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ANALYZING INDIVIDUAL DECISION MAKING VERSUS GROUP DECISION MAKING FOR ALTERNATIVE SELECTION

THESIS

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AFIT/GOR/ENS/08-05

DEPARTMENT OF THE AIR FORCE

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THESIS

Presented to the Faculty

Department of Operational Sciences

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In Partial Fulfillment of the Requirements for the

Degree of Master of Science in Operations Research

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June 2008

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Abstract

Many "real world" decisions are made by groups. It is rare that the responsibility for a very important decision is given to a single decision maker with complete authority. Group decision making adds both advantages to the process as well as disadvantages. This research examines the question: "Are decisions made by groups really that much different from the decisions made by individuals in the group?"

A specific case study involving the selection of the best primary training aircraft type for military pilot training is used to examine this question. Fifteen military pilots with various backgrounds and experience levels participate as decision makers in the study. The decision analysis method of Value Focused Thinking is used to facilitate both individual and group decision making sessions. Value hierarchies are created for all sessions, and a set of alternatives is generated and scored. Kendall's Coefficient of Concordance is used to determine the level of agreement between decisions made by the group and individual decision makers.

To My Family…

Acknowledgements

I would like to thank to my father, my mother, and my brother for their endless and deepest love, support and understanding during these two years when we missed each other so much. You are the source of my inspiration for any success.

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Alper GEZERAVCI

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ANALYZING INDIVIDUAL DECISION MAKING VERSUS GROUP DECISION MAKING FOR ALTERNATIVE SELECTION

I. Introduction

1.1 Background

Many decisions in the real world are made by groups rather than individuals, such as families, committees or legislatures. (Legislators make the laws, some business decisions are made collectively, monetary policy decisions are made by committee rather than by a single individual.) Households and firms are typically not individuals, but groups of people with a joint interest in economic decisions. Similarly, political or military decisions, as well as, decisions on monetary policy are often taken by groups rather than individuals. On the other hand, there are also decisions which are almost always made by individuals: A consumer trying to make a purchase decision with a limited budget; a realtor deciding to maximize his/her profit; a banker trying to decide an optimal interest rate in the free market.

In the field of psychology, there is significant research for comparing individual and group behavior and decision making . The results found in psychological research can be divided into two main effects. First, groups are often assumed to make better decisions than individuals. This is based on that simple idea, which is two (or more) people know more than one. Second, groups often make different decisions than individuals. From an individual's point of view, it can be simply assumed that an individual acts according to his/her own preferences. On a group level, the choices depend not only on how the individual preferences of the group members are combined into a group decision, but also how they depend on individual preferences.

Do group decisions really differ a lot from the decisions of the individuals who form the group? Most of the opinions agree that groups make decisions more slowly than individuals. Then why are so many important decisions made by groups? It is because of some belief in common sense: It may be advantageous to bring more than one person into consider a question a complicated situation where no one knows the "true" way to make a decision, or where data may be hard to process or interpret, and where individual values may influence decisions.

1.2 Problem Statement

Group decision making is an important and controversial part of life. Both in business and day-to-day life, by definition, group decisions are being made by a number of individuals coming together. A portion of the research asserts that there are advantages in having many minds focused on the same problem, and that provides this grouping with increased morale. Another portion complains about the slowness of the group decision process, the conservatism and excessive caution of groups, and the difficulties of determining who is "really" responsible for a decision made by a group.

The widely held belief that groups reach more rational or better decisions than individuals is far from being confirmed by psychological literature. Davis stated that "in the idealized form of the group superiority argument, groups are, considered to balance biases, catch errors and stimulate thoughtful work" [8]. The conventional wisdom of group superiority has been challenged by numerous experiments, leading to the conclusion that "group discussion can decrease, amplify, or simply reproduce the judgmental bias of individuals" as indicated by Holloman and Hendrick [5].

Although many studies have been performed in the area of individual decision making, the studies do not thoroughly explain the relative relation between groups and individuals. The general social psychological literature does not offer an unambiguous line of reasoning which would help to predict the relationship of individuals and groups.

Group decision making involves different characteristics in which bad decisions are likely to be made. Some decision makers may avoid expressing their true opinion on the matter at hand for fear of stepping outside the comfort zone of the group. Some members of the group may feel reluctant to share their opinions and fear a loss of respect or job title for speaking the wrong words. Johnson and Libecap state that "group pressures, biases, and other behaviors reduce the quality of the decision" [31].

In the stressful and pressure-filled atmosphere of group decision making, if many group members are likely to hesitate in expressing their real values, ideas and preferences, is it absolutely necessary and efficient to gather a number of people together?

If the individuals can already make the same decisions with the same or maybe even higher efficiency, why would the valuable time of many participants be consumed in a group decision making environment?

The case study will be proceeded with a simple question rather than a complex hypothesis. The problem to be explored is: "Are decisions made by groups really that different from the decisions made by individuals?" A slightly different focus can also be employed. It asks the question: "Do individuals really conduct themselves differently when they make decisions a member of a group or when they reach decisions by themselves?"

