https://pubs.geoscienceworld.org/srl/article-pdf/doi/10.1785/0220190090/4862061/srl-2019090.1.pdf

Westing, Nicholas M., Borghetti, Brett, J., Gross, Kevin C., "Fast and Effective Techniques for LWIR Radiative Transfer Modeling: A Dimension Reduction Approach," *Remote Sensing (MDPI)*, 9 Aug 2019, Vol 11, issue 6, pp. 1866-1886, DOI: 10.3390/rs11161866 https://www.mdpi.com/2072-4292/11/16/1866/htm

Refereed Conference Papers Accepted on the Basis of Full Paper Review

Crow, David R., Graham, Scott R., Borghetti, Brett J., Sweeney, Patrick J., "Empirical Dynamic Modeling as a Basis for an Intrusion Detection System" 14th International Conference on Critical Infrastructure Protection (IFIP), Arlington, VA, USA, Mar 2020.

Villarreal, Micah N., *Kamrud, Alexander J., Borghetti, Brett J., "Confirmation Bias Estimation from Electroencephalography with Machine Learning," Human Factors and Ergonomics Society (HFES) Annual Conference, 2019, Seattle, WA, 28 Oct-1 Nov 2019.

Refereed Conference Papers Accepted on the Basis of Abstract Review

Crow, David R., Graham, Scott R., Borghetti, Brett J., "Fingerprinting Vehicles with CAN Bus Data Samples," *15th International Conference on Cyber Warfare and Security (ICIW)*, Norfolk, VA, Feb 2020.

CUNNINGHAM, WILLIAM, A., Department of Operational Sciences

Refereed Journal Publications

Order Fulfillment Errors and Military Aircraft Readiness," Michael Weber*, Daniel Steeneck and William Cunningham, Journal of Defense Analytics and Logistics**,** Vol. 4No. 1, 2020, pp. 71-87.

Refereed Conference Papers Accepted on the Basis of Abstract Review

Examining Determinants of Non-mission Capable Time for Cargo Aircraft Using Multiple Regression Analysis," Andrew Gill*, William Cunningham and Seong-Jong Joo. Western Decision Science Institute 49th Annual Meeting, April 7-10, Portland, OR. Although this conference did not take place due to COVID-19, the paper was accepted and a proceedings was published with the abstracts.

Editorships in Professional Journals

Editorial Review Board, Journal of Transportation Management

HODSON, DOUGLAS, D., Department of Electrical and Computer Engineering

Refereed Journal Publications

Chris Weimer, J.O. Miller, Raymond Hill, Douglas D. Hodson, "Agent Scheduling in Opinion Dynamics: A Taxonomy and Comparison Using Generalized Models," Journal of Artificial Societies and Social Simulation (JASSS), Vol 22, No 4, 2019.

Refereed Conference Papers Accepted on the Basis of Full Paper Review

Joseph Tippit, Douglas Hodson, Michael Grimaila, "Julia and Singularity for High Performance Computing," The 18th International Conference on Scientific Computing (CSC'20), Las Vegas, NV, Jul 27-30, 2020.

Drew Campbell, Jake Hall, Iyanu Odebode, Douglas Hodson, Michael Grimaila, "Trojan Banker Simulation Using Python," the 18th International Conference on Scientific Computing (CSC'20), Las Vegas, NV, Jul 27-30, 2020.

Amber Modlin, Andres Gregory, Iyanu Odebode, Douglas Hodson, Michael Grimaila, "CovidLock a New Form of Ransomware," the 18th International Conference on Scientific Computing (CSC'20), Las Vegas, NV, Jul 27-30, 2020.

Braeden Bowen, Jeremy Ergybar, Iyanu Odebode, Douglas Hodson, Michael Grimaila, "The New Office Threat: A Simulation Environment of Watering Hole Cyber Attacks," The 18th International Conference on Scientific Computing (CSC'20), Las Vegas, NV, Jul 27-30, 2020.

Hai Vo, Raymond Kozlowski, Iyanu Odebode, #Douglas Hodson, Michael Grimaila, "Simulation of SYN Flood Attack and Counter-Attack Methods Using Average Connection Times," The 18th International Conference on Scientific Computing (CSC'20), Las Vegas, NV, Jul 27-30, 2020.

JOO, SEONG-JONG, Department of Operational Sciences

Sponsor Funded Research Projects

"Research, Analysis and Transition Support to the Directorate of Logistics and Sustainment/AFMC." Sponsor: HQ AFMC. Funding: $350,000 - Joo 45%, Steeneck 30%, Boehnke 20%, Breitbach 5%.

"Research, Analysis and Transition Support to the Directorate of Logistics and Sustainment/AFMC." Sponsor: HQ AFMC. Funding: $90,000 - Joo 45%, Ciarallo 30%, Reiman 20%, Cunningham 5%.

Refereed Journal Publications

Joo, S., Boehmke, B., Min, H., & Bayazit, O. (2020). Sourcing analytics for evaluating and selecting suppliers using DEA and AHP: a case of the aerospace company, *International Journal of Services and Operations Management* 35(4), 461-481.

Lee, Y., Joo, S., & Hwang, T. (2020). An aggregate DEA analysis for Korean bank performance using a chance-constrained approach, *International Journal of Operational Research* 38(4), 525-543.

Wang, Y., Anderson, J., Joo, S. and Huscroft, J. (2019). The leniency of return policy and consumers' repurchase intention in online retailing. *Industrial Management & Data Systems* 120 (1), 21-39.

Lee, Y. and Joo, S. (2019). Assessing the effects of exogenous factors for benchmarking hospitals with double bootstrapping. *Benchmarking: An International Journal* 27(1), 250-263.

Refereed Conference Papers Accepted on the Basis of Abstract Review

Joo#, S. & Yoon, G. (2019). Analyzing recurrent events of aircraft using survival analysis, *the 2019 INFORMS Annual Conference*, Seattle, WA, October 20, 2019.

Due to COVID-19, the 2020 WDSI meeting was cancelled around a month before the meeting date. The next four submissions have been published on the meeting website: http://wdsinet.org/Annual_Meetings/2020_Proceedings/ProceedingsPapers.html)

O'Neal*, T., Alamri*, A., Cherobini*, D., & Joo, S. (2020) "Assessing maintenance performance for military aircraft using data envelopment," *the 49th Annual Meeting of the Western Decision Sciences Institute**, Portland, OR, April 7-10, 2020.

Gladney*, K., Akers*, C., Alanazi*, N., & Joo, S. (2020). Measuring the comparative performance of operations of air cargo wings using DEA, *the 49th Annual Meeting of the Western Decision Sciences Institute**, Portland, OR, April 7-10, 2020.

Gill*, A., Cunningham, W., & Joo, **S**. (2020). Examining determinants of non-mission capable time for cargo aircraft using multiple regression analysis, *the 49th Annual Meeting of the Western Decision Sciences Institute**, Portland, OR, April 7-10, 2020.

Ingram*, M., Aljuaid*, S., Alqarni*, A., Brubakken*, A., & Joo, S. (2020). Comparative evaluation of suicides at a national level, *the 49th Annual Meeting of the Western Decision Sciences Institute**, Portland, OR, April 7-10, 2020.

JORDAN, JEREMY, D., LT. COL., Department of Mathematics and Statistics

Sponsor Funded Research Projects

"Design of Networks in Uncertain Environment with Buffered Probability of Exceedance (bPOE)." Sponsor: AFOSR. Funding: $13,073 - Jordan 100%.

WEIR, JEFFERY, D., Department of Operational Sciences

Sponsor Funded Research Projects

"Cost Capability Analysis AFIT Support to Headquarters Air Force A2 (HAF/A2)." Sponsor: HQ AFMC. Funding: $60,000 - Weir 100%.

"Cost Capability Analysis AFIT Support to Headquarters Air Force A2 (HAF/A2)." Sponsor: HQ AFMC. Funding: $365,000 - Weir 100%.

Refereed Journal Publications

Hanks, R, Lunday, B, and Weir, J D, "Robust Goal Programming for Multi-objective Optimization of Data-driven Problems: a Use Case for the United States Transportation Command's Liner Rate Setting Problem," Omega, vol 90, 2020, 101983 https://doi.org/10.1016/j.omega.2018.10.013.

Chu, X., Wu, T., Weir, J.D., Shi, Y., Niu, B., and Li, L., "Learning-Interaction-Diversification framework for swarm intelligence optimizers: A unified perspective," Neural Computing and Applications, vol 32, pp 1789-1809, 2020, https://doi.org/10.1007/s00521-018-3657-0.

Su, C., Weir, J.D., Zhang, F., Yan, H., Wu, T., "ENTRNA: a framework to predict RNA foldability," BMC bioinformatics, vol 20, article 373, 2019, https://doi.org/10.1186/s12859-019-2948-5.

Little, Z C, Weir, J D, Hill, R R, Stone, B B, and Freels, J K, "Batch sequential NOAB designs by way of simultaneous construction and augmentation," International Journal of Experimental Design and Process Optimisation, vol 6, no 2, pp 127-146, 2019, https://doi.org/10.1504/IJEDPO.2019.101719.

Little, Z C, Weir, J D, Hill, R R, Stone, B B, and Freels, J K, "Second-order extensions to nearly orthogonal-and-balanced (NOAB) mixed-factor experimental designs," Journal of Simulation, vol 13, no 3, pp226-237, 2019 https://doi.org/10.1080/17477778.2018.1533794.

Gehret, G. H., Weir, J. D., Johnson, A. W. and Jacques, D. R., "Advancing stock policy on repairable, intermittently-demanded service parts," Journal of the Operational Research Society, vol 13, no 9, pp1437-1447, 2020 https://doi.org/10.1080/01605682.2019.1610206.

Refereed Conference Papers Accepted on the Basis of Abstract Review

Chalé, M, Weir, J D, Bastian, N, "Holistic Approach to Algorithm Selection," Military Operations Research Society Symposium, 16 – 19 June 2020, Virtual.

Editorships in Professional Journals

Associate Editor, Military Operations Research Journal

Associate Editor, IIE Transactions on Healthcare Systems Engineering

6.5. CENTER FOR SPACE RESEARCH AND ASSURANCE

Center for Space Research and Assurance (CSRA)
Director (937) 255-3636 x4679
Deputy Director (937) 255-3636 x4285
Associate Director (937) 255-3636 x4559
Homepage: https://www.afit.edu/CSRA

6.5.1. DOCTORAL DISSERTATIONS

N/A

6.5.2. MASTER THESES

BAXTER, ADAM, L., Modulation of Lightning Occurrence by the Solar Wind. AFIT-ENP-MS-20-M-079. Faculty Advisor: Dr. Anthony L. Franz. Sponsor: AFOSR/RTB.

BURG, KEVIN, S., Spacecraft Position and Attitude Estimation Using Terrestrial Illumination Matching. AFIT-ENP-MS-20-M-085. Faculty Advisor: Maj. Daniel J. Emmons. Sponsor AFRL/RV.

ECHEVERRY, NICHOLAS, C., Signal Quality Monitoring of GNSS Signals Using a Chip Shape Deformation Metric. AFIT-ENG-MS-20-M-017. Faculty Advisor: Maj. Joan A. Betances. Sponsor: AFMC.

ERICKSON, BRIAN, Numerical Optimization of Six Degree-of-Freedom, Path-Constrained Satellite Skip Entry Tranjectories. AFIT-ENY-MS-20-M-261. Faculty Advisor: Maj. Robert A. Bettinger. Sponsor: N/A.

FARRELL, LUKE, J., A Reference Architecture for CubeSat Development. AFIT-ENV-MS-20-M-199. Faculty Advisor: Dr. David R. Jacques. Sponsor: N/A.

GALLAGHER, WILLIAM, R., Investigation of ULTEM 9085 for Use in 3-D Printed Orbital Structures. AFIT-ENY-MS-20-M-262. Faculty Advisor: Dr. Carl R. Hartsfield. Sponsor: N/A.

GOLDIN, ANDREW, W., Structural Dynamic and Inherent and Damping Characterization of Additively Manufactured Airfoil Components. AFIT-ENY-MS-20-M-263. Faculty Advisor: Dr. Richard G. Cobb. Sponsor: AFRL/RX.

HILL, JONATHAN, L., Experimental Measurements of Hypersonic Instabilities Over Ogive-Cylinders at Mach 6. AFIT-ENY-MS-20-M-265. Faculty Advisor: Lt. Col. Jeffery R. Komives. Sponsor: AFRL/RQH.

HOLOWCHIK, JOHN, CubeSat Payload Design and Integration with Software-Definded Radar and Microcomputer for Proximity Detection. AFIT-ENG-MS-20-M-267. Faculty Advisor: Dr. Peter J. Collins. Sponsor: N/A.

KLEIN, ADAM, W., Characterizing Over-the-Horizon Radar Noise Directionality Using a High-Resolution Lightning Detection Network. AFIT-ENP-MS-20-M-105. Faculty Advisor: Maj. Omar A. Nava. Sponsor: AFRL/RV.

KNISTER, SIMON, R., Evaluation Framework for Cislunar Space Domain Awareness (SDA). AFIT-ENV-MS-20-M-221. Faculty Advisor: Lt. Col. Bryan D. Little. Sponsor: N/A.

LEE, COREY, J., Hypersonic Vehicle Control and Trajectory Determination through the Application of Artificial Intelligence. AFIT-ENY-MS-20-M-268. Faculty Advisor: Lt. Col. Jeffery R. Komives. Sponsor: N/A.

LINVILLE, DAX, A., Linear Regression Models Applied to Imperfect Information Spacecraft Pursuit-Evasion Differential Games. AFIT-ENY-MS-20-M-269. Faculty Advisor: Maj. Joshuah A. Hess. Sponsor: AFRL/RV.

MATISSEK, KYLE, J., A Near-Real-Time Near-Optimal Shortest Path Solution for an Unmanned Aerial System (UAS) in a High Constrained Environment. AFIT-ENY-MS-20-M-271. Faculty Advisor: Dr. Richard G. Cobb. Sponsor: AFRL/RQQA.

MCCLEARY, KYLE, CubeSat Radar Payload Integration and Testing for Proximity Detection. AFIT-ENG-MS-20-M-272. Faculty Advisor: Dr. Peter J. Collins. Sponsor: N/A.

NARANJO, TRISTAN, R., Multi-Spectral Imaging of Vegetation with a Diffractive Plenoptic Camera. AFIT-ENP-MS-20-M-108. Faculty Advisor: Dr. Anthony L. Franz. Sponsor: N/A.

PEARSON, PAYTON, E., Chronos Spacecraft with Chiron Probe: Exploration of the Hydrosphere, Principle Satellites, Atmosphere, and Rings of Uranus. AFIT-ENG-MS-20-S-015. Faculty Advisor: Dr. Carl R. Hartsfield. Sponsor: N/A.

PICKERING, ELIZABETH, Characterizing Full-Scale Scramjet Vehicle Performance Using RANS and Propulsion Cycle Code Analysis. AFIT-ENY-MS-20-M-277. Faculty Advisor: Lt. Col. Jeffery R. Komives. Sponsor: NASIC/CAN, DARPA.

REAGANS, MILES, E., Parametric Investigation of a Two-Dimensional Planar Scramjet Compression System. AFIT-ENY-MS-20-J-079. Faculty Advisor: Lt. Col. Jeffery R. Komives. Sponsor: NASIC/CAN.

SHOCKLEY, LIBERTY, M., Spacecraft Position and Attitude Estimation Using Terrestrial Illumination Matching. AFIT-ENY-MS-20-M-280. Faculty Advisor: Maj. Robert A. Bettinger. Sponsor: AFRL/RV.

STAMBOVSKY, DANIEL, W., Simulation of Sporadic-E Parameters Using Phase Screen Method. AFIT-ENP-MS-20-M-117. Faculty Advisor: Maj. Daniel J. Emmons. Sponsor: AFRL/RV.

TASSOS, NICHOLAS, Colony II Cubesat Component Reutilization for Future Experimental Platforms. AFIT-ENY-MS-20-M-282. Faculty Advisor: Dr. Richard G. Cobb. Sponsor: AFIT/ENY.

TOUMA, JEREMY, A., Spacecraft Propulsion and Power Using an External Heat Exchanger. AFIT-ENY-MS-20-M-284. Faculty Advisor: Dr. Frederick R. Schauer. Sponsor: N/A.

WHITNEY, TAYLOR, R., Detection of Reconnection Signatures in Solar Flares. AFIT-ENP-MS-20-M-121. Faculty Advisor: Dr. Robert D. Loper. Sponsor: AFOSR/RTB1.

WIGHTMAN, JESSICA, Space-Based Localization of Radio Frequency Transmitters Utilizing Macaulay Resultant and Heuristic Optimization Methods. AFIT-ENY-MS-20-M-286. Faculty Advisor: Maj. Joshuah A. Hess. Sponsor: AFRL/RV.

6.5.3. FACULTY RESEARCH OUTPUT

Notes: Faculty Bios can be found under their respective department listings. Shared credit for funding awards is indicated by the percentages shown for each faculty member associated with the project.

ALBRECHT, TIMOTHY W., Col Department of Operational Sciences

Sponsor Funded Research Projects

"CubeSat-Optimized Software-Defined Flight Radio." Sponsor: Undisclosed. Funding: $30,000 - Albrecht 25%, Gunawardena 25%. Johnson 25%, Cobb 25%.

"Integration of NPS's Terahertz Imaging Camera for On-Orbit Demonstration." Sponsor: Undisclosed. Funding: $30,000 - Albrecht 25%, Bettinger 25%, Johnson 25%, Cobb 25%.

"Research Support to Sponsored Students (CSRA portion)." Sponsor: SAF/FBIB. Funding: $250,000 - Albrecht 25%, Bettinger 25%, Cobb 25%, Ayres 25%.

"CubeSat-Optimized Software-Defined Flight Radio." Sponsor: Undisclosed. Funding: $20,000 - Albrecht 25%, Gunawardena 25%, Johnson 25%, Cobb 25%.

"Integration of NPS's Terahertz Imaging Camera for On-Orbit Demonstration." Sponsor: Undisclosed. Funding: $20,000 - Albrecht 25%, Bettinger 25%, Johnson 25%, Cobb 25%.

AYRES, BRADLEY, J., Department of Engineering Physics

Refereed Conference Papers Accepted on the Basis of Full Paper Review

Kaslow, D., Cahill, P. T., Ayres, B., "Development and Application of the CubeSat System Reference Model," 2020 IEEE Aerospace Conference, Big Sky, MT, March 2020.

BETANCES, JOAN, A., MAJ, Department of Electrical and Computer Engineering

BETTINGER, ROBERT, A., MAJ, Department of Engineering Physics

Sponsor Funded Research Projects

"Grissom 6U Bus Integration for Space Test Program." Sponsor: SMC/DCIP. Fsmc/ng: $210,000 - Bettinger 20%, Cobb 20%, Hartsfield 20%, Johnson 20%, Keys 20%.

"Nanosatellite Attitude Determination and Control Test Program." Sponsor: NIWC Pacific. Funding: $10,001 - Bettinger 100%.

"Constellation Optimization Study for Low Earth Orbiting Spacecraft." Sponsor: NASIC/SM. Funding: $20,000 - Bettinger 100%.

"Rapid CubeSat Design, Fabrication, and Test." Sponsor: SAF/FMBIB. Funding: $101,950 - Bettinger 60%, Keys 20%, Hartsfield 20%.

"AFIT MC3 Satellite Network Node Sustainment and Upgrade." Sponsor: NPS. Funding: $33,164 - Bettinger 100%.

Refereed Journal Publications

Shockley, L. M., Bettinger R. A., "Policy and Geopolitical Implications of Launch-on-Demand Capabilities," *Journal of DOD Research and Engineering*, Vol. 3, No. 1, March 2020, pp. 2-14.