1.3 Research Focus & Methodology

A specific case study regarding what is important to a pilot in a primary training aircraft was used to examine whether the decisions made by groups are really that much different from the decisions made by individuals. This case study was performed by questioning fifteen decision makers (DMs), who also contributed as subject matter experts (SME) from a wide variety of sources (Air Force, Navy, Marine Corps, International Pilots), on what is valued in a primary training aircraft. Specifically, the pilots were selected as DMs since they are the "experts" and know best in deciding what is important in a primary training aircraft in which they either have flown or are still flying. The group of DMs consisted of US Air Force pilots (2 Lt.Col., 5 Maj.), US Navy pilots (3 LCDR) , US Marine Corps pilot (1 Maj.) and Turkish Air Force pilots (4 First Lt.s). The experience levels, ranks, ages, and proficiency in aircraft of the DMs varied tremendously. The military forces of the DMs were also scattered. This wide variety group of DMs provided the study with a decision at the end. After creating value-focused thinking (VFT) hierarchies for each DM and the group, a list of alternatives has been scored based on each hierarchy. This score provided the means to examine and explore the differences, if any, among the fifteen DMs and group. No difference would verify that individual decision making would be at least the same efficient or more efficient than bringing the group together to make the decision.

Whether there is an association among the decision makers were determined in the final result section. The DMs have been grouped under different sample forms , such as all DMS & group, USAF DMs & group, USN & USMC DMs & group, TUAF DMs & group, instructor DMs & group, non-instructor DMs & group and null hypothesis: "m sets of rankings are independent" have been tested to see if there is an agreement among the DMs for the statistical analysis. The result of the study helps allay the stress of group meetings, the time a decision takes to be met, and the perceived influence DM's have on one another.

The goal of the research is to determine if there is really a difference between an individual and group decision on the same topic.

Value Focused Thinking (VFT) technique has been applied as the methodology. VFT focuses on the values of the decision maker rather than the alternatives that are already available.

All value hierarchies were created and VFT process has been implemented by using Lt. Col. Jeffrey D. Weir's "Hierarchy Builder" software program.

The remainder of this document is consisting of four chapters and 4 appendices. Chapter-2 reviews literature covering group decision making, advantages & disadvantages, individual versus group decision making, case study, decision analysis and VFT. Chapter-3 provides detailed information on the methodology, step-by-step, as the research is conducted and develops value models. Chapter-4 runs the value models to evaluate and displays the results of the analysis done with the process outlined in Chapter-3. Chapter-5 presents the results of the study and the limitations of the work, provides discussion on recommendations based on the results, as well as future research that can be done to further explore the issue.

II. Literature Review

2.1 Overview

This chapter discusses group decision making, individual versus group decision making, the case study question, decision analysis, and value focused thinking. Decision analysis is discussed, and an in-depth discussion is provided on the VFT approach to decision making.

2.2 Group Decision Making

Many people come together everyday to make decisions concerning some topic of interest for the group or a group of people that share common characteristics or interests. Group decision making is a process that has a very wide range of ideas and events. It is a type of participation process in which multiple individuals act as a group, analyze problems or situations, consider and evaluate alternative courses of action, and select from among the alternatives a solution or solutions. The nature of the decision can be a high ranking political issue, or it can also be a public jury deciding whether someone is guilty or not. But it can equally be unofficial with some decision on the room setting. Deciding whether someone is guilty or not and the decision for the setting of a room are of a totally different nature. The number of people involved in group decision making varies greatly. The individuals in a group may be demographically similar or quite diverse. The character and composition of groups, their size, and demographic structure all affect their performance to some degree. In addition to these, the external pressure faced by groups such as time demands and conflicting goals may also impact the progress and effectiveness of decision making groups.

Groups are nothing more than a gathering of people who are working toward the same goals, in the same place, at a given time. However, when people meet in this way, surprising changes in the behavior of individuals emerge. As explained by Latane in his Social Impact Theory, the total impact of other people in an individual is related to the the number, strength, and directness of other observers. When observers have a higher level of power (determined by status, age, relationship), or are greater in number, there will be a greater effect on the individual's behavior [27].

The domain of decision making is vast. The structure of the group has diverse effects on group decision making as well. It is still open whether group decision making produces worthwhile results for a decision. This can depend on many different factors such as each person's personality, the state-of-mind at the moment of the decision, the structure of the group, and the ideas behind groupthink. Brahm and Kleiner express that "often, members do not feel comfortable expressing themselves verbally, even in groups structured to be smaller" [3]. This can cause some members to sit in a group meeting and never voice their own opinions on the decision making process, therefore, decreasing the need for them to be present. They also stated that "the decision makers of the group must be assertive and participate enough to contribute to the group" [3]. The presence of a supervisor can have very negative effects on the process because they have the final say on whether the proposed decision is acceptable. They either accept the idea or reject it, and thereby that result in demoralization of the group members. An unhappy group ends up to be an unproductive group.

Individual influences are reflected in group decisions. The evidence on whether groups or individuals make better decisions is mixed. Kerr, Kramer, MacCoun emphasized that "the details of the group-judgment process are an important determinant of the quality of the group versus individual decisions" [30]. Wallach, Kogan, and Bem have found that "group decisions can lead to excessive risk taking (so-called risky shift)". Bornstein and Yaniv studied individual versus team choices in ultimatum games and found that "teams are more game-theoretically rational players than are individuals" [11] . In contrast, Cox and Hayne found that "groups tend to deviate further from balanced strategies than do individuals" [16]. Kocher and Sutter compared decisions by individuals and groups in beauty contest games [29]. They found no difference in the depth of reasoning between individuals and groups, but found that groups learn faster than individuals. Michaelsen, Watson, and Black determined that there have been no studies on individual versus group decision making that provided any significant outcome, positive or negative, for either individual or group performance [26]. It is a big question if the decisions made by groups differ from the decisions of the individuals.