Linville, D. A., Bettinger, R. A., "An Argument against Satellite Resiliency: Simplicity in the Face of Modern Satellite Design," *Air & Space Power Journal*, Vol. 34, No. 1, Spring 2020, pp. 43-53.

Bettinger, R. A., "Linear Model for Reentry Time Prediction of Spacecraft in Low-Eccentricity, Low Earth Orbits," *Journal of Spacecraft and Rockets*, Vol. 56, No. 5, pp. 1300-1311, September-October 2019.

Refereed Conference Papers Accepted on the Basis of Full Paper Review

Shockley, L. M., Bettinger, R. A., "Spacecraft Attitude Estimation using Terrestrial Illumination Matching," 2020 IEEE Aerospace Conference, Big Sky, MT, March 2020.

Refereed Conference Papers Accepted on the Basis of Abstract Review

Lomanno, C. P., Bettinger, R. A., Gindre, P., "Utility of Modular Attitude Determination and Control Subsystems for Small Satellites," 2020 Advanced Maui Optical and Space Surveillance Technologies Conference (AMOS), Maui, HI, September 2020.

Boone, N. R., Bettinger, R. A., "Spacecraft Survivability near the Stable Earth Lagrange Points," 2020 AAS/AIAA Astrodynamics Specialist Conference, Lake Tahoe, CA, August 2020.

Keys, A. S., Bettinger, R. A., Miller, S. K., Sheffield, C. A., Lomanno, C. P., "Balancing Project Management, Risk, and Educational Opportunities on the Grissom CubeSat Project," 2020 Small Satellite Conference, Logan, UT, August 2020.

Bettinger, R. A., Hess, J. A., "Hypervelocity Impact Vulnerability Assessment for a 6U CubeSat Bus," 2020 AIAA Science and Technology Forum and Exposition, Orlando, FL, January 2020.

Bettinger, R. A., Hess, J. A., "Fractionated Spacecraft Survivability following a Catastrophic Explosion," 2020 AIAA Science and Technology Forum and Exposition, Orlando, FL, January 2020.

Shockley, L. M., Bettinger, R. A., "Spacecraft Position Estimation using Terrestrial Illumination Matching," 2020 AIAA Science and Technology Forum and Exposition, Orlando, FL, January 2020.

Patent Applications

Shockley, L. M., Bettinger, R. A., "Aerospace Vehicle Navigation and Control System Comprising Terrestrial Illumination Matching Module for Determining Aerospace Vehicle Position and Attitude," AFD-2040, U.S. Provisional Patent No. 62/957,250, January 2020.

Other Significant Research Productivity

Bettinger, R. A., Hess, J. A., "Hypervelocity Impact Vulnerability Assessment for 6U and 12U CubeSat Bus Designs," 45th AIAA Dayton-Cincinnati Aerospace Sciences Symposium (DCASS), Dayton, OH, March 2020.

Derbis, R. M., Cunningham, P. B., Thornton, D. M., Bettinger, R. A., Schubert Kabban, C., "Refined Linear Models for Spacecraft Reentry Predictions," 45th AIAA Dayton-Cincinnati Aerospace Sciences Symposium (DCASS), Dayton, OH, March 2020.

Erickson, B., Bettinger, R. A., "Numerical Optimization of Six Degree-of-Freedom, Path-Constrained Satellite Skip Entry Trajectories," 45th AIAA Dayton-Cincinnati Aerospace Sciences Symposium (DCASS), Dayton, OH, March 2020.

Keys, A. S., Bettinger, R. A., Miller, S. K., Sheffield, C. A., "Development of the Grissom CubeSat Project," 45th AIAA Dayton-Cincinnati Aerospace Sciences Symposium (DCASS), Dayton, OH, March 2020.

Tassos, N., Bettinger, R. A., "Statistical Reliability Estimation of Small Satellites," 45th AIAA Dayton-Cincinnati Aerospace Sciences Symposium (DCASS), Dayton, OH, March 2020.

Shockley, L. M., Bettinger, R. A., "Spacecraft Position Estimation using Terrestrial Illumination Matching," 15th Dayton Engineering Sciences Symposium (DESS), Dayton, OH, October 2019.

CAYLOR, MICHAEL, J., Department of Engineering Physics

COBB, RICHARD, G., Department of Aeronautics and Astronautics

Sponsor Funded Research Projects

"Space Domain Modeling & Simulation via High Performance Computing." Sponsor: Undisclosed. Funding: $230,000 - Cobb 50%, Meyer 50%.

"Satellite Attitude Control Testbed Upgrades (Continuation)." Sponsor: SAF/FMBIB. Funding: $65,366 - Cobb 34%, Hess 33%, Zagaris 33%.

"AFIT Support for Operations in Contested Space." Sponsor: SAF/FMBIB. Funding: $300,000 - Cobb 20%, Hess 20%, Zagaris 20%, Meyer 20%, Johnson 20%.

"Swarm Rendezvous and Proximity Operations via Visual-Servoing." Sponsor: AFRL/RV. Funding: $43,100 - Cobb 50%, Zagaris 50%.

"Artificial Intelligence Opponent for Contested Space (AIOCS): Game Development." Sponsor: AFRL/RV. Funding: $57,500 - Cobb 50%, Hess 50%.

"Rapid CubeSat Build and Test." Sponsor: AFRL/RV. Funding: $8,567 - Cobb 50%, Hartsfield 50%.

Refereed Journal Publications

Thomas*, G., Cobb, R., Fiorino, S. and Hawks, M., "Daytime Cloudless Sky Radiance Quantification with Ground-based Aerosol and Meteorological Observations in the Short-Wave Infrared," *Journal of Atmospheric and Oceanic Technology*, 37(5) March 2020, DOI: 10.1175/JTECH-D-19-0157.1.

Spendel, D., Hess, J., Johnson, K., and Cobb, R., "Evaluating Orbital Defender Performance Trades Using Differential Game Theory" *Journal of Defense Research & Engineering*, Vol 3, Issue 1, March 2020, AD1092565.

Thomas, G., Cobb, R., Fiorino, S. and Hawks, M., "NIR and SWIR Observations for Daytime Satellite Custody," *Journal of Defense Research & Engineering*, Vol 3, Issue 1, March 2020, AD1093125.

Smith, N.E., Cobb, R.G., and W.P. Baker, "Incorporating Stochastics into Optimal Collision Avoidance Problems using Superquadrics," *AIAA Journal of Air Transportation*, February 2020, DOI: 10.2514/1.D0170.

Spendel, D.S., Hess, J.A., Cobb, R.G., Johnson, K. J., "Developing and Analyzing Strategies Using Pursuer-Evader-Defender Differential Game Theory for Orbital Engagements," Journal of DOD Research and Engineering, July 2020.

refereed conference papers accepted on basis of full paper review

Harris, W., Cobb R., and Taylor, C., "Visual Servoing for Final Approach Phase of Spacecraft Proximity Operations with Unknown Targets," 2020 IEEE/ION Position, Location and Navigation Symposium (PLANS), Portland, OR, USA, 2020, pp. 1606-1617, doi: 10.1109/PLANS46316.2020.9110218.

Harris, W., Linville, D., Hess J., and. Cobb, R., "Development of GNC for Optimal Relative Spacecraft Trajectories," 2020 IEEE/ION Position, Location and Navigation Symposium (PLANS), Portland, OR, USA, 2020, pp. 1476-1487, doi: 10.1109/PLANS46316.2020.9110153.

Weintraub, I., Cobb, R., Baker, W. and Pachter, M., "Direct Methods Comparison for the Active Target Defense Scenario," AIAA SciTech 2020 Forum, January 2020, DOI: 10.2514/6.2020-0612.

Other Significant Research Productivity

Harris, W., Cobb R., and Taylor, C., "Visual Servoing for Final Approach Phase of Spacecraft Proximity Operations with Unknown Targets," presented virtually to the AFRL/RVSW "RANGERS" symposium, 16 April, 2020.

Matissek, K., Cobb, R. Jacques, D., Grymin, D., and Zollars, M., "A Near-Real-Time Near-Optimal Shortest Path Solution for an Unmanned Aerial System (UAS) in a Highly Constrained Environment," AIAA 45th Dayton-Cincinnati Aerospace Science Symposium, 3 March 2020.

Matissek, K., Cobb, R. Jacques, D., Grymin, D., and Zollars, M., "A Near-Real-Time Near-Optimal Shortest Path Solution for an Unmanned Aerial System (UAS) in a Highly Constrained Environment," ASME 15th Dayton Engineering Sciences Symposium, 29 October 2019.

COLLINS, PETER, J., Department of Electrical and Computer Engineering

Sponsor Funded Research Projects

"FASTBALL: Frugal Atmospheric Sounder Test Bed Auto-pointing Luneburg Lens." Sponsor: Undisclosed. Funding: $17,500 - Collins 100%.

"Enabling Technologies for Radar Scattering Measurements." Sponsor: SAF/FBIB. Funding: $142,390 - Collins 100%.

"Enabling Technologies for Advanced Munitions." Sponsor: SAF/FBIB. Funding: $100,000 - Collins 50%, Hartsfield 25%, Lingenfelter 25%.

Refereed Journal Publications

John Lee, Peter J. Collins, and Julie Ann Jackson, "Sparse Representation of Targets with Mixed Scattering Primitives," Journal of the Applied Computational Electromagnetics Society, Volume: 35, Number: 6, 2020.

Alex Paul, Collins P. J., Temple M., "Application of Machine Learning to Enhance Antenna Termination State Estimation Using Stimulated Unintended Radiated Emissions," IEEE Ant & Wireless Prop Letters, Volume: 18, Issue: 11, Nov. 2019.

Christopher Vergara, Richard K. Martin, Peter J. Collins, and James R. Lievsay, "Multi-Sensor Data Fusion between Radio Tomographic Imaging and Noise Radar," IET Radar, Sonar & Navigation, Volume: 14, Issue: 2, pp. 187-193, Feb. 2020.

Refereed Conference Papers Accepted on the Basis of Full Paper Review

Spencer R. Sellers, Peter J. Collins, and Julie Ann Jackson, "Augmenting Simulations for SAR ATR Neural Network Training," IEEE International Radar Conference, Washington D.C., 27 Apr – 1 May 2020.

COLOMBI, JOHN, M., Department of Systems Engineering and Management

Sponsor Funded Research Projects

"Model-based Systems Engineering for WNS Acq Workforce." Sponsor: AFLCMC/WNS. Funding: $100,000 - Colombi 100%.

Refereed Journal Publications

Felten, M. S., Colombi, J.M, Cobb, R.G., & Meyer, D.W. (2018). Multi-objective optimization using parallel simulation for space situational awareness, Journal of Defense Modeling and Simulation Applications, Methodology, Technology. pp 1-33. DOI: 10.1177/1548512918803212.

Refereed Conference Papers Accepted on the Basis of Full Paper Review

Hertwig, Fred D., Colombi, John M., Cobb, Richard G. and David W. Meyer (2019). Search-Based vs. Task-Based Space Surveillance for Ground-Based Telescopes. Advanced Maui Optical and Space Surveillance Technologies Conference (AMOS). Maui, HI (17-19 September, 2019).

COX, BRUCE, A., LT. COL., Department of Operational Sciences

DECKRO, RICHARD, F., Department of Operational Sciences

EMMONS, DANIEL, J., MAJ., Department of Engineering Physics

Sponsor Funded Research Projects

"Using GPS Radio Occultation to Monitor Sporadic-E." Sponsor: AFOSR. Funding: $30,240 - Emmons 50%, Nava 25%, Tseng 25%.

"Investigating Channel Scattering in GPS Radio Occultation Measurements." Sponsor: AFRL/RV. Funding: $16,100 - Emmons 100%.

Refereed Journal Publications

Aegerter, T. R. W., D. J. Emmons, and R. D. Loper. “Detection of reconnection signatures in solar flares.” Journal of Atmospheric and Solar-Terrestrial Physics 208 (2020): 105375.

Emmons, D. J., E. V. Dao, K. K. Knippling, L. F. McNamara, O. A. Nava, K. S. Obenberger, and J. J. Colman. “Estimating horizontal phase speeds of a traveling ionospheric disturbance from Digisonde single site vertical ionograms.” Radio Science 55, no. 8 (2020): e2020RS007089.

Emmons, D. J., and D. E. Weeks. “Steady-State Model of an Argon-Helium High-Pressure Radio Frequency Dielectric Barrier Discharge.” IEEE Transactions on Plasma Science 48, no. 8 (2020): 2715-2722.

Gooch, J. Y., J. J. Colman, O. A. Nava, and D. J. Emmons. “Global ionosonde and GPS radio occultation sporadic-E intensity and height comparison.” Journal of Atmospheric and Solar-Terrestrial Physics 199 (2020): 105200.

Emmons, D. J., and D. E. Weeks. “Effect of Ar ($3p^5 4p$; 2p) +M → Ar ($3p^5 4s$; 1s) +M branching ratio on optically pumped rare gas laser performance.” Optics Express 27, no. 24 (2019): 35689-35699.

Refereed Conference Papers Accepted on the Basis of Abstract Review

Williams, J., Nava, O., Emmons, D. J., & Tseng, H. L. R. (2019). Influence of Lightning on Total Electron Content during Hurricane Michael (2018). AGUFM, 2019, NH31B-08.

Burg, K. S., Emmons, D. J., Nava, O., & Dao, E. V. (2019). Numerical Validation of Ionospheric Models via Ray Tracing. AGUFM, 2019, NH33C-0931.

Urbancic, B., Tseng, R., Tournay, R., Nava, O., & Emmons, D. J. (2019). Whole Atmosphere Characterization based on Arctic Oscillation Index. AGUFM, 2019, A31S-2835.

Kanipe, M., Tseng, R., Tournay, R., Nava, O., & Emmons, D. J. (2019). Middle Atmosphere Response to the El Nino Southern Oscillation Using the Whole Atmosphere Community Climate Model-Extended. AGUFM, 2019, A31S-2833.

FERDINANDUS, MANUEL, R., Department of Engineering Physics

Sponsor Funded Research Projects

"Mid-IR Nonlinear Measurements of Optical Materials." Sponsor: AFRL/RX. Funding: $60,000 - Ferdinandus 100%.

Refereed Journal Publications

Ferdinandus, M. R., et al. (2020). “Nonlinear optical measurements of CdSiP2 at near and mid-infrared wavelengths.” Optical Materials Express 10(9): 2066.

Refereed Conference Papers Accepted on the Basis of Abstract Review

Barrette, A. G., et al. (2020). Supercontinuum generation in single-crystal YAG fibers. Photonic Fiber and Crystal Devices: Advances in Materials and Innovations, Online only, SPIE.

Ferdinandus, M.R. et. al. (2020). Z-Scan Measurements of CdSiP2 at OPA Pumping Wavelengths. Conference on Lasers and Electro-Optics, San Jose, California, Optical Society of America.

FIORINO, STEVEN, T., Department of Engineering Physics

GRIMAILA, MICHAEL, R., Department of Systems Engineering and Management

Sponsor Funded Research Projects

"Modeling and Simulation of Quantum Networks." Sponsor: NSA. Funding: $100,000 - Grimaila 50%, Hodson 50%.

Refereed Journal Publications

Engle, R., Langhals, B. T., Grimaila, M. R., Hodson, D., “Evaluation Criteria for Selecting NoSQL Databases in a Single-Box Environment,” International Journal of Database Management Systems, Vol 10, No 4, August 2018.

Span, M.T., Mailloux, L.O., Grimaila, M.R., “Cybersecurity Architectural Analysis for Complex Cyber-Physical Systems,” The Cyber Defense Review, Army Cyber Institute, Vol. 3, No. 2, pp. 115-134, August 2018.

Okolica, J.S., Peterson, G., Mills, R.F., and Grimaila, M.R., “Sequence Pattern Mining with Variables,” IEEE Transactions on Knowledge and Data Engineering, pp. 1-20, 19 November 2018, DOI: 10.1109/TKDE.2018.2881675.

Refereed Conference Papers Accepted on the Basis of Full Paper Review

Engle, D.L., Langhals, B.T., Grimaila, M.R., Hodson, D.D., “The Case for NoSQL on a Single Desktop,” 17th International Conference on Information & Knowledge Engineering, July 30-August 2, 2018.

Refereed Conference Papers Accepted on the Basis of Abstract Review

Sigala, A., Langhals, B. T., Grimaila, M. R., Hodson, D., “USAF Applications of Unmanned Aerial Systems (UAS): A Delphi Study to Examine Current and Future UAS Autonomous Mission Capabilities” Proceedings of the 44th Dayton-Cincinnati Aerospace Sciences Symposium, Dayton, OH, March 5, 2019.

Editorships in Professional Journals

Editorial Board of Information System Security Association (ISSA) Journal.

Assistant Editor, The Defense Cyber Review, Army Cyber Institute, West Point.

GUNAWARDENA, SANJEEV, Department of Electrical and Computer Engineering

HARTSFIELD, CARL, R., Department of Aeronautics and Astronautics

Sponsor Funded Research Projects

"Material Characterization of CNT Textiles (Continuation)." Sponsor: Undisclosed. Funding: $64,844 - Hartsfield 50%, Kemnitz 50%.

"Satellite Structures Built in Space (Continuation)." Sponsor: Undisclosed. Funding: $68,874 - Hartsfield 50%, Kemnitz 50%.

"Additively Manufactured Microsatellite Propulsion." Sponsor: Undisclosed. Funding: $69,029 - Hartsfield 100%.

"Material Characterization of CNT Textiles (Continuation)." Sponsor: Undisclosed. Funding: $43,229 - Hartsfield 50%, Kemnitz 50%.

"Satellite Structures Built in Space (Continuation)." Sponsor: Undisclosed. Funding: $45,916 - Hartsfield 50%, Kemnitz 50%.

"Additively Manufactured Microsatellite Propulsion." Sponsor: Undisclosed. Funding: $46,019 - Hartsfield 50%, Kemnitz 50%.

"Developing Cargo Compartments through Additive Manufacturing." Sponsor: AFRL/RQ. Funding: $21,700 - Hartsfield 100%.

Refereed Journal Publications

Crouch, S*. Hartsfield, C., 2020, "*Triggered Lightning Threat Prediction Based on Launch Vehicle Parameters*," Journal of Defense Research and Engineering, Volume 3, Issue 2, pp 39-50. (FOUO) (DTIC Accession number for issue: AD1101059).

Wilson, P.*, Hartsfield, C., 2020, "*Effects of Discontinuities on Single and Multi-Wire Solid Propellant Grains*," Journal of Defense Research and Engineering, Volume 3, Issue 2, pp 94-108. (FOUO) (DTIC Accession number for issue: AD1101059).

Anderson, W.*, Heister, S., Kan, B., Hartsfield, C., 2020, "*Experimental Study of a Hypergolically Ignited Liquid Bipropellant Rotating Detonation Rocket Engine*," AIAA Journal of Propulsion and Power, Published online 28 June 2020, DOI: https://doi.org/10.2514/1B37666.

Hartsfield, C., Shelton, T., Palmer, B.*, O'Hara, R., 2020, "*All Metallic Phase Change Thermal Management Systems for Transient Spacecraft Loads*," ASCE Journal of Aerospace Engineering, Volume 33, Issue 4. DOI: (10.1061/ (ASCE) AS.1943-5525.0001150).

Doane, B., Truster, N., Cobb, G., Shelton, T., Kemnitz, R., Hartsfield, C., 2020, "*Parameter development of selective laser melted nickel alloy 718 for thin-walled applications*," Journal of Defense Research and Engineering, Volume 3 Issue 1 (FOUO).

Shelton, T., Willburn, Z.*, Hartsfield, C., Cobb, G., Cerri, J.*, Kemnitz, R., 2019, "*Effects of Thermal Process Parameters on Mechanical Interlayer Strength for Additively Manufactured Ultem 9085*," Journal of Polymer Testing, No 81. DOI: (j.polymertesting.2019.106255).

Shelton, T., Stelzer, D.*, Hartsfield, C., O'Hara, R., 2019. "*Understanding Surface Roughness of Additively Manufactured Nickel Superalloy for Space Applications*," Rapid Prototyping, Vol 26, No 3. DOI (10.1108/RPJ-02-2019-0049).

Kemnitz, R.*, Cobb, G., Singh, A., Hartsfield, C., 2019, "*Characterization of simulated low earth orbit space environment effects on acid-spun carbon nanotube yarns*," Materials & Design, Vol 184. DOI: (j.matdes.2019.108178).

Refereed Conference Papers Accepted on the Basis of Abstract Review

Gallagher, W.*, T. Shelton, R. Kemnitz, C. Hartsfield, 2020, *Accelerated Testing of Ultraviolet and Atomic Oxygen Effects on 3-D Printed Polyetherimide Plastic*, 58th AIAA Aerospace Sciences Meeting.

HAWKS, MICHAEL, E., Department of Engineering Physics

Refereed Journal Publications

Thomas, G., R. Cobb, S. Fiorino, and M. Hawks, 2020: "Daytime Cloudless Sky Radiance Quantification with Ground-Based Aerosol and Meteorological Observations in the Shortwave Infrared," *J. Atmos. Oceanic Technol*., **37**, 777–788, doi.org/10.1175/JTECH-D-19-0157.1

HESS, JOSHUAH, A., MAJ, Department of Aeronautics and Astronautics

Refereed Journal Publications

Spendel, D.S., Hess, J.A., Cobb, R.G., Johnson, K. J., "Evaluating Orbital Defender Performance Trades Using Differential Game Theory," Journal of DOD Research and Engineering, Mar 2020, AD1092565.

Spendel, D.S., Hess, J.A., Cobb, R.G., Johnson, K. J., "Developing and Analyzing Strategies Using Pursuer-Evader-Defender Differential Game Theory for Orbital Engagements," Journal of DOD Research and Engineering, July 2020.

Nesmith, A., Lingenfelter, A., Hess, J.A., and Liu, D., "Applications of Second-Order Linear Differential Equations to Model a Hydrodynamic Ram Cavity," Journal of Aircraft Survivability, Fall 2019.

Refereed Conference Papers Accepted on the Basis of Abstract Review

Stephens, S., Casbeer, D., Kunz, D., Baker, W., and Hess, J.A., "A Control Algorithm Framework for Time-of-Arrival and Arrival Airspeed Control," ASME 2020 Dynamic Systems and Control Conference, Oct 5-7 2020, DSCC2020-3126.

Enders, N., Hess, J.A., and Cobb, R.G., "Spacecraft Moment of Inertia Estimation via Recurrent Neural Networks," 2020 AAS/AIAA Astrodynamics Specialist Conference, AAS 20-483.

Zagaris, C., and Hess, J.A., " Rapid Reachability Analysis of Single Impulse Spacecraft Relative Motion Maneuevers," 2020 AAS/AIAA Astrodynamics Specialist Conference, AAS 20-468.

Saunders, D., Zagaris, C., Hess, J.A., and Cobb, R.G., "Autonomous Cooperative Optimal Control of Multi-Agent Satellite Formations," 2020 AAS/AIAA Astrodynamics Specialist Conference, AAS 20-492.

Henderson, T., Hack, Y., Sunkin, S., Lovell, T.A., and Hess, J.A., "Initial Relative Orbit Determination of Space Objects via Radio Frequency Signal Localization," 2020 AAS/AIAA Astrodynamics Specialist Conference, AAS 20-696.

W. Harris, D. Linville, J. Hess and R. Cobb, "Development of GNC for Optimal Relative Spacecraft Trajectories," *2020 IEEE/ION Position, Location and Navigation Symposium (PLANS)*, Portland, OR, USA, 2020, pp. 1476-1487, doi: 10.1109/PLANS46316.2020.9110153.

Linville, D., Hess, J.A., "Linear Regression Models Applied to Spacecraft Imperfect Information Pursuit-Evasion Differential Games," AIAA SciTech 2020 Forum, AIAA 2020-0952.

Stephens, S., Kunz, D., and Hess, J.A., "Optimal Control Approach to Terrain Following Trajectory Generation," AIAA SciTech 2020 Forum, AIAA 2020-0859.

Bettinger, R., Hess, J.A., "Hypervelocity Impact Vulnerability Assessment for a 6U CubeSat Bus," AIAA SciTech 2020 Forum, AIAA 2020-0729.

Collins, A., Johnson, K.W., and Hess, J.A., "Development of Cislunar Space Logistics Networks for Satellite Constellation Support," AIAA SciTech 2020 Forum, AIAA 2020-2135.

Bettinger, R., Hess, J.A., "Fractionated Spacecraft Survivability following a Catastrophic Explosion," AIAA SciTech 2020 Forum, AIAA 2020-0729.

Lee, C., Komives, J., and Hess J.A., "Reinforcement Learning Applied to High-Speed Systems," Accepted to 2020 AIAA Defense Forum (to be presented in 2021 due to COVID-19).

Other Significant Research Productivity

Hess, J.A., and Zagaris, C., "Limitations of Relative Satellite Motion State Transition Matrix Impulsive Maneuvering Algorithms," 45th Dayton-Cincinnati Aerospace Sciences Symposium, Sinclair Community College, Dayton, OH, 3 Mar, 2020.

Linville, D., and Hess, J.A., "Linear Regression Models Applied to Spacecraft Imperfect Information Pursuit-Evasion Differential Games," 45th Dayton-Cincinnati Aerospace Sciences Symposium, Sinclair Community College, Dayton, OH, 3 Mar, 2020.

HODSON, DOUGLAS, D., Department of Electrical and Computer Engineering

Refereed Journal Publications

Chris Weimer, J.O. Miller, Raymond Hill, Douglas D. Hodson, "Agent Scheduling in Opinion Dynamics: A Taxonomy and Comparison Using Generalized Models," Journal of Artificial Societies and Social Simulation (JASSS), Vol 22, No 4, 2019.

Refereed Conference Papers Accepted on the Basis of Full Paper Review

Joseph Tippit, Douglas Hodson, Michael Grimaila, "Julia and Singularity for High Performance Computing," The 18th International Conference on Scientific Computing (CSC'20), Las Vegas, NV, Jul 27-30, 2020.

Drew Campbell, Jake Hall, Iyanu Odebode, Douglas Hodson, Michael Grimaila, "Trojan Banker Simulation Using Python," the 18th International Conference on Scientific Computing (CSC'20), Las Vegas, NV, Jul 27-30, 2020.

Amber Modlin, Andres Gregory, Iyanu Odebode, Douglas Hodson, Michael Grimaila, "CovidLock a New Form of Ransomware," The 18th International Conference on Scientific Computing (CSC'20), Las Vegas, NV, Jul 27-30, 2020.

Braeden Bowen, Jeremy Ergybar, Iyanu Odebode, Douglas Hodson, Michael Grimaila, "The New Office Threat: A Simulation Environment of Watering Hole Cyber Attacks," the 18th International Conference on Scientific Computing (CSC'20), Las Vegas, NV, Jul 27-30, 2020.

Hai VO, Raymond Kozlowski, Iyanu Odebode, #Douglas Hodson, Michael Grimaila, "Simulation of SYN Flood Attack and Counter-Attack Methods Using Average Connection Times," the 18th International Conference on Scientific Computing (CSC'20), Las Vegas, NV, Jul 27-30, 2020.

HOPKINSON, KENNETH. M., Department of Electrical and Computer Engineering

Sponsor Funded Research Projects

"Task-Oriented Dynamic Knowledge Graphs for Information Integration at Operation Centers." Sponsor: 711 HPW. Funding: $30,000 - Hopkinson 100%.

"Verifying and Validating Cyber-Physical Software Systems via Software Modeling." Sponsor: AFRL/RQ. Funding: $60,000 - Hopkinson 100%.

"Artificial Intelligence Opponent for Contested Space (AIOCS) - Multi-Asset Scenarios." Sponsor: AFRL/RV. Funding: $34,500 - Hopkinson 100%.

"Artificial Intelligence Opponent for Contested Space (AIOCS) - Training Strategies." Sponsor: AFRL/RV. Funding: $34,500 - Hopkinson 100%.

"Verifying and Validating Cyber-Physical Software Systems via Software Modeling." Sponsor: AFRL/RQ. Funding: $40,000 - Hopkinson 100%.

"Task-Oriented Dynamic Knowledge Graphs for Information Integration at Operation Centers." Sponsor: AFRL/RH. Funding: $30,000 - Hopkinson 100%.

Refereed Journal Publications

Heglund, J., Hopkinson, K., Tran, H.T., Social Sensing: Towards Social Media as a Sensor for Resilience in Power Systems and Other Critical Infrastructures, Taylor and Francis Journal of Sustainable and Resilient Infrastructure, 12 March 2020, pp. 1-13.

Becherer, N., Pecarina, J., Nykl, S., Hopkinson, K., Improving Optimization of Convolutional Neural Networks Through Parameter Fine-tuning, Springer Neural Computing and Applications, Volume 31, Issue 8, August 2019 pp.3469-3479.

JACQUES, DAVID, R., Department of Systems Engineering and Management

JOHNSON, KIRK, W., LT. COL., Department of Aeronautics and Astronautics

Sponsor Funded Research Projects

"Noise Radar CubeSat 6u CubeSat Flight Model-Phase 1." Sponsor: SAF/FMBIB. Funding: $300,000 - Johnson 35%, Collins 35%, Hartsfield 10%, Albrecht 10%, Cobb 10%.

Refereed Journal Publications

Spendel, D.S., Hess, J.A., Cobb, R.G., Johnson, K. J., “Evaluating Orbital Defender Performance Trades Using Differential Game Theory,” Journal of DOD Research and Engineering, Mar 2020, AD1092565.

Spendel, D.S., Hess, J.A., Cobb, R.G., Johnson, K. J., “Developing and Analyzing Strategies Using Pursuer-Evader-Defender Differential Game Theory for Orbital Engagements,” Journal of DOD Research and Engineering, July 2020.

Refereed Conference Papers Accepted on the Basis of Abstract Review

Hall, Z., Johnson, K.W., and Singla, P., “A Particle Filtering Approach to Space-based Maneuvering Satellite Location and Estimation,” AAS 20-569, Astrodynamics Specialist Conference, August 2020.

Collins, A.R., and Johnson, K.W., “Development of Cislunar Space Logistics Networks for Satellite Constellation Support,” AIAA 2020-2135, AIAA 2020 SciTech Forum, Orlando, FL, January 2020.

KOMIVES, JEFFREY R., Lt Col, Department of Aeronautics and Astronautics

Sponsor Funded Research Projects

"PACAF/PACOM Training, Consultation and Modeling & Simulation for Hypersonics." Sponsor: DRE. Funding: $75,000 - Komives 100%.

Refereed Conference Papers Accepted on the Basis of Abstract Review

Thompson, R. J., & Komives, J. R. (2019). Compressible Flow Through a Diffusing Serpentine Inlet Duct Assessed with Wall-Modeled Large Eddy Simulation. In *AIAA Aviation 2019 Forum* (p. 3702).

Elliott, O. S., Greendyke, R., Jewell, J. S., & Komives, J. R. (2019). Effect of CO2 Concentration in the Hypersonic Boundary Layer on Second Mode Disturbances. In *AIAA Aviation 2019 Forum* (p. 2851).

Elliott, O. S., Greendyke, R., Jewell, J. S., & Komives, J. R. (2019). Effect of Carbon-based Ablation Products on Boundary Layer Stability. In *AIAA Scitech 2019 Forum* (p. 0625).

Other Significant Research Productivity

Komives, J. R. (2019). Hypersonics in the Indo-Pacific. Invited Presentation, *1st NDIA Hypersonics Capabilities Conference.*

Crouch, T. E. & Komives, J. R. (2019) Direct Numerical Simulation of Roughness Induced Boundary Layer Transition on a 7° Half-Angle Cone at Mach 10. In *AIAA Defense 2019 Conference.*

LAURVICK, TOD, V., MAJ., Department of Electrical and Computer Engineering

Refereed Conference Papers Accepted on the Basis of Abstract Review

M. Sherburne, T. Laurvick, L. Burggraf, I. Bean, P. Crandall, M. Du, C. Adams, E. Burke, V. Klimov, I. Fedin, and T.E. Weber, "Characterizing Nanomaterial Response for sub-100 ps X-ray Scintillation," 61st Annual Meeting of the APS Division of Plasma Physics, 21 Oct 2019

Patent Applications

M. Sherburne, T. Laurvick "Using 3D Printing Rapid Manufacturing to integrate Colloidal Quantum Dots as a Radiation Scintillator," Mar 2020 (currently in legal review).

M. Sherburne, T. Laurvick, "Colloidal Quantum Dots Loaded into Polymer for Use in optical non-Destructive Testing Strain Detecting Applications," Mar 2020 (currently in legal review).

LINGENFELTER, ANDREW, J., MAJ, Department of Aeronautics and Astronautics

LITTLE, BRYAN, D., LT. COL., Department of Aeronautics and Astronautics

Little, B. D., & Frueh, C. E. (2020). Space situational awareness sensor tasking: Comparison of machine learning with classical optimization methods. Journal of Guidance, Control, and Dynamics, 43(2), 262–273. https://doi.org/10.2514/1.G004279.

Little, B.D., Frueh, C.E. Multiple Heterogeneous Sensor Tasking Optimization in the Absence of Measurement Feedback. J Astronaut Sci (2020). https://doi.org/10.1007/s40295-020-00232-1.

Refereed Conference Papers Accepted on the Basis of Abstract Review

Vasso, A. R., Cobb, R. G., Colombi, J. M., Little, B. D., Meyer, D. W., "Optimal Incorporation of Non-Traditional Sensors into the Space Domain Awareness Architecture," AMOS Technical Conference 202, Maui, HI, 17 Sep 20.

LOPER, ROBERT, D., Department of Engineering Physics

Sponsor Funded Research Projects

"Reconnection Signatures in Solar Magnetograms." Sponsor: AFOSR. Funding: $30,888 - Loper 100%.

Refereed Journal Publications

Loper, R. D., and Weeks, D. E., "A fully quantum calculation of broadening and shifting coefficients of the D1 and D2 spectral lines of alkali-metal atoms colliding with noble-gas atoms," Journal of Physics B: Atomic, Molecular and Optical Physics, Vol. 53, No. 20, p. 205403, 15 Sep 2020.

Whitney Aegerter, T. R., Emmons, D. J., and Loper, R. D., "Detection of Reconnection Signatures in Solar Flares," Journal of Atmospheric and Solar-Terrestrial Physics, Vol. 208, p. 105375, 15 Oct 2020 (available online 30 Jul 2020).

Refereed Conference Papers Accepted on the Basis of Abstract Review

Loper, R. D., "Plasma structure of the deep solar interior," AGU 2019 Fall Meeting, San Francisco, CA, 9-13 Dec 2019.

Whitney, T. R., Emmons, D. J., and Loper, R. D., "Reconnection Signatures in Solar Magnetograms," AGU 2019 Fall Meeting, San Francisco, CA, 9-13 Dec 2019.

Schwalbe, S. G., Loper, R. D., Nava, O. A., and Lewis, C. D., "Modeling the Effects of a Second Sun on Ionospheric Composition and Structure," AGU 2019 Fall Meeting, San Francisco, CA, 9-13 Dec 2019.

MAGNUS, AMY, L., Department of Mathematics and Statistics

MARCINIAK, MICHAEL, A., Department of Engineering Physics

MCCLORY, JOHN W., Department of Engineering Physics

Sponsor Funded Research Projects

"Support for the US Nuclear Detonation Detection System." Sponsor: NNSA/NA-22. Funding: $50,000 - McClory 50%, Singleton 50%.

Refereed Journal Publications

K. Choe, M.R. Hogsed, N. Miguel, J.W. McClory, and J. Kouvetakis, "Displacement Damage Effects in Germanium Tin LEDs," *Journal of Radiation Effects, Research and Engineering*, vol. 38, no. 1, pp. 11-17, March 2020.

M.C. Recker and J.W. McClory, "Comparison of Clustering Algorithms for Analysis of Pulse-Shape Data from Cerium- Doped Cesium Lithium Yttrium Chloride," *Journal of Radiation Effects, Research and Engineering*, vol. 38, no. 1, pp. 14-23, March 2020.

M.E. Mace, J.W. McClory, J.C. Petrosky, E. Heller, and G. Vizkelethy, "Targeted Heavy-Ion Radiation of Aluminum Gallium Nitride/Gallium Nitride HEMTs," *Journal of Radiation Effects, Research and Engineering*, vol. 38, no. 1, pp. 52-61, March 2020.

W.D. Johnston, M.L. Dexter, J.W. McClory, and J.E. Bevins, "Simulating Surface-Interacting Nuclear Detonations using RECIPE and SHAMRC," *Journal of Radiation Effects, Research and Engineering*, vol. 38, no. 1, pp. 14-23, March 2020.

Michael A. Ford, Buckley E. O'Day, John W. McClory, Areg Danagoulian, "Development of a Neutron Spectrometer Utilizing Rubberized Eu: LiCAF Wafers," Nuclear Instruments and Methods in Physics Research A, vol. 954, 161685, February 2020. https://doi.org/10.1016/j.nima.2018.11.144.

M.C. Recker, E. Cazalas, J.W. McClory, "Pulse shape discrimination with a low-cost digitizer using commercial off-the-shelf components," Nuclear Instruments and Methods in Physics Research A, vol. 954, 161479, February 2020. https://doi.org/10.1016/j.nima.2018.10.157.

E. Cazalas, M. R. Hogsed, S. Vangala, M. R. Snure, and J. W. McClory, "Gamma-ray radiation effects in graphene-based transistors with h-BN nanometer film substrates, *Applied Physics Letters*, vol. 115, 223504 (5 pages), November 2019. https://doi.org/10.1063/1.5127895.

Nicole Benker, *Elena Echeverria, *Robert Olesen, *Brant Kananen, John McClory, Yaroslav Burak, Volodymyr Adamiv, Ihor Teslyuk, George Peterson, Ben Bradley, Ethiyal R. Wilson, James Petrosky, Bin Dong, Jeffry Kelber, Jennifer Hamblin, Jacques Doumani, Peter A. Dowben, Axel Enders, "Possible Detection of Low Energy Solar Neutrons Using Boron Based Materials," *Radiation Measurements*, vol. 129, 106190 (7 pages), October 2019. https://doi.org/10.1016/j.radmeas.2019.106190.

Refereed Conference Papers Accepted on the Basis of Abstract Review

D. Gum, G. Varshney, J.W. McClory, A.A. Bickley, and A. Holland, "A Machine Learning Approach to Characterizing Particle Morphology in Nuclear Forensics," accepted by the *Hardened Electronics and Radiation Technology Conference*, August 2020.

T.L. Freeman, M.L. Dexter, J.W. McClory, H. Happ, "The Effects of Water Entrainment on Blast Waves in Marine Environments," accepted by the *Hardened Electronics and Radiation Technology Conference*, August 2020.

N. J. Gale, J. W. McClory, M. Hogsed, and B. Wang, "Neutron Displacement Damage in Germanium-Tin Photodiodes," accepted by the *Hardened Electronics and Radiation Technology Conference*, August 2020.