A strong personal identity in a group could lead to different results. In some cases personal identity is lost and replaced by an identification with the goals and actions of the group which is called the "deindividuation" described by Gustave LeBon in his Crowd Theory (1896) [28]. He developed a theory that "in the right situations, the emotions of one person spread through the group like a cold through a building". According to the theory, during the time shared in a group environment, control mechanisms such as values, principles, and learned social rules are broken down and forgotten. Forsyth defines "the complete feeling of anonymity and being less accountable" as the key to people's actions [10]. Many other theorists (Zimbardo, 1970; Diener, Fraser, Beamen, and Kelem, 1976) have done experiments showing that when the sense of responsibility for our actions is lost, the participants will behave in more extreme ways then when each member feels responsibility for the decision. [40] [9].

Agreeing with the beliefs of a group may affect personal decisions. Groups make decisions that are often riskier than what would be expected given the views held by individual members before the decision. People have a tendency to compare themselves socially to the opinions of others in the group. If the group tends to be leaning to a more radical idea, many others will also shift their views in that direction.

Group decision making is found in many different areas of the workforce. People take different sides on the issue of the effectiveness of group decision making. Watson, Sharp, and Michaelsen have debated that group decision making is effective and announced that "decisions made will reflect those higher qualities than the group's most knowledgeable member" [38]. This coincides with the notion that different values or alternatives may come about in a group.

2.3 Advantages and Disadvantages of Group Decision Making

The effectiveness of decision making groups can be affected by a variety of factors. Therefore, it is not possible to suggest that group decision making is always better or group decision making is always worse than individual decision making. For example, due to the increased demographic diversity in the workforce, a considerable amount of research has focused on diversity's impact on the effectiveness of group performance. In general, demographic diversity can sometimes have positive or negative effects, depending on the specific situation. Some research indicates that diverse groups tend to generate a wider variety and higher quality of decision alternatives than demographically homogeneous groups.

In the ideal, group decision making takes advantage of the varied strengths and expert opinions of its members. It is possible that the group can generate a greater number of alternatives that are of higher quality than the individual. If a greater number of higher quality alternatives are generated, then it is likely that the group will eventually reach a better and greater problem solution than the individual. Since it is possible that many of the group members are affected by the decision at the end, they actually might have input into the decision which results in a group decision of greater combined understanding of the eventual course of action chosen.

There are also many potential disadvantages to group decision making. Groups are generally slower to arrive at decisions than individuals, so sometimes it is difficult to put them to practical use in situations where decisions must be made very quickly. One of the most common problems is "groupthink". Irving Janis defined the phenomenon as "the decline of mental efficiency, reality testing, and moral judgment resulting from group pressure" in his book "Victims of Groupthink" [18].

Groupthink is a characteristic of group decision making in which bad decisions are likely to be made. Groupthink can be thought of as a mode of thinking that people engage in when they are deeply involved in a well-united group. Groupthink occurs when individuals in a group feel pressure to comply with what seems to be the dominant view in the group. Opposing views of the majority opinion are suppressed, and alternative courses of action are not fully explored. Some decision makers avoid raising their true opinion on the matter at hand for fear of stepping outside the comfort zone of the group. Members of the group may feel inferior to others and fear a loss of respect for speaking the wrong words. Johnson indicates that those group pressures, biases, and other behaviors reduce the quality of the decision. He also states that "the decision context and available alternatives will determine the effect of groupthink on a situation" [21]. Although groupthink in different situations can be difficult to detect or measure, it offers insight into understanding how various factors and conditions combine to affect decision outcomes. To prevent groupthink and enhance the effectiveness of group decision making, the leader of the group may encourage the group members to express objections, or he or she may also remain unbiased to ideas as they are presented.

Some research suggests that certain characteristics of groups contribute to groupthink. In the first place, if the group does not have an agreed upon process for developing and evaluating alternatives, it is possible that an incomplete set of alternatives will be considered and that different courses of action will not be fully explored. Many of the formal decision making processes, for instance "nominal group technique" and "brain-storming", are designed to reduce the potential for groupthink by ensuring that group members offer and consider a large number of decision alternatives. Secondly, if a powerful leader dominates the group, other group members may quickly comply with the dominant view. Additionally, if the group is under stress and/or time pressure, groupthink may occur. Finally, studies suggest that well-adjusted groups are more susceptible to groupthink.

Another potential disadvantage of group decision making is group polarization. The group my tend to focus on more extreme solutions to a problem. An example of polarization is the risky shift phenomenon. When the group decision is a riskier one than any of the group members would have made individually, it results in risky shift. Members of the groups sometimes may not feel as much responsibility for the actions of the group as they would, if they were making the decision alone.

Decision making in groups is a fact of life in organizations for many individuals. Because so many individuals spend at least some of their work time in decision making groups, hundreds of research studies are carried out on such groups each year. There is still much to learn about the development and performance of groups. However, it is more likely that research studies will continue to focus on identifying course of actions that will make group decision making more efficient and effective. It is also likely that the effect of internal characteristics of groups (e.g demographic, age, status, rank etc.) will be researched more in depth.

2.4 Individual Versus Group Decision Making

Individual decision making occurs happens a lot on a daily basis (financial investments, residential location, insurance etc.). But decisions are often taken by a group rather than by a single individual. Even when these decisions are formally taken by only one of the members of the group, they may affect (and/or be affected by) the way the group shares other decisions. Almost every important decision involves risk and individuals include risk into their decisions.