MERKLE, LAURENCE, D., Department of Electrical and Computer Engineering

Refereed Conference Papers Accepted on the Basis of Abstract Review

T. Dontigney, L. Merkle, R. Cobb, J. Colombi, G. Lamont. Methodology for Comparison of Algorithms for Real-World Multi-objective Optimization Problems: Space Surveillance Network Design. Comparison of Multi-Objective Optimization Algorithms for GEO Space Surveillance Network Architecture Design. 20th Annual Advanced Maui Optical and Space Surveillance Technologies Conference, 2019.

L. Hsia, L. Merkle, D. Weeks, G. Vernizzi, M. Lanzerotti, D. Langley. Physically Unclonable Characteristics for Verification of Transmon-Based Quantum Computers. Government Microcircuit Applications and Critical Technology Conference, 2020.

MEYER, DAVID, W., Department of Aeronautics and Astronautics

REFEREED CONFERENCE PAPERS ACCEPTED ON THE BASIS OF ABSTRACT REVIEW

Vasso, A. R., Cobb, R. G., Colombi, J. M**.,** Little, B. D., Meyer, D. W., "Optimal Incorporation of Non-Traditional Sensors into the Space Domain Awareness Architecture," AMOS Technical Conference 202, Maui, HI, 17 Sep 20.

NAVA, OMAR, A., LT. COL., Department of Engineering Physics

Sponsor Funded Research Projects

"Modulation of Lightning Occurrence by the Solar Wind." Sponsor: AFOSR. Funding: $42,196 - Nava 100%.

Refereed Journal Publications

Emmons, D. J., Dao, E. V., Knippling, K. K., McNamara, L. F., Nava, O. A., Obenberger, K. S., & Colman, J. J. (2020). Estimating horizontal phase speeds of a traveling ionospheric disturbance from Digisonde single site vertical ionograms. Radio Science, 55(8), e2020RS007089.

Gooch, J. Y., Colman, J. J., Nava, O. A., & Emmons, D. J. (2020). Global ionosonde and GPS radio occultation sporadic-E intensity and height comparison. Journal of Atmospheric and Solar-Terrestrial Physics, 199, 105200.

Refereed Conference Papers Accepted on the Basis of Abstract Review

Tournay, R. C., Nava, O. A., & Tseng, H. R. (2020, January). Influence of Tropical Cyclones on Total Electron Content. In 100th American Meteorological Society Annual Meeting. AMS.

Schwalbe, S. G., Loper Jr, R. D., Nava, O., & Lewis, C. D. (2019). Modeling the Effects of a Second Sun on Ionospheric Composition and Structure. AGUFM, 2019, SA12A-08.

Williams, J., Nava, O., Emmons, D. J., & Tseng, H. L. R. (2019). Influence of Lightning on Total Electron Content during Hurricane Michael (2018). AGUFM, 2019, NH31B-08.

Burg, K. S., Emmons, D. J., Nava, O., & Dao, E. V. (2019). Numerical Validation of Ionospheric Models via Ray Tracing. AGUFM, 2019, NH33C-0931.

Urbancic, B., Tseng, R., Tournay, R., Nava, O., & Emmons, D. J. (2019). Whole Atmosphere Characterization based on Arctic Oscillation Index. AGUFM, 2019, A31S-2835.

Kanipe, M., Tseng, R., Tournay, R., Nava, O., & Emmons, D. J. (2019). Middle Atmosphere Response to the El Nino Southern Oscillation Using the Whole Atmosphere Community Climate Model-Extended. AGUFM, 2019, A31S-2833.

PETROSKY, JAMES, C., Department of Engineering Physics

Sponsor Funded Research Projects

"Support Activities to Homeland Security." Sponsor: DHS/DNDO. Funding: $200,000 - Petrosky 10%, Slagely 40%, Varshney 40%, Cooper 10%.

"Distance Learning Countering Weapons of Mass Destruction Graduate Certificate (CWMD) Program." Sponsor: DHS/DNDO. Funding: $300,000 - Petrosky 10%, Slagley 40%, Varshney 40%, Cooper 10%.

Refereed Journal Publications

J.C. Paxton, M.F. Reeder, E.F. Dean, A. Cahill, J. Rutledge, and J. Petrosky, “Effect of upstream heating examined via the wind tunnel-enhanced experimental irradiation test system,” *JRERE*, vol. 38, no. 1, pp. 281–290, March 2020.

Knight, S., Korlacki, R., Dugan, C., Petrosky, J., Mock, A., Dowben, P., Mann, J. M., Kimani, M.M., Schubert, M. “Infrared-active phonon modes in single-crystal thorium dioxide and uranium dioxide.” Journal of Applied Physics 127, 125103 (2020), doi:10.1063/1.5143724 (Published Online: 23 March 2020).

Hamilton, N., Graham, S., Carbino, T., Petrosky, J., and Betances, Addison. "Adaptive-Hybrid Redundancy with Error Injection." Electronics 2019, 8(11), 1266; doi: 10.3390/electronics8111266 (published 1 November 2019).

Nicole Benker, Elena Echeverria, Robert Olesen, Brant Kananen, John McClory, Yaroslav Burak, Volodymyr Adamiv, Ihor Teslyuk, George Peterson, Ben Bradley, Ethiyal R. Wilson, James Petrosky, Bin Dong, Jeffry Kelber, Jennifer Hamblin, Jacques Doumani, Peter A. Dowben, Axel Enders; "Possible Detection of Low Energy

Solar Neutrons Using Boron Based Materials." Radiation Measurements, 129, October 2019, doi:10.1016/j.radmeas.2019.106190.

RUTLEDGE, JAMES, L., LT. COL., Department of Aeronautics and Astronautics

Sponsor Funded Research Projects

"Advanced Film Cooling Development." Sponsor: AFRL/RQ. Funding: $11,160 - Rutledge 100%.

Refereed Journal Publications

Fischer, J.P., McNamara, L.J., Rutledge, J.L., Polanka, M.D., 2020, "Scaling Flat-Plate, Low-Temperature Adiabatic Effectiveness Results Using the Advective Capacity Ratio," *Journal of Turbomachinery*, Vol. 142, No. 8, August 2020.

Bryant, C.E. and Rutledge, J.L., 2020, "A Computational Technique to Evaluate the Relative Influence of Internal and External Cooling on Overall Effectiveness," *Journal of Turbomachinery*, Vol. 142, No. 5, May 2020.

Paxton, J.C., Reeder, M.F., Dean, E.F., Cahill, D.A., Rutledge, J.L., Petrosky, J.C., 2020, "Effect of Upstream Heating Examined Via the Wind-Tunnel Enhanced Experimental Irradiation Test System," *Journal of Radiation Effects, Research and Engineering*, Vol. 38, No. 1, Mar 2020, pp. 280-290.

Bohan, B.T., Polanka, M.D., Rutledge, J.L., 2019, "Sweeping Jets Issuing From the Face of a Backward-Facing Step," *Journal of Fluids Engineering*, Vol. 141, No. 12, December 2019.

DeMarco, K.J., Bohan, B.T., Polanka, M.D., Rutledge, J.L., Akbari, P., 2019, "Analysis of an Additively Manufactured Cooled Ultra Compact Combustor Vane," *Journal of Thermal Science and Engineering Applications*, Vol. 11, No. 5, October 2019.

Refereed Conference Papers Accepted on the Basis of Full Paper Review

Wiese, C.J., Rutledge, J.L., 2020, "The Effects of Specific Heat and Viscosity on Film Cooling Behavior," *ASME Turbo Expo 2020*, Paper No. GT2020-15253.

Fuqua, M.N., Rutledge, J.L., 2020, "Film Cooling Superposition Theory for Multiple Rows of Cooling Holes with Multiple Coolant Temperatures," *ASME Turbo Expo 2020*, Paper No. GT2020-15252.

McNamara, L.J., Fischer, J.P., Rutledge, J.L., Polanka, M.D., 2020, "Scaling Considerations for Thermal and Pressure Sensitive Paint Methods Used to Determine Adiabatic Effectiveness," *ASME Turbo Expo 2020*, Paper No. GT2020-16129.

Refereed Conference Papers Accepted on the Basis of Abstract Review

Macias, R., Polanka, M.D., Rutledge, J.L., 2020, "Effects of High Freestream Turbulence on Film Cooling Effectiveness of Shaped Holes," AIAA Aerospace Sciences Meeting, AIAA SciTech Forum.

Editorships in Professional Journals

Associate Editor, *ASME Journal of Turbomachinery*

Patents Awarded

Pickl, C.W., Rutledge, J.L., Polanka, M.D., Harkless, C., Crabtree, B., 12 May 2020, "Wind Tunnel Wake Generator," U.S. Patent No. 10,648,882 B2.

Patent Applications

Rutledge, J.L., Fuqua, M.N., Bryant, C.E., "Energy Separation Turbine Cooling Method, application filed May 2020.

STEWARD, BRYAN, J., Department of Engineering Physics

TEMPLE, MICHAEL, A., Department of Electrical and Computer Engineering

Refereed Journal Publications

Bihl, Pacienci, Bauer, Temple, "Cyber-Physical Security with RF Fingerprint Classification through Distance Measure Extensions of GRLVQ," Jour of Security and Comm Nets (SCN), Vol. 2020, ID: 3909763, Hindawi, Feb 2020.

Voetber, Temple, Carbino, Bukohl, Glavi†, Deneault, "Using Active DNA Fingerprinting to Discriminate AJP Conductive Ink Elements Embedded in ICs," Jour of DOD Rsrch & Engr (JDR&E), Vol. 2, No. 2, pp. 2-12, Aug 2019.

Paul, Collins, Temple, "Enhancing Microwave System Health Assessment Using ANNs," IEEE Antenna & Wireless Propagation Letters, **DOI:** 10.1109/LAWP.2019.2926932, Jul 2019.

Rondeau, Temple, Betances, Schubert Kabban, "Extending Critical Infrastructure Element Longevity Using Constellation-Based ID Verification," Jour of Computers & Security, Vol. 100, ID: 102073, Jan 2021.

Rondeau, Temple, Betances, Schubert Kabban, "Protection of Critical Infrastructure COTS Elements Using CB-DNA Fingerprints," Jour of DOD Rsrch & Engr (JDR&E), Vol. 3(2), pp. 2-19, Jul 2020.

Refereed Conference Papers Accepted on the Basis of Full Paper Review

Rondeau, Temple, Betances, "DNA Feature Selection for Discriminating Wireless HART IIoT Devices," 53rd Hawaii Int'l Conf. on System Sciences (HICSS), pp. 6387-6396, 7-10 Jan 2020.

Wargo, Boggs, Temple, Mills, "DNA Fingerprinting Ping2020i ADS-B Beacons," 2019 Military Communications Conf. (MILCOM19), Norfolk VA, 12-14 Nov 2019.

Refereed Conference Papers Accepted on the Basis of Abstract Review

Rondeau, Temple, "PHY-Based DNA Fingerprinting to Discriminate Wireless HART Sensor Network Devices," 2019 Security Week ICS Cyber Security Conference, Atlanta Georgia, 21-24 Oct 2019.

Patent Applications

Rondeau, Temple, Lopez, "Passive Physical Layer Distinct Native Attribute Cyber Security Monitor," Application Serial No. 63/031,132, Submitted: 28 May 2020.

TERZUOLI, ANDREW, J., JR, Department of Electrical and Computer Engineering

Refereed Conference Papers Accepted on the Basis of Full Paper Review

Andrew Knisely, Andrew Terzuoli, "Numerical Dispersion Reduction in the Parabolic Wave Equation," Proceedings of the 2019 International Conference on Electromagnetics in Advanced Applications (ICEAA 2019), Granada, SP, 9-13 Sept 2019.

Andrew J. Knisely and Andrew J. Terzuoli, Jr, "Phase Screen Scintillation Model Accuracy Assessment Using FDM, FEM, and Spectral Techniques to solve the Parabolic Wave Equation," Proceedings of the 2020 IEEE International Conference on Communications (ICC 2020), Dublin, IR, 7-11 June 2020.

Andrew J. Knisely, Andrew J. Terzuoli, "Wideband SATCOM Model: Evaluation of Numerical Accuracy and Efficiency," Proceedings of the XXIVth International Society for Photogrammetry and Remote Sensing Congress (ISPRS 2020), Nice, FR, 14-20 June 2020.

Andrew J. Knisely, Andrew J. Terzuoli, "First Principle Scintillation Characterization of Natural and Artificial Disturbances on V/W Band Signals in the Ionosphere Using the Multiple Phase Screen Technique," Proceedings of the XXXIII General Assembly and Scientific Symposium (GASS) of the International Union of Radio Science Union Radio Scientifique Internationale-URSI), Rome, IT, 29 Aug – 5 Sept, 2020.

Andrew J. Knisely, Andrew J. Terzuoli, "First Principle EMI Model of Wideband Signal Temporal Delay Induced by A HANE in the Ionosphere," Proceedings of the International Symposium on Electromagnetic Compatibility (EMC 2020), Rome, IT, 7-11 Sept 2020.

WIESEL, WILLIAM, E., JR., Department of Aeronautics and Astronautics

Wiesel, W. E. "Onboard Satellite Cluster Navigation," in PA review.

Wiesel, W.E. "Hill's Lunar Theory Revisited," presented at the AAS/AIAA Astrodynamics Conference, (Virtual), July 2020.

Dr. Wiesel also spent a considerable time this year packaging and documenting on board software for small satellite navigation and onboard mission planning. This has been supplied not only to AFIT, but also to AFRL.

6.6. CENTER FOR TECHNICAL INTELLIGENCE STUDIES AND RESEARCH

Center for Technical Intelligence Studies and Research (CTISR)
Director (937) 255-3636 x4742
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Home page: https://www.afit.edu/CTISR

6.6.1. DOCTORAL DISSERTATIONS

WESTING, NICHOLAS, M., Physics-Constrained Hyperspectral Data Exploitation Across Diverse Atmospheric Scenarios. AFIT-ENG-DS-20-S-021. Faculty Advisor: Dr. Richard K. Martin. Sponsor: NASIC/GSP.

6.6.2. MASTER'S THESES

BOETTIGER, JAMES, P., A Comparative Evaluation of the Detection and Tracking Capability between Novel Event-Based and Conventional Frame-Based Sensors. AFIT-ENG-MS-20-M-007. Faculty Advisor: Dr. Michael A. Marciniak. Sponsor: N/A.

MARTIN, NICHOLAS, Modeling LEO-Altitude Sensor Detection of Thermal Signatures in ASSET. AFIT-ENG-MS-20-M-040. Faculty Advisor: Dr. Bryan J. Steward. Sponsor: N/A.

NARANJO, TRISTAN, R., Mult-Spectral Imaging of Vegetation with a Diffractive Plenoptic Camera. AFIT-ENP-MS-20-M-108. Faculty Advisor: Lt. Col. Anthony L. Franz. Sponsor: N/A.

6.6.3. FACULTY RESEARCH OUTPUT

Notes: Faculty Bios can be found under their respective department listings. Shared credit for funding awards is indicated by the percentages shown for each faculty member associated with the project.

BORGHETT, BRETT, J., Department of Electrical and Computer Engineering

Refereed Journal Publications

Westing, Nicholas M., Gross, Kevin C., Borghetti, Brett, J., Martin, Jacob, and Meola, Joseph, "Learning Set Representations for LWIR In-Scene Atmospheric Compensation" *IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing*, 2 Apr 2020, Vol 13, pp 1438-1449
https://ieeexplore.ieee.org/document/9055124

Dickey, Joshua, T., Borghetti, Brett, J., Junek, William, and Martin, Richard "Beyond Correlation: A Path-invariant Measure for Seismogram Similarity" *Seismological Research Letters*, 6 Nov 2019, DOI: 10.1785/022019009
https://pubs.geoscienceworld.org/srl/article-pdf/doi/10.1785/0220190090/4862061/srl-2019090.1.pdf

Westing, Nicholas M., Borghetti, Brett, J., Gross, Kevin C., "Fast and Effective Techniques for LWIR Radiative Transfer Modeling: A Dimension Reduction Approach," *Remote Sensing (MDPI)*, 9 Aug 2019, Vol 11, issue 6, pp. 1866-1886, DOI: 10.3390/rs11161866
https://www.mdpi.com/2072-4292/11/16/1866/htm

Refereed Conference Papers Accepted on the Basis of Full Paper Review

Crow, David R., Graham, Scott R., Borghetti, Brett J., Sweeney, Patrick J., "Empirical Dynamic Modeling as a Basis for an Intrusion Detection System" *14th International Conference on Critical Infrastructure Protection (IFIP)*, Arlington, VA, USA, Mar 2020.

Villarreal, Micah N., *Kamrud, Alexander J., Borghetti, Brett J., "Confirmation Bias Estimation from Electroencephalography with Machine Learning," *Human Factors and Ergonomics Society (HFES) Annual Conference, 2019,* Seattle, WA, 28 Oct-1 Nov 2019.

Refereed Conference Papers Accepted on the Basis of Abstract Review

Crow, David R., Graham, Scott R., Borghetti, Brett J., "Fingerprinting Vehicles with CAN Bus Data Samples," *15th International Conference on Cyber Warfare and Security (ICIW)*, Norfolk, VA, Feb 2020.

BUTLER, SAMUEL, D., LT. COL., Department of Engineering Physics

Sponsor Funded Research Projects

"Analysis of Modified Microfacet BRDF Models for Polarimetric Optical Scatter." Sponsor: AFOSR. Funding: $147,262 - Butler 75%, Marciniak 25%.

Refereed Conference Papers Accepted on the Basis of Abstract Review

Todd V. Small, Samuel D. Butler, and Michael A. Marciniak "Augmenting CASI® BRDF measurement device to measure out-of-plane scatter with CCD pixel array," Proc. SPIE 11485, Reflection, Scattering, and Diffraction from Surfaces VII, 114850B (31 August 2020); https://doi.org/10.1117/12.2568050.

Michael W. Bishop, Samuel D. Butler, and Michael A. Marciniak "Analysis of hybrid directional volumetric scatter terms for enhanced microfacet BRDF modeling," Proc. SPIE 11485, Reflection, Scattering, and Diffraction from Surfaces VII, 114850I (20 August 2020); https://doi.org/10.1117/12.2568046.

Rachel L. Wolfgang, Samuel D. Butler, and Michael A. Marciniak "Comparison of the accuracy of Rayleigh-Rice polarization factors to improve microfacet pBRDF models," Proc. SPIE 11485, Reflection, Scattering, and Diffraction from Surfaces VII, 114850H (20 August 2020); https://doi.org/10.1117/12.2568042.

CAYLOR, MICHAEL, J., Department of Engineering Physics

COBB, RICHARD, G., Department of Aeronautics and Astronautics

FIORINO, STEVEN, T., Department of Engineering Physics

Refereed Journal Publications

Fiorino, S.T, S.R. Bose-Pillai, J.E. Schmidt, B.J. Elmore, K.J. Keefer, 2020: "Implications of 4D weather cubes for improved cloud free line of sight assessments of free space optical communications link performance," *Opt. Eng*. **59**(8), 081808, doi: 10.1117/1.OE.59.8.081808.

McCrae, J.E., S.R. Bose-Pillai, S.T. Fiorino, A. Archibald, J. Meoak, B. Elmore, T. Kesler, and C. Rice, 2020, "Measurements of Optical Turbulence over 149 km Path," *Opt. Eng*. **59**(8), 081806, doi: 10.1117/1.OE.59.8.081806.

Zuraski, S.M., E. Beecher, J.E. McCrae, and S.T. Fiorino, 2020, "Turbulence profiling using pupil plane wavefront data derived Fried parameter values for a dynamically ranged Rayleigh beacon," *Opt. Eng.* **59**(8), 081807, doi: 10.1117/1.OE.59.8.081807.