It can't be simply assumed that groups make the same decisions as individuals. There is a significant amount of research in psychology comparing individual and group behavior and decision making. The psychological findings can be very roughly divided into two main effects. First, groups are often assumed to make better decisions than individuals. This is based on the simple idea that two (or more) people know more than one. This effect depends on the decision at hand; there has to be a provable right solution. Secondly, groups often make different decisions than individuals. On an individual level, a particular individual acts according to his/her preferences (if someone prefers X over Y, he/she will choose X). On a group level, choices not only depend on how the individual preferences of the group members are combined into a group decision, but individual preferences can change because an individual is a member of a particular group.

A growing amount of literature has concentrated on the impact of different characteristics of the decision maker, among which the differences between male and female decision makers have been most thoroughly studied (e.g., Eckel and Grossman,1998 [4]; Andreoni and Vesterlund,2001 [15]; Gneezy, Niederle and Rustichini,2003 [37]).

Bornstein and Yaniv have studied individual versus group behaviour in a standard, "one-shot ultimatum game", where a fixed amount of money is split between a proposer and a responder [11] . Bornstein and Yaniv compared two treatments, one with individuals playing against individuals and one with groups (of three subjects each) playing against groups. Their main result was that "groups are more rational players than individuals by demanding more than individuals in the role of proposer and by accepting relatively lower offers in the role of responder".

Cox and Hayne have explored decision making of groups and individuals in common value auctions, characterized by "risky outcomes" [17]. "Although both groups and individuals deviate from rational bidding when they have more information, groups are more affected by the disadvantage of information, leading to the conclusion that groups are less rational decision makers than individuals". The studies of Bone, Hey and Suckling [20] and Rockenbach, Sadrieh and Mathauschek [2] are somewhat related to the paper by Cox and Hayne in that they investigated group decision making under risk.

Blinder and Morgan studied group versus individual decision making in an urn problem and in a monetary policy experiment [1]. Blinder and Morgan were particularly interested in whether groups are slower in decision making than individuals. Measuring the speed of decision making by the amount of information needed before reaching a decision, they found no support for the widely held belief that it takes longer for groups to reach a decision.

Gillet explored the view that "groups are better than individuals at solving an inter-temporal choice problem", which he saw as confirmation for the hypothesis that groups are smarter than individuals, by designing and running a number of separate experiments combining different attributes to compare the differences between decisions made by groups and individuals [12].

Finally, Kocher and Sutter contributed to this growing literature availability by addressing the influence of the type of decision maker on the rationality of decision making [29]. They focused on two main research questions. First, "are groups of more rational decision makers in the sense that their decisions are closer or converge faster to the balanced prediction of the strategic situation?" Second, "do groups outperform individuals in terms of payoff when competing against individuals?" They used an experimental beauty-contest game. Their first research question was related to a growing number of economic literature examining whether groups behave and decide differently than individuals. An interesting general result was the fact that "differences in decision making between groups and individuals can neither be explained by simple collection of individual preferences or choices nor by simple theories of group decision making". They came up with the conclusion that "it seems reasonable that many important and recurrent decisions in societies are entrusted to groups". It may be beneficial to use groups as decision makers instead of individuals. However, they also stated that they still know too little on such important questions as, for instance, which tasks should actually be entrusted to small groups as decision makers or which internal structure of small groups contributes best to reaching optimal decisions and preventing adverse effects like groupthink or overconfidence biases.

2.5 Case Study : Best Primary Training Aircraft

Pilot training aircraft are used to take officers through flight training programs to provide rated military aviators to fly their respective services' fixed-and rotary-wing aircraft. According to Federation of American Scientists' (FAS) military analysis [14], the flight training process has been shaped and conducted through the years as summarized below:

"The Air Force has transitioned from undergraduate pilot training (UPT) to specialized undergraduate pilot training (SUPT) in order to better prepare pilots for the entire spectrum of aircraft and flying missions. Specialized undergraduate pilot training began at Reese Air Force Base, Texas, in July 1992, following the arrival of the T-1A aircraft. Undergraduate pilot training, which universally trained all students in the T-37 and T-38 trainer aircraft, continued at each base at the same time until all required T-1A aircraft arrived at that base. Transition to SUPT was completed in early 1997 when the last UPT class graduated at Columbus AFB, Miss.

Specialized undergraduate pilot training differs from generalized training primarily in the advanced phase. After primary training in the T-37 Tweet, or the U.S. Navy's T-34 Mentor, students select, by order of merit, advanced training in the bomber-fighter, airlift-tanker, helicopter, or turboprop tracks.

The preflight phase of SUPT takes three weeks and consists of academics and physiology training to prepare students for flight. The second phase, primary training, is conducted in the twin-engine, subsonic T-37 Tweet, a rugged aircraft equal in maneuverability to most of the fighters of World War II. Students learn aircraft flight characteristics, emergency procedures, takeoff and landing procedures, aerobatics, and formation flying. Students also practice night, instrument, and cross-country navigation flying. Primary training takes approximately 23 weeks and includes about 250 hours of ground training, 25 hours in the flight simulator, and 90 flying hours in the T-37.

Advanced training for the bomber-fighter track is accomplished using the T-38 Talon and prepares pilots for transition to fighter and bomber aircraft. The T-38 is a tandem-seat, twin-engine, supersonic jet. There is increased emphasis on formation, navigation, and low level navigation flying. Training takes approximately 26 weeks and includes about 380 hours of ground training, 30 hours in the flight simulator and 120 flying hours in the T-38.

The airlift tanker track uses the T-1A Jayhawk, the military version of a multiplace business jet, facilitating the transition to crew positions in airlift and tanker aircraft. Instruction centers on crew coordination and cockpit management duties in a multi-place crew aircraft. Flight training includes visual and instrument transition, radar cell formation, and simulated refueling and airdrop missions. Training takes approximately 26 weeks and includes about 185 hours of ground training, 45 hours in the flight simulator and 100 flying hours in the T-1A.

The helicopter track trains in the UH-1 Huey utility helicopter for follow-on assignments in special operations, rescue, missile site support, and distinguished personnel support missions. The helicopter track transitions students from fixed wing to rotary-winged flight. The initial phase consists of basic helicopter flying including takeoff and landing, hovering, and emergency procedures. Advanced training consists of instruments, day tactics, and night tactics including night vision goggle training. Training takes approximately 24 weeks and includes 25 hours in a simulator and 110 hours of flying time."

The decision of choosing a primary training aircraft to train new military pilots to the standard at which they can go to their next training phase (advanced training) and then to operational level units has always been a challenging and important process for the military forces throughout the world. The case study focuses on this problem. What are the characteristics of an ideal primary training aircraft? This question has been asked this way "What is important to you in a primary training aircraft?", to the Air Force, Navy and Marine Corps pilots, who come from different backgrounds, different ranks, different experience levels, different ages and different perspectives.

Primary training includes general handling, stalling, spinning, solo flight, formation flying, aerobatics, and navigation at high and low levels, and various levels of instrument training. One desirable characteristic of a primary training aircraft for relatively inexperienced students is that it must be easy to fly safely, and to fly solo, in clear air and in clouds, in turbulent and smooth air, in good and bad weather, at low level and at high altitude. However, it should not be too easy to fly well enabling students to be easily assessed for ability and potential. The aircraft must react safely to typical student mistakes such as flying slightly out-of-trim or flying with less than perfect accuracy such as on the downwind leg of the traffic pattern, in the critical final turn before landing, in night flying or flying at low level. Also, when making predictably large errors, such as in aerobatics students can make incredibly creative mistakes. In such an aircraft, natural aerodynamic stability and ease of trimming are requirements rather than having a training aircraft that flies like a neutrally stable fighter and therefore difficult for student pilots to fly.

The priority in choosing the characteristics of any training aircraft is always how students will fly it, not how instructors and senior officers will enjoy it. The second part is important for instructor motivation, but teaching the student is the primary aim. Although this is perhaps obvious, it is often forgotten because the pilots who assess training aircraft before purchase (senior officers who like playing with the aircraft around the sky, which is a great relief compared to their desk work for sure) will naturally be very experienced. It is sometimes difficult for an experienced pilot to put himself back instead of an inexperienced student unless he is a current instructor with a real feeling for the failings of the student pilots.

The study includes many terms relating to the aircraft systems. All those terms are explained in Appendix-B: Aircraft Systems Terminology.

The pilots (decision makers) participating in this case study have mentioned several criteria which forms their values, such as reliability, performance, maintainability, technology, safety, flying quality, training quality, design, supporting systems and cost, which a primary training aircraft should possess in order to guarantee improvement in the skills of the trainees. These values also branch out to the sub-tier values. In order to familiarize individuals with the terms and expressions, these criteria were explained in detail in Appendix-C: The Decision Makers' Criteria.

2.6 Decision Analysis

Clemen states that "the obvious reason for studying decision analysis is that carefully applying its techniques can lead to better decisions" [6]. Each individual decision has its own defining frame. The decision analysis process helps the decision maker pick the best alternatives within the decision frame. "A decision is considered difficult due to its complexity, uncertainty in the situation, multiple objectives, different perspectives and different conclusions" [6]. Decision analysis provides structure and guidance for systematic thinking in difficult situations [6]. Decision analysis includes many procedures, methods, and tools. It helps recognizing, clearly depicting, and formally estimating the important aspects of a decision situation for addressing the recommended course. However, decision analysis is not designed to make the decision for the decision maker.

The Webster Dictionary defines analysis as "separation of a whole into its component parts". Decision analysis is the process of separating a complex decision into its component parts. It is a method of helping decision makers make simple and familiar choices. It is using a mathematical model to conclude from these choices what would the decision maker would have preferred to do in a complex, inflexible decision. Any real world decision has many different effects which are important dimensions that should be considered during the analysis and in any assessment performed afterward.

In the decision analysis literature, there are many methodologies to help one make logical decisions. In most methodologies, there is a repeating topic of breaking down or decomposing the problem to better understand the situation and to simplify the problem. Each process includes some form of the following steps: define the problem, identify objectives, develop alternatives, evaluate consequences, and evaluate tradeoffs. The problem is the challenge that must be solved, the objectives are the desired goals for achievement, the alternatives are possible solutions, the consequences are the undesirable side effects of alternatives, and tradeoffs are values that can be exchanged. Models are developed in various stages in the process, frequently involving numerical expressions to allow experts to acknowledge what is known and not known.

Decisions are hard to make and complex because of uncertainty about the outcome of the decisions and confusion about the value of various outcomes. The purpose of analysis is not to capture decisions in all their complexity. The goal of analysis is to simplify the decision enough to meet the decision maker's needs. An important challenge then is to determine how to simplify an analysis without diminishing its usefulness and accuracy.

A useful simplification is to ignore some uncertainties, so the value of an action is assumed to be more certain than it really is. In other words, the chance of an event is either near zero or one. For instance, in deciding which schools need additional funds, the decision maker might choose to assess current levels of needs and ignore the uncertainty about future needs. Of course, such simplifications are only appropriate when using them will make little difference in the results of the analysis. Alternatively, the analyst may assume that uncertainty is the only issue and that the other values and actions can be addressed without the help of analysis.