Thomas, G., R. Cobb, S. Fiorino, and M. Hawks, 2020: "Daytime Cloudless Sky Radiance Quantification with Ground-Based Aerosol and Meteorological Observations in the Shortwave Infrared," *J. Atmos. Oceanic Technol*., **37**, 777–788, doi.org/10.1175/JTECH-D-19-0157.1.

Refereed Conference Papers Accepted on the Basis of Full Paper Review

Boeckenstedt, A., J. McCrae, S. Bose-Pillai, B. Wilson, and S. Fiorino, "Validation of HTS optical turbulence profiling via sonic anemometry," Proc. SPIE. 11508, Unconventional Imaging and Adaptive Optics 2020 (8 September 2020).

Bose-Pillai, S., B. Wilson*, J. Krone*, A. Archibald, B. Elmore, J. McCrae, and S. Fiorino, "Profiling atmospheric turbulence using dual-camera imagery of non-cooperative targets," Proc. SPIE. 11506, Laser Communication and Propagation through the Atmosphere and Oceans IX (22 August 2020).

Zuraski, S., J. McCrae, and S.T. Fiorino, "Focal anisoplanatism influence on dynamically ranged Rayleigh beacon measurements," Proc. SPIE. 11508, Unconventional Imaging and Adaptive Optics 2020 (20 August 2020).

#McCrae, J., S. Bose-Pillai, A. Boeckenstedt*, B. Wilson*, K.J. Keefer, and S.T. Fiorino, "Turbulence profiling with a dual beacon Hartmann turbulence sensor using simulation derived weighting functions," Proc. SPIE. 11508, Unconventional Imaging and Adaptive Optics 2020 (20 August 2020).

Fiorino, S.T., K.J. Keefer, and J.C. Grossnickle*, "Comparison of NOAA's CLAP Measurements to Aerosol Absorption from Number Concentration," in Propagation through and Characterization of Atmospheric and Oceanic Phenomena (pcAOP), (JTu5F.2), OSA Optical Sensors and Sensing Congress, Virtual Event, 23 June 2020.

Bose-Pillai, S., B. Wilson*, J. McCrae, A. Boeckenstedt*, A. Archibald, K. Keefer, and S. Fiorino, "Profiling of atmospheric turbulence from dual-camera time-lapse imagery of a LED array," in Propagation through and Characterization of Atmospheric and Oceanic Phenomena (pcAOP), (PTu4F.2), OSA Optical Sensors and Sensing Congress, Virtual Event, 23 June 2020.

Wilson, B., S. Bose-Pillai, J. McCrae, and S. Fiorino, "Profiling of atmospheric turbulence using time-lapse imagery of non-cooperative targets from multiple cameras," in Propagation through and Characterization of Atmospheric and Oceanic Phenomena (pcAOP), (PTu4F.3), OSA Optical Sensors and Sensing Congress, Virtual Event, 23 June 2020.

McCrae, J.E., S.R. Bose-Pillai, C.A. Rice, A. Archibald, and S.T. Fiorino, "Wave Optics Simulations of a Dual Beacon Hartmann Turbulence Sensor," 2020 IEEE Aerospace Conference, Big Sky, MT, 7-14 Mar 2020.

Refereed Conference Papers Accepted on the Basis of Abstract Review

Fiorino, S.T., D. Narcisse, and J.E. Schmidt, "Development of a 3-Category Weather Effects Assessment Tool for DEW Test and/or Employment," 2020 Annual DEPS S&T Symposium, West Point, NY, 9-13 March 2020.

Bose-Pillai, S., B. Wilson*, J.E. McCrae, A. Boeckenstedt*, A. Archibald, C. Rice, K.J. Keefer, and S.T. Fiorino, "Atmospheric Turbulence Profiling with Dual- Camera Time-Lapse Imagery and Validation with Sonic Anemometers," 2020 Annual DEPS S&T Symposium, West Point, NY, 9-13 March 2020.

Grossnickle, J., S.T. Fiorino# , K.J. Keefer, H.R. Tseng, and R.C. Tournay, "Determining Bulk Aerosol Absorption from Off-Axis Backscattering using Rayleigh Beacon Laser Pulses," 2020 Annual DEPS S&T Symposium, West Point, NY, 9-13 March 2020.

Jagoda, D., S.T. Fiorino, S. Peckham, K.J. Keefer, R. Tournay, and J.E. Schmidt, "A Method for Routine PM2.5 Observation and Incorporation into Numerical Weather Prediction," 2020 Annual DEPS S&T Symposium, West Point, NY, 9-13 March 2020.

Boeckenstedt, A., J.E. McCrae, S.R. Bose-Pillai, and S.T. Fiorino, "Validation of Hartmann Turbulence Sensor Optical Turbulence Profiling via Sonic Anemometry," 2020 Annual DEPS S&T Symposium, West Point, NY, 9-13 March 2020.

Schmidt, J.E., J. Burley, B. Fourman*, and S.T. Fiorino, "Global Cloud Free Line of Sight (CFLOS) Characterizations Using Numerical Weather Prediction Data," 2020 Annual DEPS S&T Symposium, West Point, NY, 9-13 March 2020.

Grossnickle, J., S.T. Fiorino , K.J. Keefer, H.R. Tseng, and R.C. Tournay, "Determining Bulk Aerosol Absorption from Off-Axis Backscattering using Rayleigh Beacon Laser Pulses," 24th Conference on Integrated Observing and Assimilation Systems for the Atmosphere, Oceans, and Land Surface (IOAS-AOLS), 100th Annual American Meteorological Society Meeting, Boston, MA, Jan 2020. (Poster and web posting: https://ams.confex.com/ams/2020Annual/meetingapp.cgi/Paper/370190.

Jagoda, D., S.T. Fiorino, S. Peckham, K.J. Keefer, and J.E. Schmidt, "Assessment of Improved WRF-Chem PM2.5 Characterization via Implementation of an Aerosol Measurement Network," 12th Symposium on Aerosol - Cloud - Climate Interactions, 100th Annual American Meteorological Society Meeting, Boston, MA, Jan 2020. (Poster and web posting: https://ams.confex.com/ams/2020Annual/meetingapp.cgi/Paper/370208.

Schmidt, J.E., J. Burley, B. Fourman*, and S.T. Fiorino, "Global Cloud Free Line of Sight (CFLOS) Characterizations Using Numerical Weather Prediction Data," 20th Conference on Aviation, Range, and Aerospace Meteorology, 100th Annual American Meteorological Society Meeting, Boston, MA, Jan 2020. (Poster and web posting: https://ams.confex.com/ams/2020Annual/meetingapp.cgi/Paper/369796.

Fiorino, S.T., J. Schmidt, B. Elmore, and B. Fourman*, "Global Cloud Free Line of Sight (CFLOS) Characterizations for Air Force SDPE Sites," 14th Annual Directed Energy Systems Symposium, San Diego, CA, 20 November 2019.

Schmidt, J., S.T. Fiorino, B. Elmore, and K.J. Keefer, "Expected HEL Performance Quantification for Air Force SDPE Sites and Systems using Weather Cubes," 14th Annual Directed Energy Systems Symposium, San Diego, CA, 20 November 2019.

Editorships in Professional Journals

Guest Editor, Atmospheric Propagation Special Section of *Optical Engineering* (Vol 59, Issue 8).

Editor, *Journal of Directed Energy* (2020)

Patent Applications

Zuraski, S.M., E.A. Beecher, S.T. Fiorino, J.D. Schmidt, J.E. McCrae, N.M. Figlewski, "Design for an electro-optic testbed utilizing a dynamic range gated Rayleigh beacon for atmospheric turbulence profiling," AFD-1721. Application filed on 31 January 2020, with the U.S. Patent and Trademark Office. The application was accorded U.S. Serial No. 16/778,424.

Bose-Pillai, S.R., J.E. McCrae, C.A. Rice, and S.T. Fiorino, "Estimation of Atmospheric Turbulence Parameters using Differential Motion of Extended Features in Time-lapse Imagery," AFD-1920. Filed as an application for Letters Patent of the United States (Application Serial Number 62/924,745, filed 23-October-2019 and Application Serial Number 17/077,323, filed 22-October-2020).

Other Significant Research Productivity

Ward, D. J. Bowers*, S. Sanyal, T. Vo, S. Fiorino and N. Flores, 2020: "Empirical Derivation of Power Measurement Scaling Factor for Beam Irradiance on Target System (BITS) utilizing Novel in-situ Primary Standard," accepted *Journal of Directed Energy*.

Fiorino, S, A. van Eijk, S. Hammel, and A. Berk, 2020: "Special Section Guest Editorial: Atmospheric Propagation," *Opt. Eng*. **59**(8).

FRANZ, ANTHONY, L., LT. COL., Department of Engineering Physics

Sponsor Funded Research Projects

"Performance Analysis and Sensor Toolkit for ASSET (PASTA), Phase II." Sponsor: SAF/FMBIB. Funding: $79,684 - Franz 50%, Hawks 25%, Dexter 25%.

Refereed Conference Papers Accepted on the Basis of Abstract Review

Tristan R. Naranjo and Anthony L. Franz, "Experimental demonstration of multi-spectral imaging of vegetation with a diffractive plenoptic camera," Proc. SPIE 11396, Computational Imaging V, 113960R (21 April 2020).

HAWKS, MICHAEL, E., Department of Engineering Physics

Refereed Journal Publications

Thomas, G., R. Cobb, S. Fiorino, and M. Hawks, 2020: "Daytime Cloudless Sky Radiance Quantification with Ground-Based Aerosol and Meteorological Observations in the Shortwave Infrared," *J. Atmos. Oceanic Technol*., **37**, 777–788, doi.org/10.1175/JTECH-D-19-0157.1

HOPKINSON, KENNETH. M., Department of Electrical and Computer Engineering

Sponsor Funded Research Projects

"Cluster Cognition for Multi-INT Target Extraction and Analysis." Sponsor: Undisclosed. Funding: $43,100 - Hopkinson 35%, Betances 35%, Steward 15%, Hawks 15%.

"Task-Oriented Dynamic Knowledge Graphs for Information Integration at Operation Centers." Sponsor: 711 HPW. Funding: $30,000 - Hopkinson 100%.

"Verifying and Validating Cyber-Physical Software Systems via Software Modeling." Sponsor: AFRL/RQ. Funding: $60,000 - Hopkinson 100%.

"Cluster Cognition for Multi-INT Target Extraction and Analysis." Sponsor: Undisclosed. Funding: $28,733 - Hopkinson 35%, Betances 35%, Steward 15%, Hawks 15%.

"Verifying and Validating Cyber-Physical Software Systems via Software Modeling." Sponsor: AFRL/RQ. Funding: $40,000 - Hopkinson 100%.

"Task-Oriented Dynamic Knowledge Graphs for Information Integration at Operation Centers." Sponsor: AFRL/RH. Funding: $30,000 - Hopkinson 100%.

Refereed Journal Publications

Heglund, J., Hopkinson, K., Tran, H.T., Social Sensing: Towards Social Media as a Sensor for Resilience in Power Systems and Other Critical Infrastructures, *Taylor and Francis Journal of Sustainable and Resilient Infrastructure*, 12 March 2020, pp. 1-13.

Becherer, N., Pecarina, J., Nykl, S., Hopkinson, K., Improving Optimization of Convolutional Neural Networks through Parameter Fine-tuning, *Springer Neural Computing and Applications*, Volume 31, Issue 8, August 2019, pp. 3469-3479.

JACKSON, JULIE, A., Department of Electrical and Computer Engineering

Sponsor Funded Research Projects

"Radar and RF Sensors Technology Research Report." Sponsor: AFRL/STO. Funding: $30,933 - Jackson 100%.

"Signal Detection in Linearly Mixed Observations with Background Replacement." Sponsor: AFOSR. Funding: $30,975 - Jackson 100%.

Refereed Journal Publications

J. A. Jackson and F. Lee-Elkin, "Exploiting Channel Crosstalk for Polarimetric SAR Compressive Sensing," in IEEE Transactions on Aerospace and Electronic Systems, vol. 56, no. 1, Feb. 2020, pp. 475-485. https://ieeexplore.ieee.org/document/8718553

A. Evers and J. A. Jackson, "Generalized Phase Gradient Autofocus Using Semidefinite Relaxation Phase Estimation," in IEEE Transactions on Computational Imaging, vol. 6, pp. 291-303, 2020. https://ieeexplore.ieee.org/document/8878126

Refereed Conference Papers Accepted on the Basis of Full Paper Review

J. Kempf and J. A. Jackson, "A Modified Least-Squares Mismatch Filter for Use in Radar Applications with Additive Noise," 2020 IEEE International Radar Conference, Washington DC, Apr 27 – May 1, 2020, paper ID 4033, p. 1-6

S. Sellers, P. Collins, and J. A. Jackson, "Augmenting Simulations for SAR ATR Neural Network Training," 2020 IEEE International Radar Conference, Washington DC, Apr 27 – May 1, 2020, paper ID 4167, p. 1-

A. Evers and J. A. Jackson, "A Comparison of Autofocus Algorithms for Back projection Synthetic Aperture Radar," 2020 IEEE International Radar Conference, Washington DC, Apr 27 – May 1, 2020, paper ID 4021, p. 1-6.

KOMIVES, JEFFREY R., Lt Col, Department of Aeronautics and Astronautics

LIEVSAY, JAMES, R., MAJ, Department of Electrical and Computer Engineering

MARCINIAK, MICHAEL, A., Department of Engineering Physics

Sponsor Funded Research Projects

"Meta-optic microlenses for severe-axial-chromatic-aberration imaging systems." Sponsor: Undisclosed. Funding: $26,496 - Marciniak 75%, Franz 25%.

"Meta-optic microlenses for severe-axial-chromatic-aberration imaging systems." Sponsor: Undisclosed. Funding: $39,743 - Marciniak 75%, Franz 25%.

Refereed Journal Publications

C.D. Diaz,* A.L. Franz, and M.A. Marciniak, "Spatial resolution comparison of a diffractive plenoptic camera and an intermediate image diffractive plenoptic camera," Optical Engineering 58(12), 123102(1-13) (Dec 2019).

Refereed Conference Papers Accepted on the Basis of Abstract Review

C.D. Diaz,* B.M. Adomanis, D.B. Burckel and M.A. Marciniak, "Simulation and modeling of fabricated metasurface optical device measured via polarimetric scatterometer," Proc. SPIE 11467, (11467-18) (2020).

T.V. Small,* S.D. Butler and M.A. Marciniak, "Augmenting CASI® BRDF measurement device to measure out-of-plane scatter with CCD pixel array," Proc. SPIE 11485, (11485-9) (2020).

R.L. Wolfgang,* S.D. Butler and M.A. Marciniak, "Comparison of the accuracy of Rayleigh-Rice polarization factors to improve microfacet pBRDF models," Proc. SPIE 11485, (11485-15) (2020).

M.W. Bishop,* S.D. Butler and M.A. Marciniak, “Analysis of hybrid directional volumetric scatter terms for enhanced microfacet BRDF modeling,” Proc. SPIE 11485, (11485-16) (2020).

Other Significant Research Productivity

C.D. Diaz,*# M.A. Marciniak, M. Miller,* A.M. Urbas, D.B. Burckel, E.B. Whiting, S.D. Campbell and D.H. Werner, “Measurement of an infrared plasmonic out-of-plane 3D thin-film meta-surface beam-steerer,” presented at Metamaterials 2020 held on 28 September-1 October 2020 in New York, NY (on line).

MCCLORY, JOHN W., Department of Engineering Physics

Sponsor Funded Research Projects

"Support for the US Nuclear Detonation Detection System." Sponsor: NNSA/NA-22. Funding: $50,000 - McClory 50%, Singleton 50%.

Refereed Journal Publications

K. Choe, M.R. Hogsed, N. Miguel, J.W. McClory, and J. Kouvetakis, “Displacement Damage Effects in Germanium Tin LEDs,” *Journal of Radiation Effects, Research and Engineering*, vol. 38, no. 1, pp. 11-17, March 2020.

M.C. Recker and J.W. McClory, “Comparison of Clustering Algorithms for Analysis of Pulse-Shape Data from Cerium- Doped Cesium Lithium Yttrium Chloride,” *Journal of Radiation Effects, Research and Engineering*, vol. 38, no. 1, pp. 14-23, March 2020.

M.E. Mace, J.W. McClory, J.C. Petrosky, E. Heller, and G. Vizkelethy, “Targeted Heavy-Ion Radiation of Aluminum Gallium Nitride/Gallium Nitride HEMTs,” *Journal of Radiation Effects, Research and Engineering*, vol. 38, no. 1, pp. 52-61, March 2020.

W.D. Johnston, M.L. Dexter, J.W. McClory, and J.E. Bevins, “Simulating Surface-Interacting Nuclear Detonations using RECIPE and SHAMRC,” *Journal of Radiation Effects, Research and Engineering*, vol. 38, no. 1, pp. 14-23, March 2020.

Michael A. Ford, Buckley E. O'Day, John W. McClory, Areg Danagoulian, “Development of a Neutron Spectrometer Utilizing Rubberized Eu: LiCAF Wafers,” Nuclear Instruments and Methods in Physics Research A, vol. 954, 161685, February 2020. https://doi.org/10.1016/j.nima.2018.11.144.

M.C. Recker, E. Cazalas, J.W. McClory, "Pulse shape discrimination with a low-cost digitizer using commercial off-the-shelf components," Nuclear Instruments and Methods in Physics Research A, vol. 954, 161479, February 2020. https://doi.org/10.1016/j.nima.2018.10.157.

E. Cazalas, M. R. Hogsed, S. Vangala, M. R. Snure, and J. W. McClory, “Gamma-ray radiation effects in graphene-based transistors with h-BN nanometer film substrates, *Applied Physics Letters*, vol. 115, 223504 (5 pages), November 2019. https://doi.org/10.1063/1.5127895.

Nicole Benker, *Elena Echeverria, *Robert Olesen, *Brant Kananen, John McClory, Yaroslav Burak, Volodymyr Adamiv, Ihor Teslyuk, George Peterson, Ben Bradley, Ethiyal R. Wilson, James Petrosky, Bin Dong, Jeffry Kelber, Jennifer Hamblin, Jacques Doumani, Peter A. Dowben, Axel Enders, “Possible Detection of Low Energy Solar Neutrons Using Boron Based Materials,” *Radiation Measurements*, vol. 129, 106190 (7 pages), October 2019. https://doi.org/10.1016/j.radmeas.2019.106190.

Refereed Conference Papers Accepted on the Basis of Abstract Review

D. Gum, G. Varshney, J.W. McClory, A.A. Bickley, and A. Holland, ”A Machine Learning Approach to Characterizing Particle Morphology in Nuclear Forensics,” accepted by the *Hardened Electronics and Radiation Technology Conference*, August 2020.

T.L. Freeman, M.L. Dexter, J.W. McClory, H. Happ, "The Effects of Water Entrainment on Blast Waves in Marine Environments," accepted by the *Hardened Electronics and Radiation Technology Conference*, August 2020.

N. J. Gale, J. W. McClory, M. Hogsed, and B. Wang, "Neutron Displacement Damage in Germanium-Tin Photodiodes," accepted by the *Hardened Electronics and Radiation Technology Conference*, August 2020.

OXLEY, MARK, E., Department of Mathematics and Statistics

Refereed Journal Publications

Cordeiro, J. D., Kharoufeh, J. P., and Oxley, M. E., "On the Ergodicity of a Class of Level-Dependent Quasi-Birth-and-Death Processes," *Applied Probability Trust*, Vol. 51, No. 4, pp. 1109-1128, Dec 2019.