Good analysis is about the process not the numbers. One way to analyze a decision is for the analyst to conduct an independent analysis and present the results to the decision maker in a brief paper. This is usually not very helpful and emphasizes the findings as opposed to the process. Decision makers are more likely to accept an analysis in which they have actively participated.

The preferred method is to conduct decision analysis as a series of increasingly more sophisticated communications with the decision maker. At each communication, the analyst listens and summarizes the decision maker's statements. In each step, the problem is structured, and an analytical model is created. Through these cycles, the decision maker comes to certain determinations, and the analyst documents his/her conclusions.

It is difficult to evaluate the effectiveness of decision analysis because, often no information is available on what might have happened if decision makers had not followed the course of action recommended by the analysis. One way to improve the accuracy of analysis is to make sure that the process of analysis is followed accurately. Rouse and Owen suggest asking the following questions about decision analysis to determine if it was done accurately [7]:

1. "Were all realistic strategies included?"
2. "Was the appropriate type of model employed?"
3. "Were all important outcomes considered?"
4. "Was an explicit and sensible process used to identify, select and combine the evidence into probabilities?"
5. "Were utilities assigned to outcomes conceivable, and were they obtained in a methodologically acceptable manner?"
6. "Was the potential impact of any uncertainty in the probability and utility estimates thoroughly and systematically evaluated?"

These authors also point out four serious limitations to decision analysis which are important to keep in mind:

1. "Decision analysis may oversimplify problems to the point that they do not reflect the real concerns and accurately represent the perspective from which the analysis is being conducted."

2. "Available data simply may be inadequate to support the analysis."

3. "Utility assessment, in particular assessment of quality of life, may be problematic."

4. "Outcomes of decision analysis are not agreeable to traditional statistical analysis. Strictly by the principles of decision analysis, the preferred strategy or treatment is the one that yields the greatest utility (or maximizes the occurrence of favorable outcomes) no matter how narrow the margin of improvement."

In the end, the value of decision analysis (with all of its limitations) is in the eye of the one who regards. If the decision maker can understand and have new insights into a problem, and if the problem and suggested course of action can be documented and communicated to others more easily, a decision maker may judge decision analysis, even imperfect analysis, as useful.

2.7 Value Focused Thinking

The methodology for this research is a decision analysis technique called value focused thinking (VFT). Traditional decision making concentrates on the alternatives and their potential outcomes. However, the VFT process focuses on the values of the decision maker rather than the alternatives that are already available at hand. Keeney states that "alternatives are only means to achieve objectives" [23]. "Values are the fundamental objectives that the decision seeks to achieve, so they should be the focus of analysis" [22]. "This is considered a proactive rather than reactive method of examining the problem" [23].

Fundamental objectives refer to the objectives underlying the essential reasons for the problem being under consideration while means objectives are regarded as those whose fulfillment will help achieve the fundamental objectives. To perform this step, Keeney's "Why is this important?" test is done. Each objective is evaluated against this question, and if an objective is found to be important because it helps achieve another objective, it is categorized as a means objective. Otherwise it is a fundamental objective.

There are two primary methods of thinking about decisions: alternative focused thinking and value focused thinking. The difference between the two is simple. Alternative focused thinking (AFT) considers the available alternatives and subsequently compares them to each other, while value-focused thinking (VFT) compares alternatives to organizational values. As expressed by Keeney, "value focused thinking implies that one determines what is important and subsequently figures out how to get it" [22]. While making decisions based only on available alternatives gets the job done, it constrains the ability of an individual or organization to achieve their true values. Keeney summarizes the fundamental difference between alternatives and values as "the values that are fundamentally important in any decision situation. Alternatives are relevant only because they are the means to achieve the values." [22].

He continues to indicate that "consequences are the result of decisions, and the desirability of consequences is a concept based on values" [22].

Kirkwood explains clearly the four primary uses of the VFT process as an important tool. First, "it assists organizations in collecting appropriate information". That is, it highlights what is important, by means of allowing an organization to focus on collecting relevant information that is outside the decision maker's concern. Second, "when there are no previously present alternatives, the VFT process facilitates focused brainstorming that leads to the development of alternatives which address values important to a decision". Third, "the VFT process provides clear communication". It demonstrates to the ones who hold a share or interest what the decision makers consider important. It facilitates the objective defense of specific alternative selections. Finally, "the VFT process provides the model for evaluating, and subsequently ranking, the alternatives with respect to the value added to an organization (or individual)" [25].

The process used in this research was the ten step process shown in Figure 2.1. In the first step, the fundamental problem is identified. This helps to focus the analysis on exactly what the decision maker is trying to achieve. The value hierarchy is created in the second step. All of the decision maker's values are identified and then organized into a hierarchy. The tiers of a value hierarchy show the relative importance of the evaluation considerations. The most important values should be in the first tier; these values are further decomposed into various tiers of sub-values. Kirkwood emphasizes that "the value hierarchies should be complete, non-redundant, decomposable, operable and relatively small" [25]. A value hierarchy contains evaluation considerations, objectives, and evaluation measures. In the third step, the means to measure the lowest tier values are determined. The scale used to score an evaluation measure can be natural or constructed and direct or proxy. Kirkwood says that "profit in dollars is a natural scale and gross national product as a measure of economic well-being is a proxy scale" [25]. In the fourth step, the decision maker creates value functions for each measure. The y-axis will have a range of zero to one, and the x-axis will be the potential range of each measure. This step not only normalizes the measures, but also encourages the decision maker to realistically think about the measures and determine what quantities are desirable. In the fifth step, the decision maker determines weights for each value and measure in the hierarchy. In this step, they are identifying how important a value is relative to the other values in the hierarchy. In the sixth step, alternatives are generated. In the seventh step, the scoring of the alternatives by evaluating each alternative is done against the measures.