Books and Chapters in Books

Hartman, H. and Oxley, M. E., "Individual Exposure Health Risk Profile (IEHRP) – Developing a Risk Profile Tool Beyond Dose Response." *Total Exposure Health, an Introduction*. Boca Raton, FL, K. Phillips, D. Yamamoto, and L. Racz, eds., CRC Press, Taylor & Francis Group, 4 May 2020, pp, 31-40.

PERRAM, GLEN, P., Department of Engineering Physics

Sponsor Funded Research Projects

"Digital Holography: Coherence Effects." Sponsor: Undisclosed. Funding: $12,371 - Perram 50%, Rice 50%.

"Digital Holography: Coherence Effects." Sponsor: Undisclosed. Funding: $8,247 - Perram 50%, Rice 50%.

Refereed Journal Publications

N.D. Haluska, G. P. Perram, and Christopher A. Rice, "Efficient cascade lasing on over 17 wavelengths from two-photon excitation of cesium 62D" Optics Communications, 476, 126328, August 2020.

T.A. Van Woerkom, G.P. Perram, C.D. Phelps, B.D. Dolasinski, and P.A. Berry, "Picosecond laser ablation of metals and semiconductors with low transverse order gaussian beams" Opt. Eng. 60(3), 031002, Mar 2021.

Timothy True, Christopher Rice and Glen P. Perram "The cesium 6 2P3/2 to 8 2S1/2line shape broadened by He, Ar, and Kr" Journal of Quantitative Spectroscopy and Radiative Transfer, 250 107010, May 2020.

Douglas E. Thornton, Mark F. Spencer, Christopher A. Rice, and Glen P. Perram "Impacts of Laboratory Vibrations and Laser Flicker Noise on Digital Holography" IEEE Journal of Quantum Electronics, 56, 1400107, Oct 2020.

David E. Weeks, Charlton D. Lewis, L.A. (Vern) Schlie and Glen. P. Perram, "Temperature dependence of the fine structure mixing induced by 4He and 3He in K and Rb Diode Pumped Alkali Lasers," Applied Physics B, 126, 79 Apr 2020.

James Caplinger and Glen P. Perram, "The importance of cascade emission and metastable excitation in modeling strong atomic oxygen lines in laboratory plasmas" Plasma Sources Science and Technology, 29, 015011, 1-11, Jan 2020.

Douglas E. Thornton, Davin Mao, Mark F. Spencer, Christopher A. Rice, and Glen P. Perram "Digital holography experiments with degraded temporal coherence" Optical Engineering, 59 102606-1, Oct 2019.

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Davin Mao, Douglas Thornton, Christopher Rice, Mark Spencer, and Glen Perram, "Effects of sinusoidal phase modulation on the signal-to-noise ratio in a digital holographic system," Proc SPIE 111350E, Optical Engineering and Applications, Sep 2019.

Other Significant Research Productivity

Glen P. Perram, Douglas E. Thornton, Davin Mao, and Mark F. Spencer, "Digital Holography for Laser Weapons and Remote Sensing" Laser Applications to Chemical, Security and Environmental Analysis 2020, Optical Society of America, June 2020, Vancouver, Canada. (Invited).

RICE, CHRISTOPHER, A., Department of Engineering Physics

Refereed Journal Publications

D. E. Thornton, D. Mao, M. F. Spencer, C. A. Rice, and G. P. Perram, "Digital holography experiments with degraded temporal coherence," Opt. Eng., vol. 59, no. 10, p. 1, Jan. 2020.

D. E. Thornton, M. F. Spencer, C. A. Rice, and G. P. Perram, "Impacts of Laboratory Vibrations and Laser Flicker Noise on Digital Holography," IEEE J. Quantum Electron, vol. 56, no. 5, Oct. 2020.

J. E. McCrae et al., "Measurements of optical turbulence over 149-km path," Opt. Eng., vol. 59, no. 08, p. 1, Jun. 2020.

N. D. Haluska, G. P. Perram, and C. A. Rice, "Efficient cascade lasing on over 17 wavelengths from two-photon excitation of the cesium 62D states," Opt. Commun., vol. 476, p. 126328, Dec. 2020.

T. M. True, C. A. Rice, and G. P. Perram, "The cesium 62P3/2 to 82S1/2 line shape broadened by He, Ar, and Kr," J. Quant. Spectrosc. Radiat. Transf., vol. 250, p. 107010, Jul. 2020.

D. E. Thornton, M. F. Spencer, C. A. Rice, G. P. Perram, and G. P. Perram, "Digital holography efficiency measurements with excess noise," Appl. Opt., vol. 58, no. 34, p. G19, Dec. 2019.

Rice, C. A., Lapp, K., Rapp, A., Miller, W. S., & Perram, G. P. (2019). Rubidium D1 and D2 far wing line shapes induced by rare gases. Journal of Quantitative Spectroscopy and Radiative Transfer, 224, 550–555.

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J. E. McCrae, C. A. Rice, S. T. Fiorino, S. R. Bose-Pillai, and A. J. Archibald, "Wave Optics Simulations of a Dual Beacon Hartmann Turbulence Sensor," in IEEE Aerospace Conference Proceedings, 2020.

D. Mao, D. E. Thornton, C. A. Rice, M. F. Spencer, and G. P. Perram, "Effects of sinusoidal phase modulation on the signal-to-noise ratio in a digital holography system," in Unconventional and Indirect Imaging, Image Reconstruction, and Wavefront Sensing 2019, 2019, vol. 11135, p. 14.

D. E. Thornton, M. F. Spencer, C. Rice, and G. P. Perram, "Laser linewidth measurements using digital holography," in Unconventional and Indirect Imaging, Image Reconstruction, and Wavefront Sensing 2019, 2019, vol. 11135, p. 15.

Patent Applications

Bose-Pillai, S.R., J.E. McCrae, C.A. Rice, and S.T. Fiorino, "Estimation of Atmospheric Turbulence Parameters using Differential Motion of Extended Features in Time-lapse Imagery," provisional application filed in Jun 2019.

Haluska, Rice, Perram, "Diode pumped alkali laser extended to novel wavelengths via two-photon pumping." provisional application filed in Sept 2017.

STEWARD, BRYAN, J., Department of Engineering Physics

Sponsor Funded Research Projects

"Support to TAP Lab Effort (STAPLES)." Sponsor: SMC. Funding: $911,255 - Steward 95%, Taylor 5%.

"ASSET Scenes for Future Operationally Resilient Ground Evolution (FORGE)." Sponsor: SMC. Funding: $300,000 - Steward 100%.

6.7. NUCLEAR EXPERTISE FOR ADVANCING TECHNOLOGIES

Nuclear Expertise for Advancing Technologies (NEAT)

Director	(937) 255-3636 x4562
Deputy Director/Publications Chair	(937) 255-3636 x4609
Administrator/Education Chair	(937) 255-3636 x4735
Research Chair	(937) 255-3636 x4767

Homepage: https://www.afit.edu/NEATCSR/

6.7.1. DOCTORAL DISSERTATIONS

OLESEN, ROBERT, J., Low-Information Radiation Imaging using Rotating Scatter Mask Systems and Neural Network Algorithms. AFIT-ENP-DS-20-S-028. Faculty Advisor: Dr. James E. Bevins. Sponsor: DTRA.

6.7.2. MASTER'S THESES

BURKHARDT, AARON, W., An Assessment of the Spatial Variation of Isotopic Ratios in a CANDU-6 Reactor for Nuclear Treaty Monitoring. AFIT-ENP-MS-20-M-086. Faculty Advisor: Dr. James E. Bevins. Sponsor: AFTAC.

CHAPMAN, RYAN, K., Measurement of the 160GD (p, n) 160 Tb excitation function from 4-18 MeV using a stacked foil technique. AFIT-ENP-MS-20-M-088. Faculty Advisor: Dr. James E. Bevins. Sponsor: AFTA.

FREEMAN, TRENTON, L., Effects of Water Entrainment on Shock Propagation from a Nuclear Detonation. AFIT-ENP-MS-20-M-095. Faculty Advisor: Dr. Michael L. Dexter. Sponsor: N/A.

GALE, NATHAN, J., Neutron Displacement Damage in Germanium-Tin Photodiodes. AFIT-ENP-MS-20-M-096. Faculty Advisor: Dr. John W. McClory. Sponsor: AFOSR/RT.

GUM, DANIEL, A., A Machine Learning Approach to Characterizing Particle Morphology in Nuclear Forensics. AFIT-ENP-MS-20-M-099. Faculty Advisor: Dr. Abigail A. Bickley. Sponsor: N/A.

HORAN, LANSING, S., Neutron Energy Effects on Asteroid Deflection. AFIT-ENP-MS-20-M-101. Faculty Advisor: Dr. Darren E. Holland. Sponsor: NNSA.

MIHAL, CHRISTOPHER, J., Analysis of the Correlation between Re Filament Surface Features and Tims Performance. AFIT-ENP-MS-20-M-107. Faculty Advisor: Dr. Abigail A. Bickley. Sponsor: N/A.

NICHOLS, TAYLOR, M., Determination and Simulation of the Neutron Spectrum of Nuclear Detonations and Surrogate Sources. AFIT-ENP-MS-20-M-109. Faculty Advisor: Dr. John W. McClory. Sponsor: DTRA-RD.

RAO, ASHWIN, P., Rapid Analysis of Plutonium Surrogate Material via Hand-held Laser-induced Breakdown Spectroscopy. AFIT-ENP-MS-20-M-115. Faculty Advisor: Dr. Michael B. Shattan. Sponsor: AFTAC; AFOSR; DTRA; DHS; LANL.

SILVERBUSH, AMY, E., An Analysis of Tinker Air Force Base Thermal Spray Hazardous Waste Stream from 2003-2019 and its Potential Reclamation. AFIT-ENV-MS-20-M-239. Faculty Advisor: Dr. Jeremy M. Slagley. Sponsor: AFCEC/CZTQ.

STEELE, MEGAN, L., Assessing Challenges Associated with Sampling Hexavalent Chromium under New Consensus Guidelines. AFIT-ENV-MS-20-M-242. Faculty Advisor: Dr. Jeremy M. Slagley. Sponsor: N/A.

TITUS, EMILY, M., Development of a Semi-Quantitative Methodology for Evaluation of Chemical, Biological, Radiological and Nuclear (CBRN) Decontamination Using an Ultraviolet Fluorescent Aerosol. AFIT-ENV-MS-20-S-081. Faculty Advisor: Dr. Jeremy M. Slagley. Sponsor: AFRL/RHBAF.

WOOD, JASON, C., Determination of Lithium Isotope Concentration by Laser Induced Breakdown Spectroscopy Using Chemometrics. AFIT-ENP-MS-20-M-124. Faculty Advisor: Dr. Michael B. Shattan. Sponsor: AFTAC; AFOSR.

6.7.3. FACULTY RESEARCH OUTPUT

Notes: Faculty Bios can be found under their respective department listings. Shared credit for funding awards is indicated by the percentages shown for each faculty member associated with the project.

BEVINS, JAMES E., Maj, Department of Engineering Physics

Sponsor Funded Research Projects

"Nuclear Survivability Experimentation, Modeling and Data Verification." Sponsor: NNSA. Funding: $12,200 - Bevins 100%.

"Nuclear Survivability Experimentation, Modeling and Data Verification." Sponsor: NNSA. Funding: $125,000 - Bevins 55%, Hobbs 20%, Dexter 15%, McClory 10%.

"MOA - Support of the Development of Civilian Technical Expertise in Key Nuclear Competencies." Sponsor: AFNWC. Funding: $10,000 - Bevins 40%, Holland 20%, Reeder 20%, Petrosky 20%.

"MOA - AFTAC Endowed Term Chairs." Sponsor: AFTAC/XPB. Funding: $30,000 - Bevins 100%.

"MOA - AFTAC Endowed Term Chairs." Sponsor: AFTAC/XPB. Funding: $22,000 - Bevins 100%.

"MOA - AFTAC Endowed Term Chairs." Sponsor: AFTAC/XPB. Funding: $38,000 - Bevins 100%.

Refereed Journal Publications

Robert J. Olesen*, Darren E. Holland, Erik M. Brubaker, and James E. Bevins, “Maximum Likelihood Reconstructions for Rotating Scatter Mask Imaging," *Radiation Measurements*, vol. 137, September 2020, DOI: 10.1016/j.radmeas.2020.106441.

Amy Hall*, Daniel A. Gum*, Richard Ferrieri, John Brockman, and James E. Bevins, “Development of an Experimentally-Validated MCNP6 Model for 11C Production via the 14N (p,n) Reaction Using a GE PETTrace Cyclotron," *Nuclear Technologies*, May 2020, DOI: 10.1080/00295450.2020.1740561.

N. J. Quartemont*, J. E. Bevins, R. Slaybaugh, and L. Bernstein, “Analysis of an Energy Tuning Assembly for Simulating Nuclear Weapon Environments at the National Ignition Facility," *Journal of Radiation Effects Research and Engineering*, vol. 38, no. 1, Mar. 2020.

W. D. Johnston*, M. L. Dexter, J. W. McClory, and J. E. Bevins, “Simulating Surface-interacting nuclear Detonations using RECIPE and SHAMRC," *Journal of Radiation Effects Research and Engineering*, vol. 38, no. 1, pp. 14-23, Mar. 2020.

N. J. Quartemont*, A. A. Bickley, and J. E. Bevins, “Nuclear Data Covariance Analysis in Radiation Transport Simulations Utilizing SCALE Sampler and the IRDFF Nuclear Data Library," *IEEE Transactions on Nuclear Science*, vol. 67, no. 3, pp. 482-491, Mar. 2020, DOI:10.1109/TNS.2020.2970700

R. Olesen*, B. E. O'Day, D. E. Holland, L. W. Burggraf, and J. E. Bevins, “Characterization of Novel Rotating Scatter Mask Designs for Gamma Direction Identification," *Nuclear Instruments and Methods Phys. Res. A*, vol. 954, no. 21, Feb. 2020, DOI: 10.1016/j.nima.2018.09.067.

Refereed Conference Papers Accepted on the Basis of Full Paper Review

Robert J. Robert J. Olesen*, James B. Cole, Erik M. Brubaker, Darren E. Holland, James E. Bevins, “Design and gTesting a Regenerative Neural Network for Radiation Imaging," in *IEEE Nuclear Science and Security Symposium*, November 1st, 2020.

Bryan V. Egner*, Michael T. Febbraro, James E. Bevins, “Development of a Boron-Loaded Deuterated Liquid Scintillator for Neutron Spectroscopy," in *IEEE Nuclear Science and Security Symposium*, November 1st, 2020.

Nicholas J. Quartemont*, Narek Gharibyan, Ken Moody, James E. Bevins, “Simulating Nuclear Weapon Neutron Environments at the National Ignition Facility," in *Hardened Electronics and Radiation Technology Conference*, August 17th, 2020.

Robert J. Olesen*, Darren E. Holland, James E. Bevins, “Imaging Fast Burst Reactor with Rotating Scatter Mask Imaging System," in Hardened Electronics and Radiation Technology Conference, August 17th, 2020.

Bryan V. Egner*, Michael T. Febbraro, James E. Bevins, “Characterization of a Boron-Loaded Deuterated Liquid Scintillator for Neutron Spectroscopy," in *Hardened Electronics and Radiation Technology Conference*, August 17th, 2020.

Aaron W. Burkhardt*, Stephen H. Baxter*, James E. Bevins, “An Assessment of the Spatial Variation of Isotopic Ratios in a CANDU Reactor for Nuclear Monitoring", in *Physics of Reactors*, Cambridge, UK, March 29th, 2020.

Lansing Horan*, Darren E. Holland, Megan Syal, Joe Wasem, Michael Dexter, James E. Bevins, “Neutron Energy Effects on Asteroid Deflection." in *IEEE Aerospace Conference*, Big Sky, MT, March 2020.

Jason Seik*, Darren E. Holland, James E. Bevins, “Rotating Scatter Mask Single Voxel Characterization," in *ANS Student Conference*, Raleigh, NC, April 5th, 2020.

Sean Fitzpatrick*, Ryan S. Chapman*, Darren E. Holland, James E. Bevins, “Evaluation of the 154-Gd(p,2n)153-Tb Cross Section," in *ANS Student*

Patents Awarded

Holland, D., Olesen, R.*, Burggraf, L., O’Day, B., Bevins, J. 2019. “Rotating Scatter Mask Design Classes for Directional Radiation Detection and Imaging.” U.S. Patent Application 16/812,844, filed September 17, 2020.

HOLLAND, DARREN, E., Department of Engineering Physics

Refereed Journal Publications

Logan, J., Holland, D., Burggraf, L., Clinton, J., O’Day, B. 2019. “Monte Carlo and Experimental Analysis of a Novel Directional Rotating Scatter Mask Gamma Detection System.” *Nuclear Instruments and Methods in Physics Research Section A: Accelerators, Spectrometers, Detectors and Associated Equipment*. **947**, pp. 162698. https://doi.org/10.1016/j.nima.2019.162698

Olesen R., O’Day B., Holland D., Burggraf L., and Bevins J., 2020. “Characterization of novel rotating scatter mask designs for gamma direction identification”. *Nuclear Instruments and Methods in Physics Research Section A: Accelerators, Spectrometers, Detectors and Associated Equipment*. **954**, pp. 161232. https://doi.org/10.1016/j.nima.2018.09.067

Refereed Conference Papers Accepted on the Basis of Full Paper Review

Horan, L., Holland, D., Syal, M., Wasem, J., Dexter, M., Bevins, J., "Neutron Energy Effects on Asteroid Deflection." *2020 IEEE Aerospace Conference*, Big Sky, MT, presented March 2020.

Olesen, R., Holland, D., Bevins, J., "Imaging Fast Burst Reactor with a Rotating Scatter Mask Imaging System," *Hardened Electronics and Radiation Technology Conference*, to be presented August 2020.

Seik, J., Holland, D., Bevins, J., "Rotating Scatter Mask Single Voxel Characterization," 2021 ANS Student Conference, Raleigh, NC, to be presented April 2021.

Fitzpatrick, S., Chapman, R., Holland, D., Bevins, J., "Evaluation of the 154-Gd (p, 2n) 153-Tb Cross Section," 2021 ANS Student Conference, Raleigh, NC, to be presented April 2021.

Patents Awarded

Holland, D., Olesen, R.*, Burggraf, L., O'Day, B., Bevins, J. 2019. "Rotating Scatter Mask Design Classes for Directional Radiation Detection and Imaging." U.S. Patent Application 16/812,844, filed September 17, 2020.

Patent Applications

Holland, D., Olesen, R., Burggraf, L., O'Day, B., Bevins, J. 2019. "Rotating Scatter Mask Design Classes for Directional Radiation Detection and Imaging." U.S. Patent Application 62,986,892, additional provisional filed April 2, 2020.

Egner, B., Olesen, R., Holland, D., Martin, V., O'Day, B., Burggraf, L., Bevins, J. 2019. "An Efficient, Dual-Particle Directional Detection System using a Rotating Scatter Mask." U.S. Patent Application 16,812,844, Non-provisional filed March 11, 2020.

JACQUES, DAVID R., Department of Systems Engineering and Management

Sponsor Funded Research Projects

"Measurement of Drag Savings Associated with Variable Camber Controlled Wing." Sponsor: AFRL/RQ. Funding: $28,000 - Jacques 80%, Cox 20%.

OXLEY, MARK, E., Department of Mathematics and Statistics

Sponsor Funded Research Projects

"MOA - AFTAC Endowed Term Chairs." Sponsor: AFTAC/XPB. Funding: $30,000 - Oxley 100%. [NEAT]

Refereed Journal Publications

Cordeiro, J. D., Kharoufeh, J. P., and Oxley, M. E., "On the Ergodicity of a Class of Level-Dependent Quasi-Birth-and-Death Processes," *Applied Probability Trust*, Vol. 51, No. 4, pp. 1109-1128, Dec 2019.