After creating the hierarchy and scoring the alternatives, analysis can begin as outlined by Keeney. In the eighth step, deterministic analysis is performed for each alternative by adding the weighted value of the measure score to produce an overall score. The alternatives with higher values are preferred over those with lower values. In the ninth step, a sensitivity analysis is performed to determine how sensitive the alternatives are to changes in the weights of the hierarchy. For each value and measure, the weight is varied to see how the ranking of alternatives changes. Finally in the tenth step, recommendations for the most preferred alternatives are made [22]. The

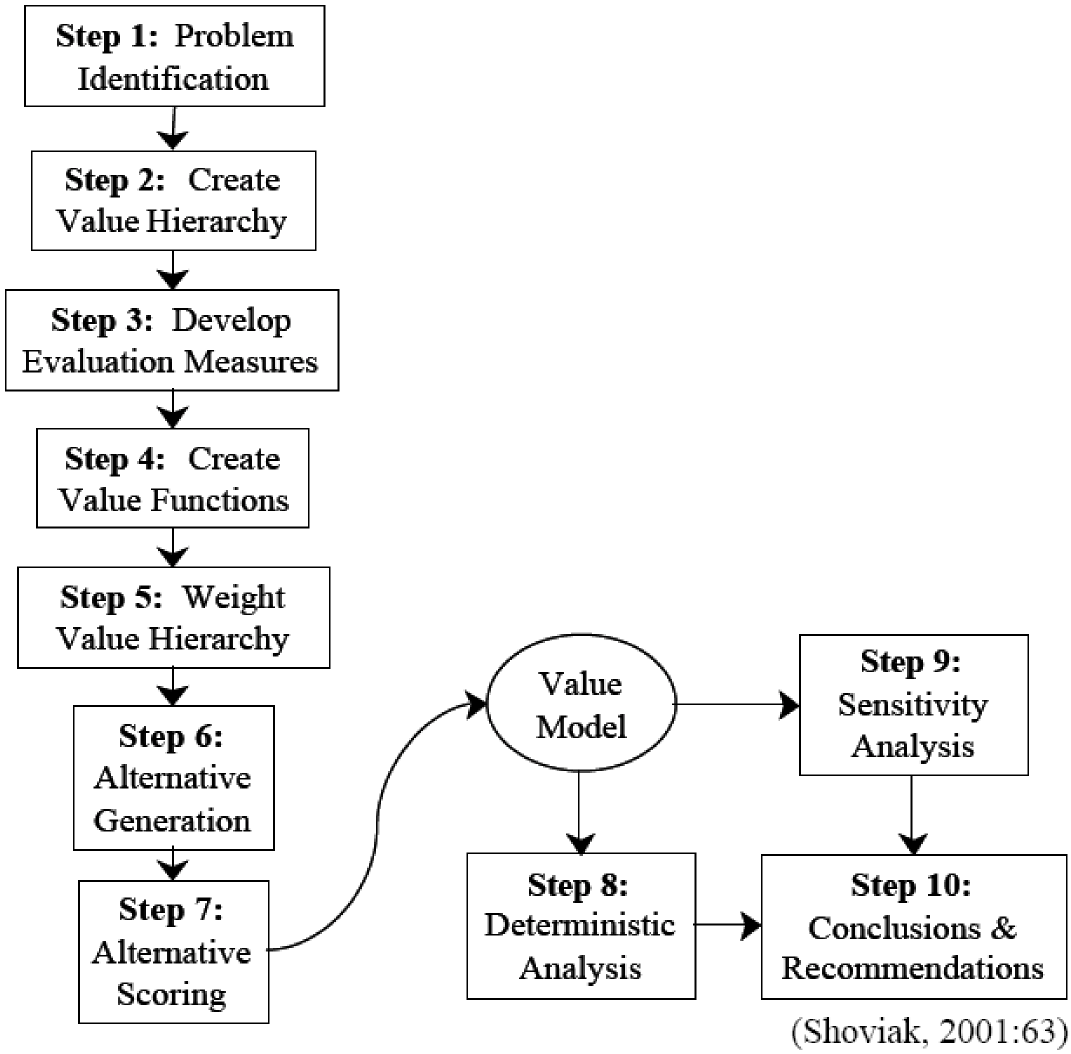

Figure 2.1: Value Focused Thinking Process

result of this process is identification of alternatives that reflect and fulfill the decision maker's values.

Kirkwood states that "the value focused thinking helps to create better alternatives for decision problems" [25]. Alternative focused thinking is a reactive approach. "A decision problem arises, and alternatives are generated to solve that problem which result in a limited pool of alternatives" as stated by Keeney [23]. Conversely, for VFT, the fundamental values of the decision maker are identified first, so actions can be taken to achieve those values. In Step 6 of the ten step process, alternatives are generated based on the value hierarchy. The result is a pool of more creative alternatives that better reflect the decision maker's values. Keeney expresses that "the value focused thinking helps to develop an enduring set of guiding principles for an organization" [23]. Whether there is a decision opportunity or not, it is useful for an organization to list and organize its fundamental objectives. "For many, simply listing their values allows for more focused actions to achieve those values" as stated by Kirkwood [25].

VFT allows the decision maker or the analyst the ability to focus his/her efforts on assembling the right information for the problem according to what was identified as being important. VFT process is also helpful in creating the suitable alternatives in situations where previously existing alternatives are not readily available. By using VFT, all the important considerations are taken into account for all involved. This is especially important when the decision problem is large enough to have many people involved in the outcome. To end with, VFT concentrates on determining the values at the core of the decision.