Books and Chapters in Books

Hartman, H. and Oxley, M. E., "Individual Exposure Health Risk Profile (IEHRP) – Developing a Risk Profile Tool Beyond Dose Response." *Total Exposure Health, an Introduction*. Boca Raton, FL, K. Phillips, D. Yamamoto, and L. Racz, eds., CRC Press, Taylor & Francis Group, 4 May 2020, pp, 31-40.

7. TECHNOLOGY TRANSFER

7.1. COOPERATIVE RESEARCH AND DEVELOPMENT AGREEMENTS

"Optical Diagnostics of Materials and Reacting Flows," USAF CRADA No. 19-AFIT-07, Collaborator: Spectral Energies, LLC, Faculty Investigator: Dr. Anil Patnaik. Effective Date: 17 October 2019, Term: 23 months.

"NDA - Intelligent Space and Aero Communication Systems -2020," USAF CRADA No. 19-AFIT-08, Collaborator: Blue Cranium, LLC dba Comsat Architects, Faculty Investigator: Dr. Robert Mills. Effective Date: 4 October 2019, Term: 12 months.

"Advanced Electro-Optic & Infrared Sensor Research & Development," USAF CRADA No. 20-AFIT-01, Collaborator: Radiance Technologies, Faculty Investigator: Dr. Bryan Steward. Effective Date: 30 December 2019, Term: 36 months.

"Radar Target Detection in Heterogeneous Clutter Environments," USAF CRADA No. 20-AFIT-02, Collaborator: University of Oklahoma, Faculty Investigator: Dr. Julie Jackson. Effective Date: 21 October 2019, Term: 60 months.

"Marine Atmospheric Modeling, Data Collection, Visualization & Metrological Toolset for Submarine Electromagnetic (EM) Maneuverability," USAF CRADA No. 20-AFIT-03, Collaborator: University of New Hampshire, Faculty Investigator: Dr. Christopher Rice. Effective Date: 27 November 2019, Term: 12 months.

"SWL - Interactive and Associative Computer Security Data Visualization," USAF CRADA No. AFIT SWL 2020-01, Collaborator: Vambrace, Inc., Faculty Investigator: Dr. Gilbert Peterson. Effective Date: 17 October 2019, Term: 59 months.

"EPA - WMU Space Propulsion Research," USAF CRADA No. AFIT EPA 2020-01, Collaborator: Western Michigan University, Faculty Investigator: Dr. Carl Hartsfield. Effective Date: 9 January 2020, Term: 60 months.

"Electro-Optics and Algorithms Research," USAF CRADA No. 20-AFIT-04, Collaborator: Ball Aerospace, Faculty Investigator: Lt Col Michael Dexter. Effective Date: 11 December 2019, Term: 24 months.

"Solar Panel for Prompt Detection and Identification of Nuclear Detonations," USAF CRADA No. 20-AFIT-05, Collaborator: The Ohio State University Department of Mechanical, Aerospace, and Nuclear Engineering, Faculty Investigator: Dr. John McClory. Effective Date: 31 January 2020, Term: 36 months.

"GNSS Antenna Characterization," USAF CRADA No. 20-AFIT-06, Collaborator: The Ohio State University, Faculty Investigator: Dr. Robert Leishman. Effective Date: 7 February 2020, Term: 15 months.

"Film Cooling Overall Effectiveness Measurements at High Freestream Turbulence," USAF CRADA No. 20-AFIT-07, Collaborator: Honeywell Aerospace Inc., Faculty Investigator: Dr. Marc Polanka. Effective Date: 10 February 2020, Term: 19 months.

"EPA - Equipment Donation," USAF CRADA No. AFIT EPA 2020-02, Collaborator: Coy Middle School, Faculty Investigator: Capt Joseph Scott. Effective Date: 10 February 2020, Term: 12 months.

"EPA - Equipment Donation," USAF CRADA No. AFIT EPA 2020-04, Collaborator: KLEPTZ Early Learning Center, Faculty Investigator: Capt Joseph Scott. Effective Date: 10 February 2020, Term: 12 months.

"EPA - Equipment Donation," USAF CRADA No. AFIT EPA 2020-05, Collaborator: St Peter Elementary, Faculty Investigator: Capt Joseph Scott. Effective Date: 10 February 2020, Term: 12 months.

"SWL - VULCAN v7.0, LAR-18512-1," USAF CRADA No. NASA SWL SUA1-15512, Collaborator: National Aeronautics and Space Administration - Langley Research Center, Faculty Investigator: Lt Col Jeffrey Komives. Effective Date: 27 April 2020, Term: 60 months.

"Design of Quantum Circuits with Error Correction," USAF CRADA No. 20-AFIT-08, Collaborator: Azimuth Corporation, Faculty Investigator: Dr. David Weeks. Effective Date: 29 May 2020, Term: 16 months.

"Electro-Optical and Infrared Research and Development," USAF CRADA No. 20-AFIT-09, Collaborator: Resonant Sciences LLC, Faculty Investigator: Lt Col Michael Dexter. Effective Date: 20 August 2020, Term: 24 months.

"NDA - Encryption Analysis and Communication Algorithms," USAF CRADA No. 20-AFIT-10, Collaborator: QRC America LLC, Faculty Investigator: Maj Rich Dill. Effective Date: 20 August 2020, Term: 12 months.

"EPA - Equipment Donation," USAF CRADA No. AFIT EPA 2020-07, Collaborator: Yellow Springs Science Castle, Faculty Investigator: Dr. Mark Oxley. Effective Date: 21 August 2020, Term: 12 months.

"NDA - Nano-Light Emitting Diodes and Their Application," USAF CRADA No. 20-AFIT-11, Collaborator: NS Nanotech, Faculty Investigator: Dr. Michael Miller. Effective Date: 1 September 2020, Term: 11 months.

"Robust Sensor Fusion with Integrity," USAF CRADA No. 20-AFIT-12, Collaborator: CAL Analytics LLC, Faculty Investigator: Dr. Robert Leishman. Effective Date: 10 September 2020, Term: 3 months.

"GPS-denied Orbs with Bandwidth Limited Intelligent Navigation Solutions (GOBLINS)," USAF CRADA No. 20-AFIT-13, Collaborator: Opti-Knowledge Systems Inc., Faculty Investigator: Dr. Robert Leishman. Effective Date: 14 September 2020, Term: 12 months.

7.2. PATENTS

Invention Disclosures

Flat lens optical limiter. Inventors: Thomas M. Cooper, Edward J. Hurd Jr. Hengky Chandrahalim, Matthew S. Mills and Heidi D. Nelson-Quillin, Air Force Disclosure# 2087, Filing date: March 31, 2020.

A mechanically-enabled microscale Fabry–Pérot optical cavity on an optical fiber tip Inventors: Jeremiah C. Williams and Hengky Chandrahalim Air Force Disclosure# 2066 Filing date: February 18, 2020.

A monolithically integrated microscale pressure sensor on an optical fiber tip Inventors: Jeremiah C. Williams and Hengky Chandrahalim, Air Force Disclosure# 2065, Filing date: February 18, 2020.

Monolithically integrated microscale flow sensors on optical fiber tips Inventors: Jeremiah C. Williams and Hengky Chandrahalim, Air Force Disclosure# 2054, Filing date: January 21, 2020.

Liquid crystal (LC)-enhanced photophones, Inventors: Hengky Chandrahalim and Michael T. Dela Cruz Air Force Disclosure# 2041, Filing date: December 09, 2019.

AFD 2073, “Disposable UAS-Compatible Biological Aerosol Sampler” Ohms, S., Eninger, R., & Slagley, J.

Patent Applications

Temperature-immune self-referencing Fabry–Pérot cavity sensors Inventors: Hengky Chandrahalim and Jonathan W. Smith US Patent App. 16/785,718, 2020 Date: 13 Aug 2020
Link: https://patents.google.com/patent/US20200257049A1/en).

Noncontact liquid crystalline broadband optoacoustic sensors Inventors: Hengky Chandrahalim and Michael T. Dela Cruz US Patent App. 16/782,608, 2020 Date: 13 Aug 2020.

M. Sherburne, T. Laurvick “Using 3D Printing Rapid Manufacturing to integrate Colloidal Quantum Dots as a Radiation Scintillator,” Mar 2020 (currently in legal review).

M. Sherburne, T. Laurvick, “Colloidal Quantum Dots Loaded into Polymer for Use in optical non-Destructive Testing Strain Detecting Applications,” Mar 2020 (currently in legal review).

Richard K. Martin, “Methods for Radio Tomographic Image Formation,” United States Patent #10,386,499 (application serial number 15/040,585), issued on 20 Aug 2019.

Nykl, Scott and Woolley, Brian and Pecarina, John. *Process for Stereo Vision Relative Navigation of Airborne Vehicles*. U.S. Patent Pending 62/886,550, August, 2019.

Rondeau, Temple, Lopez, "Passive Physical Layer Distinct Native Attribute Cyber Security Monitor," Application Serial No. 63/031,132, Submitted: 28 May 2020.

Holland, D., Olesen, R., Burggraf, L., O’Day, B., Bevins, J. 2019. “Rotating Scatter Mask Design Classes for Directional Radiation Detection and Imaging.” U.S. Patent Application 62,986,892, Additional provisional filed April 2, 2020.

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Miller, M.E., Stephens, C.I., Kennedy, K.D., Pope, A.T., Borghetti, B. (Sept 2020), Display System Interface using Visually-Evoked Cortical Potentials, Patent Application.

Bohan, BT, Polanka, MD, Staton, BM. “Disc Engine with Circumferential Swirl Radial Combustor,” 5 May 2019. Patent Pending.

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Bohan, B.T., Polanka, M.D., Staton, B.M., Filed 5 Jun, 2019, “Disk Engine with Circumferential Swirl Radial Combustor,” Application AFD 1976P

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Holland, D., Olesen, R.*, Burggraf, L., O'Day, B., Bevins, J. 2019. "Rotating Scatter Mask Design Classes for Directional Radiation Detection and Imaging." U.S. Patent Application 16/812,844, filed September 17, 2020.

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Pickl, C.W., Rutledge, J.L., Polanka, M.D., Harkless, C., Crabtree, B., 12 May 2020, "Wind Tunnel Wake Generator," U.S. Patent No. 10,648,882 B2.

APPENDICES

APPENDIX A: POST-DOCTORAL AND OTHER RESEARCH ASSOCIATES' CREDENTIALS

ARCHIBALD, AARON J.
Research Engineer, Department of Engineering Physics, AFIT Center for Directed Energy. Appointment Date: 2016 (AFIT/ENP); BS, Engineering Physics, Wright State University, 2010; MS, Nanotechnology, Chuang Yuen Christian University, 2012. Mr. Archibald's research supports the efforts of the Airborne Aero-Optics Laboratory through design, fabrication and operation of experimental laser tracking system.

Refereed Journal Publications

McCrae, J.E., S.R. Bose-Pillai, S.T. Fiorino, A. Archibald, J. Meoak, B. Elmore, T. Kesler, and C. Rice, 2020, "Measurements of Optical Turbulence over 149 km Path," *Opt. Eng*. **59**(8), 081806, doi: 10.1117/1.OE.59.8.081806.

Refereed Conference Papers Accepted on the Basis of Full Paper Review

#Bose-Pillai, S., B. Wilson*, J. Krone*, A. Archibald, B. Elmore, J. McCrae, and S. Fiorino, "Profiling atmospheric turbulence using dual-camera imagery of non-cooperative targets," Proc. SPIE. 11506, Laser Communication and Propagation through the Atmosphere and Oceans IX (22 August 2020).

#Bose-Pillai, S., B. Wilson*, J. McCrae, A. Boeckenstedt*, A. Archibald, K. Keefer, and S. Fiorino, "Profiling of atmospheric turbulence from dual-camera time-lapse imagery of a LED array," in Propagation through and Characterization of Atmospheric and Oceanic Phenomena (pcAOP), (PTu4F.2), OSA Optical Sensors and Sensing Congress, Virtual Event, 23 June 2020

#McCrae, J.E., S.R. Bose-Pillai, C.A. Rice, A. Archibald, and S.T. Fiorino, "Wave Optics Simulations of a Dual Beacon Hartmann Turbulence Sensor," 2020 IEEE Aerospace Conference, Big Sky, MT, 7-14 Mar 2020

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Santasri Bose-Pillai, Benjamin Wilson, Jonathan Krone, Aaron Archibald, Brannon Elmore, Jack McCrae, Steven Fiorino, "Profiling atmospheric turbulence using dual-camera imagery of non-cooperative targets," Proc. SPIE 11506, Laser Communication and Propagation through the Atmosphere and Oceans IX, 115060J (22 August 2020); https://doi.org/10.1117/12.2569048

McCrae, J.E., S. Bose-Pillai, A. Archibald, J. Meoak, B. Elmore, T. Kesler, C. Rice and S.T. Fiorino, "Initial Results for Turbulence Measurement Experiment on 149 km Path," 2019 UK/US Directed Energy Workshop, Swindon, UK, 25 July 2019.

Schmidt, J.E., S.T. Fiorino, K.J. Keefer, A.J. Archibald, and B.J. Elmore "HEL Performance Forecasting for Field Experiments using Weather Cubes," 21st Annual DEPS S+T Symposium, Destin, FL, 08 Apr – 12 Apr, 2019.

ELMORE, BRANNON, J.
Brannon J. Elmore received his BS degree in computer science from Wright State University (2014). He is the lead software developer for the Center for Directed Energy at the Air Force Institute of Technology, Wright-Patterson Air Force Base, Ohio. His research efforts are focused on the continuous improvement of LEEDR and HELEEOS, the core applications of the AFIT Directed Energy and Atmospheric Models (ADAM) software package. Tel. (937) 255-3636 x3132; email: Brannon.Elmore.ctr@afit.edu

Refereed Journal Publications

Burley, J.L., S.T. Fiorino, B.J. Elmore, and J.E. Schmidt, 2019: "A Remote Sensing and Atmospheric Correction Method for Assessing Multispectral Radiative Transfer through Realistic Atmospheres and Clouds," *J. Atmos. Oceanic Technol*., **36**, 203–216, doi.org/10.1175/JTECH-D-18-0078.1.

Fiorino, S.T, S.R. Bose-Pillai, J.E. Schmidt, B.J. Elmore, K.J. Keefer, "Implications of 4D weather cubes for improved cloud free line of sight assessments of free space optical communications link performance," Proc. SPIE 10981, Laser Technology for Defense and Security XV, 109810S (13 May 2019).

McCrae, J.E., S.R. Bose-Pillai, S.T. Fiorino, A. Archibald, J. Meoak, B. Elmore, T. Kesler, and C. Rice, 2020, "Measurements of Optical Turbulence over 149 km Path," *Opt. Eng*. **59**(8), 081806, doi: 10.1117/1.OE.59.8.081806.

Refereed Conference Papers Accepted on the Basis of Full Paper Review

Fiorino, S.T. S.R. Bose-Pillai, J.E. Bills, J.E. Schmidt, B.J. Elmore, and K.J. Keefer, "Assessing free space optical communications through 4D weather cubes," 2019 IEEE Aerospace Conference, Big Sky, MT, 2-9 Mar 2019.

Santasri Bose-Pillai, Benjamin Wilson, Jonathan Krone, Aaron Archibald, Brannon Elmore, Jack McCrae, Steven Fiorino, "Profiling atmospheric turbulence using dual-camera imagery of non-cooperative targets," Proc. SPIE 11506, Laser Communication and Propagation through the Atmosphere and Oceans IX, 115060J (22 August 2020);

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Fiorino, S.T., J. Schmidt, B. Elmore and K. Keefer, "Expected HEL Performance Quantification for EHEL PA using Weather Cubes," 2019 UK/US Directed Energy Workshop, Swindon, UK, 25 July 2019.

McCrae, J.E., S. Bose-Pillai, A. Archibald, J. Meoak, B. Elmore, T. Kesler, C. Rice and S.T. Fiorino, "Initial Results for Turbulence Measurement Experiment on 149 km Path," 2019 UK/US Directed Energy Workshop, Swindon, UK, 25 July 2019.

Fiorino, S.T., K.J. Keefer, J.E. Schmidt, B.J. Elmore "The Apparent Coupling of Surface Layer Turbulence and PM2.5 Aerosol Concentrations and Effects on HEL Propagation," 21st Annual DEPS S+T Symposium, Destin, FL, 08 Apr – 12 Apr, 2019.

Schmidt, J.E., S.T. Fiorino, J.L. Burley, and B.J. Elmore "Global Cloud Free Line of Sight (CFLOS) Characterizations using Numerical Weather Prediction Data," 21st Annual DEPS S+T Symposium, Destin, FL, 08 Apr – 12 Apr, 2019.

Schmidt, J.E., S.T. Fiorino, K.J. Keefer, A.J. Archibald, and B.J. Elmore "HEL Performance Forecasting for Field Experiments using Weather Cubes," 21st Annual DEPS S+T Symposium, Destin, FL, 08 Apr – 12 Apr, 2019.

ETHRIDGE, JAMES A.
AFIT Appointment Date: 2020 (AFIT/ENP); BS, Physics, and BS, Mathematics, Cedarville University (2017); MS, Applied Physics, AFIT (2019). Mr. Ethridge is focused on metamaterial research, specifically on applications of metamaterials in optical devices, such as optical switches. Tel. 614-707-6338, email: james.ethridge@afit.edu

EVERT, DAVID, N.
Software Engineer, Department of Engineering Physics, AFIT Center for Directed Energy (ENP/CDE) and Center for Space Research and Assistance (ENY/CSRA). Appointment Date: 2019 (AFIT/ENP), 2020 (AFIT/ENY); BS, Aerospace Engineering, Ohio State University, 2019. Mr. Evert's research for CDE includes development and validation of C++ LEEDR software to measure atmospheric effects on directed energy applications, and his research for CSRA includes management of several DI2E software repositories and updating and improving the ProxBox/MAZER orbital warfare simulator (MATLAB). Email: david.evert.ctr@afit.edu

FOURMAN, BLAINE A.

Software Engineer, AFIT Center for Directed Energy (ENP/CDE). Mr. Fourman is currently in his senior year of completing a Computer Science and Engineering degree from The Ohio State University. His research efforts primarily are focused on improvements to LEEDR and HELEEOS with an emphasis on High Powered Computing to handle large data sets. LEEDR and HELEEOS are the core applications of the AFIT Directed Energy and Atmospheric Models (ADAM) software package. Email: Blaine.Fourman.Ctr@afit.edu

Refereed Conference Papers Accepted on the Basis of Abstract Review

Schmidt, J.E., J. Burley, B. Fourman*, and S.T. Fiorino, "Global Cloud Free Line of Sight (CFLOS) Characterizations Using Numerical Weather Prediction Data," 2020 Annual DEPS S&T Symposium, West Point, NY, 9-13 March 2020.

Schmidt, J.E., J. Burley, B. Fourman*, and S.T. Fiorino, "Global Cloud Free Line of Sight (CFLOS) Characterizations Using Numerical Weather Prediction Data," 20th Conference on Aviation, Range, and Aerospace Meteorology, 100th Annual American Meteorological Society Meeting, Boston, MA, Jan 2020. (Poster and web posting: https://ams.confex.com/ams/2020Annual/meetingapp.cgi/Paper/369796.

Fiorino, S.T., J. Schmidt, B. Elmore, and B. Fourman*, "Global Cloud Free Line of Sight (CFLOS) Characterizations for Air Force SDPE Sites," 14th Annual Directed Energy Systems Symposium, San Diego, CA, 20 November 2019.

Other Significant Research Productivity

Gave an invited talk in June 2020 at the Summer Directed Energy Joint Technology Office Modeling and Simulation Technology Area Working Group Meeting entitled: “New Developments with the Global Cloud Free Line of Sight (CFLOS) Model.”

JOO, JORDAN W.
Research Associate, Department of Engineering Physics, AFIT Appointment Date: 2016 (AFIT/ENP); BS, Physics, University of Cincinnati, 2016; Jordan’s research interests include optics, high powered lasers, optically pumped gas phase lasers, laser material interaction, reaction kinetics, molecular spectroscopy, atmospheric propagation, and imaging. AFIT research center affiliation(s): CDE. Tel. (937) 255-3636 x4857, email Jordan.Joo.ctr@AFIT.edu

KEEFER, KEVIN J.
Principal Atmospheric Research Scientist, Department of Engineering Physics. AFIT Appointment Date: 2012 (AFIT/ENP). BS, Atmospheric Physics, United States Air Force Academy, 1981; MS, Systems Management, University of Southern California, 1983; MS Engineering Physics, Air Force Institute of Technology, 1985; PhD Solid State Physics, Air Force Institute of Technology, 1990; Measurement and Signature Intelligence Certificate, Air Force Institute of Technology, 2004. Dr. Keefer’s research interests include: a.) atmospheric sciences with special emphasis on microphysical processes and radiative transfer effects associated with atmospheric molecular and aerosol constituents as well as solar radiative flux; b.) micrometeorological, molecular, aerosol and optical turbulence field measurement for remote sensing and directed energy research and experimentation; and c.) military/geo-political history and implications for development of current and future national security strategy. Tel. (937) 255-3636 x4344, email: kevin.keefer.ctr@afit.edu

Refereed Journal Publications

Fiorino, S.T, S.R. Bose-Pillai, J.E. Schmidt, B.J. Elmore, K.J. Keefer, 2020: "Implications of 4D weather cubes for improved cloud free line of sight assessments of free space optical communications link performance," *Opt. Eng*. **59**(8), 081808, doi: 10.1117/1.OE.59.8.081808.

Refereed Conference Papers Accepted on the Basis of Full Paper Review

McCrae, J., S. Bose-Pillai, A. Boeckenstedt*, B. Wilson*, K.J. Keefer, and S.T. Fiorino, "Turbulence profiling with a dual beacon Hartmann turbulence sensor using simulation derived weighting functions," Proc. SPIE. 11508, Unconventional Imaging and Adaptive Optics 2020 (20 August 2020).

Fiorino, S.T., K.J. Keefer, and J.C. Grossnickle*, "Comparison of NOAA's CLAP Measurements to Aerosol Absorption from Number Concentration," in Propagation through and Characterization of Atmospheric and Oceanic Phenomena (pcAOP), (JTu5F.2), OSA Optical Sensors and Sensing Congress, Virtual Event, 23 June 2020.

Bose-Pillai, S., B. Wilson*, J. McCrae, A. Boeckenstedt*, A. Archibald, K. Keefer, and S. Fiorino, "Profiling of atmospheric turbulence from dual-camera time-lapse imagery of a LED array," in Propagation through and Characterization of Atmospheric and Oceanic Phenomena (pcAOP), (PTu4F.2), OSA Optical Sensors and Sensing Congress, Virtual Event, 23 June 2020.

Refereed Conference Papers Accepted on the Basis of Abstract Review

Jack E. McCrae Jr., Santasri Bose-Pillai, Alexander Boeckenstedt, Ben Wilson, Kevin Keefer and Steven T. Fiorino, "Turbulence profiling with a dual beacon Hartmann turbulence sensor using simulation derived weighting function," Proc. SPIE 11508, Unconventional Imaging and Adaptive Optics 2020, 1150805 (Sep 2020).

Bose-Pillai, S., B. Wilson*, J.E. McCrae, A. Boeckenstedt*, A. Archibald, C. Rice, K.J. Keefer, and S.T. Fiorino, "Atmospheric Turbulence Profiling with Dual- Camera Time-Lapse Imagery and Validation with Sonic Anemometers," 2020 Annual DEPS S&T Symposium, West Point, NY, 9-13 March 2020.

Grossnickle, J., S.T. Fiorino# , K.J. Keefer, H.R. Tseng, and R.C. Tournay, "Determining Bulk Aerosol Absorption from Off-Axis Backscattering using Rayleigh Beacon Laser Pulses," 2020 Annual DEPS S&T Symposium, West Point, NY, 9-13 March 2020.

Jagoda, D., S.T. Fiorino, S. Peckham, K.J. Keefer, R. Tournay, and J.E. Schmidt, "A Method for Routine PM2.5 Observation and Incorporation into Numerical Weather Prediction," 2020 Annual DEPS S&T Symposium, West Point, NY, 9-13 March 2020.

Grossnickle, J., S.T. Fiorino , K.J. Keefer, H.R. Tseng, and R.C. Tournay, "Determining Bulk Aerosol Absorption from Off-Axis Backscattering using Rayleigh Beacon Laser Pulses," 24th Conference on Integrated Observing and Assimilation Systems for the Atmosphere, Oceans, and Land Surface (IOAS-AOLS), 100th Annual American Meteorological Society Meeting, Boston, MA, Jan 2020. (Poster and web posting) https://ams.confex.com/ams/2020Annual/meetingapp.cgi/Paper/370190

Jagoda, D., S.T. Fiorino, S. Peckham, K.J. Keefer, and J.E. Schmidt, "Assessment of Improved WRF-Chem PM2.5 Characterization via Implementation of an Aerosol Measurement Network," 12th Symposium on Aerosol - Cloud –Climate Interactions, 100th Annual American Meteorological Society Meeting, Boston, MA, Jan 2020. (Poster and web posting) https://ams.confex.com/ams/2020Annual/meetingapp.cgi/Paper/370208.

Schmidt, J., S.T. Fiorino, B. Elmore, and K.J. Keefer, "Expected HEL Performance Quantification for Air Force SDPE Sites and Systems using Weather Cubes," 14th Annual Directed Energy Systems Symposium, San Diego, CA, 20 November 2019.

Other Significant Research Productivity

Gave an invited talk in June 2020 at the Summer Directed Energy Joint Technology Office Atmospheric Propagation Technology Area Working Group Meeting entitled: "Aerosol Profiling for DE Mission Planning, Execution, and Assessment."

PETERSON, GEORGE, G.

ORISE Participant, AFIT Appointment Date: 2018 (AFIT/ENP); BA, Political Science, Augustana University, 1998; BSME, Mechanical Engineering, University of Nebraska – Lincoln, 2012; PhD, Materials Engineering, University of Nebraska – Lincoln, 2017. Dr. Peterson's work is focused on the correlation of material properties and changes to electrical response of semiconductors with emphasis on radiation interaction. The related mission spaces are

electronics survivability, stockpile to target delivery, nuclear forensics, and radiation detection, comprised of both modeling and experimental testing. Tel. (937) 255-3636 x4688, email: george.peterson@afit.edu

Refereed Journal Publications

N. Benker, E Echeverria, R Olesen, B. Kananen, J. McClory, Y. Burak, V. Adamiv, I. Teslyuk, *George Peterson*, B. Bradley, E. Wilson, J. Petrosky, B. Dong, J. Kelber, J. Hamblin, J. Doumani, P. Dowben, A. Enders, *Possible detection of low energy solar neutrons using boron-based materials*, Radiation Measurements, 129(106190) (Oct 2019). doi: 10.1016/j.radmeas.2019.106190.

Other Significant Research Activity

Contributor, Technical Report, "Guidelines for Space Qualifications of GaN HEMT Technologies" (2020)

RAUT, YOGENDRA Y.
Research Scientist- Atmospheric Effects, AFIT Appointment date: 2019 (AFIT/ENP). PhD, The Ohio State University 2017; MS, The University of New England, New South Wales (Australia), 1997; BS (Hons) Tribhuvan University (Nepal). Dr. Raut's work is focused on the soil hydrology and air quality. Fate of storm water management, carbon fractionation, nanoparticles, and Laboratory equipment are some of the other areas of his expertise. Dr. Raut has authored/co-authored four books, including one textbook. Tel. (937) 255-3636 x4241, email: Yogendra.Raut.ctr@afit.edu

Refereed Journal Publications

Raut, Y., Vinayak S. Shedekar, Khandakar Islam, Javier Gonzalez, Dexter Watts, Warren Dick, Dennis Flanagan, Norman Fausey, Marvin Batte, Randall Reeder, Tara VanToai (2020) Soybean yield response to gypsum soil amendment, cover crop and rotation. Agri. and Environmental Letters. 1-6

Refereed Conference Papers Accepted on the Basis of Full Paper Review

Raut, Y. and Dick, W. A. (2020) Biodrilling, Compaction Alleviation, and Fate of Storm water Management. World Environmental & Water Resources Congress. American Society of Civil Engineers (ASCE). May 17-21, 2020 Henderson, Nevada.

SCHMIDT, JACLYN E.
Research Meteorologist**,** LEEDR POC, Department of Engineering Physics, AFIT Appointment Date: 2015 (AFIT/ENP); BS, Meteorology, University of South Alabama, 2010. Ms. Schmidt's research involves atmospheric characterization and radiative transfer modeling and simulation, the enhancement of 4D Weather Cubes and their applications to directed energy system performance climatological assessments and forecasting. Tel. 601-616-6531; email: jaclyn.schmidt@afit.edu.

Refereed Conference Papers Accepted on the Basis of Full Paper Review

Fiorino, S.T, S.R. Bose-Pillai, J.E. Schmidt, B.J. Elmore, K.J. Keefer, "Implications of 4D weather cubes for improved cloud free line of sight assessments of free space optical communications link performance," Proc. SPIE 10981, Laser Technology for Defense and Security XV, 109810S (13 May 2019).

Fiorino, S.T. S.R. Bose-Pillai, J.E. Bills, J.E. Schmidt, B.J. Elmore, and K.J. Keefer, "Assessing free space optical communications through 4D weather cubes," 2019 IEEE Aerospace Conference, Big Sky, MT, 2-9 Mar 2019.

Refereed Conference Papers Accepted on the Basis of Abstract Review

Fiorino, S.T., J. Schmidt, B. Elmore and B. Fourman, "Global Cloud Free Line of Sight (CFLOS) Characterizations for Air Force SDPE Sites," 2019 DEPS Systems Symposium, La Jolla, CA, 20 November 2019.

Schmidt, J.E. S. Fiorino, B. Elmore and K. Keefer, "Expected HEL Performance Quantification for Air Force SDPE Sites and Systems using Weather Cubes," 2019 DEPS Systems Symposium, La Jolla, CA, 20 November 2019.

Fiorino, S.T., J. Schmidt and K. Keefer, "Multi-Spectral Transmission and Extinction Quantification for HEL Test and Evaluation," 2019 UK/US Directed Energy Workshop, Swindon, UK, 25 July 2019.

Fiorino, S.T., J. Schmidt, B. Elmore and K. Keefer, "Expected HEL Performance Quantification for EHEL PA using Weather Cubes," 2019 UK/US Directed Energy Workshop, Swindon, UK, 25 July 2019.

Fiorino, S.T., K.J. Keefer, J.E. Schmidt, B.J. Elmore "The Apparent Coupling of Surface Layer Turbulence and PM2.5 Aerosol Concentrations and Effects on HEL Propagation," 21st Annual DEPS S+T Symposium, Destin, FL, 08 Apr – 12 Apr, 2019.

Schmidt, J.E., S.T. Fiorino, J.L. Burley, B.J. Elmore, " Global Cloud Free Line of Sight (CFLOS) Characterizations using Numerical Weather Prediction Data," 21st Annual DEPS S+T Symposium, Destin, FL, 08 Apr – 12 Apr, 2019.

Schmidt, J.E., S.T. Fiorino, K.J. Keefer, A.J. Archibald, and B.J. Elmore "HEL Performance Forecasting for Field Experiments using Weather Cubes," 21st Annual DEPS S+T Symposium, Destin, FL, 08 Apr – 12 Apr, 2019.

Schmidt, J.E., S.T. Fiorino, S. Peckham, and K.J. Keefer, "Evaluation of Aerosol Characterizations in Numerical Weather Modeling for Emerging DOD Technologies and Climate Change Studies," 23rd Conference on Integrated Observing and Assimilation Systems for the Atmosphere, Oceans, and Land Surface (IOAS-AOLS), 99th Annual American Meteorological Society Meeting, Phoenix, AZ, Jan 2019. (Poster and web posting: https://ams.confex.com/ams/2019Annual/meetingapp.cgi/Paper/356249).

Other Significant Research Productivity

Gave two invited talks in June 2020 at the Summer Directed Energy Joint Technology Office Modeling and Simulation Technology Area Working Group Meeting entitled: (1) "An Overview of LEEDR Aerosol Modeling" and (2) "New Developments with the Global Cloud Free Line of Sight (CFLOS) Model."

TRUE, TIMOTHY M.
AFIT Appointment Date: 2018 (AFIT/ENP), BS Physics, Cedarville University, 2019. Mr. True's work is focused on gas kinetics research to support the diode pumped alkali laser (DPAL). Tel. 269-270-1812, email: ttrue@afit.edu

Refereed Journal Publications

True, Timothy M., Christopher A. Rice, and Glen P. Perram. "The cesium $6^2P_{3/2}$ to $8^2S_{1/2}$ line shape broadened by He, Ar, and Kr." *Journal of Quantitative Spectroscopy and Radiative Transfer* (2020): 107010.

WANG, BUGUO, part-time research scientist (research faculty)
Appointment Date: 2014 (AFIT/ENP); BSc, MSc, Physical Chemistry, Soochow University (Suzhou, China); Ph.D., Materials Science and Engineering, Chinese Academy of Sciences (Shanghai, China). Dr. Wang's work is focused on the structural, optical and electrical properties of novel semiconductor materials and devices in correlation with their growth conditions as well as radiation effects. Email: buguo.wang.ctr@afit.edu

Refereed Conference Papers Accepted on the Basis of Abstract Review

N. J. Gale, J. W. McClory, M. Hogsed, and B. Wang, "Neutron Displacement Damage in Germanium-Tin Photodiodes," accepted by the *Hardened Electronics and Radiation Technology Conference*, August 2020.

APPENDIX B: SELECTED ACRONYM LIST

There are a number of abbreviations for organizations that are used in this report. This alphabetical listing includes only selected organizations.

711 HPW/RH	711 Human Performance Wing Human Effectiveness Directorate
ACC	Air Combat Command
AETC	Air Education and Training Command
AFCAA	Air Force Cost Analysis Agency
AFCEC	Air Force Civil Engineering Center
AFGSC	Air Force Global Strike Command
AFIA	Air Force Inspection Agency
AFIMSC	Air Force Installation and Mission Support Center
AFIT	Air Force Institute of Technology
AFIT ANT	AFIT Center for Autonomy and Navigation Technology
AFIT CCR	AFIT Center for Cyberspace Research
AFIT CDE	AFIT Center for Directed Energy
AFIT COA	AFIT Center for Operational Analysis
AFIT CSRA	AFIT Center for Space Research and Assurance
AFIT CTISR	AFIT Center for Technical Intelligence Studies and Research
AFIT/ENC	AFIT Department of Mathematics & Statistics
AFIT/ENG	AFIT Department of Electrical & Computer Engineering
AFIT/ENP	AFIT Department of Engineering Physics
AFIT/ENR	AFIT Office of Research and Sponsored Programs
AFIT/ENS	AFIT Department of Operational Sciences
AFIT/ENV	AFIT Department of Systems Engineering & Management
AFIT/ENY	AFIT Department of Aeronautics and Astronautics
AFIT STAT COE	AFIT Scientific Test & Analysis Techniques Center of Excellence
AFLCMC	Air Force Life Cycle Management Center
AFMC	Air Force Materiel Command
AFMOA	Air Force Medical Operations Agency
AFNWC	Air Force Nuclear Weapons Center
AFRL	Air Force Research Laboratory
AFRL/AFOSR	AFRL/Air Force Office of Scientific Research
AFRL/RD	AFRL/Directed Energy Directorate
AFRL/RI	AFRL/Information Directorate
AFRL/RQ	AFRL/Aerospace Systems Directorate
AFRL/RV	AFRL/Space Vehicles Directorate
AFRL/RW	AFRL/Munitions Directorate
AFRL/RX	AFRL/Materials and Manufacturing Directorate
AFRL/RY	AFRL/Sensors Directorate
AFSC	Air Force Sustainment Center
AFSPC	Air Force Space Command
AFTAC	Air Force Technical Applications Center
AFTPS	Air Force Test Pilot School
AIAA	American Institute of Aeronautics and Astronautics
AMC	Air Mobility Command
ASEE	American Society for Engineering Education
DAGSI	Dayton Area Graduate Studies Institute
DARPA	Defense Advanced Research Projects Agency
DEJTO	Directed Energy Joint Technology Office
DHS	Department of Homeland Security
DOD	Department of Defense
DOE	Department of Energy
DTRA	Defense Threat Reduction Agency
EPA	Environment Protection Agency

ERDC	Engineer Research and Development Center
EUCOM	United States European Command
IEEE	Institute of Electrical and Electronics Engineers
INCOSE	International Council on Systems Engineering
JASPO	Joint Aircraft Survivability Program Office
JTWC	Joint Typhoon Warning Center
JWAC	Joint Warfare Analysis Center
MIT	Los Alamos National Laboratory
LTS	Laboratory for Telecommunications Sciences
MDA	Missile Defense Agency
MIT	Massachusetts Institute of Technology
MORS	Military Operations Research Society
NASA	National Aeronautics and Space Administration
NASIC	National Air and Space Intelligence Center
NAVAIR	Naval Air Systems Command
NGA	National Geospatial-Intelligence Agency
NNSA	National Nuclear Security Administration
NPS	Naval Postgraduate School
NSA	National Security Agency
NSF	National Science Foundation
OSD	Office of the Secretary of Defense
SAF	Office of the Secretary of the Air Force
SCOW	635 Supply Chain Operations Wing
SMC	Space and Missile Systems Center
SOCHE	Southwestern Ohio Council for Higher Education
SPIE	The International Society for Optical Engineering
TuAF	Turkish Air Force
USAF	United States Air Force
USAFA	United States Air Force Academy
USSOCOM	United States Special Operations Command
USTRANSCOM	United States Transportation Command
WPAFB	Wright-Patterson Air Force Base

APPENDIX C: INFORMATION FOR OBTAINING A COPY OF A THESIS

Copies of theses with unlimited distribution may be obtained from the following agencies, **depending on the particular circumstances.**

U.S. Government employees, individuals affiliated with a research and development activity within the U.S. Government, or its associated contractors, subcontractors, and grantees, under current U.S. Government contract, can order from:

DEFENSE TECHNICAL INFORMATION CENTER
8725 John J. Kingman Road
Ft Belvoir, VA 22060-6218

Phone: 1-800-225-3842, option 1

Website: For members of the public or to register:
https://discover.dtic.mil/

For users with a smartcard (i.e., CAC, PIV or ECA):
https://www.dtic.mil/

Private U. S. citizens without a U.S. Government contract can order from:

NATIONAL TECHNICAL INFORMATION SERVICE
U.S. Department of Commerce
Website: https://ntrl.ntis.gov/NTRL/

Click on the 'keyword' dropdown menu on the left side of the page. Click on thesis (for dissertations also). In addition to the title and author, 'Air Force' should be entered as 'source.'

General inquiries concerning faculty and student research at the Air Force Institute of Technology may be addressed to:

Office of Research and Sponsored Programs (AFIT/CZ)
Air Force Institute of Technology
2950 Hobson Way
Wright-Patterson AFB, OH 45433-7765
Phone: (937) 255-3633 (DSN 785-3633)
Website: https://www.afit.edu
Email: research@afit.edu