III. Methodology

3.1 Overview

This chapter describes how the topics and methods from Chapter 2 were applied to the value-focused thinking based individual versus group decision problem on the case study. The value-focused thinking process is detailed in creating the individual and group hierarchies for the case study question. While creation of the individual hierarchies was not a complicated process, there was difficulty in the group session in coming up with consensus over scoring the measures which was already the main observation purpose of the research topic. Group and individual decision processes have been discussed on an interesting topic which every country's Air Force faces: What is the best primary training aircraft for pilot training? The decision makers were all seasoned military pilots who are from different ranks, ages, experience levels, forces and countries. The best primary training aircraft hierarchies for the individuals and the group are constructed throughout the chapter as the process steps are described. After following the steps dictated in VFT method through chapter-3, evaluating the individual decisions versus group decision, will be analyzed in step-8: Deterministic Analysis in chapter-4. The discussion will be made on whether the individual decisions differ from the group decision on the same topic together with the resulting decision and the suggestions will be presented on the case study topic: *the best primary training aircraft* by the end of chapter-4.

3.2 Problem Identification

Problem identification is very important to clearly establishing the focus of the decision making process; it is often the most difficult, and always the most important step. Primary flight training is the most significant part of the flight training program. Some considerations for choosing a primary training aircraft might be that it is safe enough for relatively inexperienced students to fly solo in clear air and in clouds, in turbulence and in smooth air, in good and bad weather, at low level and at altitude. The aircraft must react safely to typical student mistakes such as flying slightly out of trim or flying with less than perfect accuracy, such as on the downwind leg in the circuit, in the critical final turn before landing, in night flying or in flying at low altitude. Due to the importance of choosing the best primary trainer for primary flight training, decision makers were asked: "What is important to you in a primary training aircraft in order to choose the best primary trainer?" The decision makers play a key role in this process since they are typically the ones faced with the requirement to solve the problem. For this research, however, a problem was initially identified through the literature review presented in the previous chapter. This made it very important to ensure that the problem initially identified was identified correctly. This step was further complicated by the fact that making such a decision for any military force is not realistic with a single decision maker. To address this decision maker problem, 15 decision makers, who can expectedly become a potential member of any procurement phase for the forces they serve, were used the values obtained from these DMs are assumed to represent the essential values held by operational users of that primary training aircraft. The decision makers (DMs) participating in this research were 2 Lieutenant Colonels from the USAF, 5 Majors from USAF, 1 Major from USMC, 3 LCDRs from USN and 4 First Lieutenants from TUAF (Turkish Air Force) with different service years and experience levels (from both academic and operational perspective).

3.3 Step-2: Create the Value Hierarchy

Generating the values related to the overall objective and then organizing them into a value hierarchy is the next step after clearly identifying the problem. The silver standard was the initial method used for identifying the values from the decision makers, who are also subject matter experts. Parnell et al. [13] define three standards for developing multiple-objective value models: platinum, gold, and silver standard. A platinum standard process uses interviews with senior stakeholders and decision makers to determine the objectives. A gold standard process determines the objectives from policy or strategic planning documents approved by the decision makers. The silver standard uses interviews with subject-matter experts and stakeholder representatives. This project used the silver standard method. As the decision makers did not consist of the top level military officials with the authority and budget to acquire the new primary trainer, the desired end result of the decision process was an identification of the values and preferences at the user level that could give a robust beginning point for the future acquisition process.

The following concepts were defined for each DM:

Decision: An allocation of resources whose change would be costly.

Decision Analysis: Discipline for evaluating complex alternatives by systematically examining decisions, uncertain variables and preferences (value, risk and time).

Purpose of DA: Provides insight to decision makers faced with hard problems.

Structure of Strategic Decisions: Composes of values (What do we want?), information (What do we know?) and alternatives (What can we do?). The key idea is using our strategic values to create decision opportunities.

Change to Thinking: The classical thinking process (Alternative Focused Thinking) starts with the present alternatives and implements and evaluation among those whereas Value Focused Thinking adds new alternatives to the eixsting at hand in order to cover all the values of the decision maker and then implements the evaluation among those. It doesn't focus on the alternatives. It does focus on the values.

Value Focused Thinking (VFT) Approach: Guides to strategic thinking, facilitates involvement in multiple-stakeholder decisions and uncovers hidden objectives.

DA Applications: Private (automotive; General Motors, Ford, oil & gas; Chevron, Phillips Petroleum, pharmaceutical; Eli Lilly, R & D portfolios, etc.), public (DOD; Army, Air Force, Navy, Intel Agencies, DOE; nuclear waste, hazardous chemicals, NASA, public utilities, etc.)

VFT methodology: 10-Step VFT process. [33]

After they had a clear idea of VFT, the DMs were asked the question: ”If you had no limitation at all, what would your objectives be in a primary training aircraft?”. They were asked to answer the question, under the circumstances that they had no limitations. If they could have anything they wanted, what would they desire in a primary training aircraft? Also some alternative questions were created, such as ”What are some problems or missing parts in the current training aircraft that they would want corrected in future trainers?”, to help the brainstorming. Each DM provided his wish list in a primary training aircraft (Typically capable of high subsonic speeds, high-energy maneuvers, and equipped with systems that simulate modern weapons and surveillance or more advanced training. Examples of such trainer aircraft include the T-38 Talon (actually capable of supersonic speeds), the BAE Hawk, the Alpha Jet and the Aero L-39, which are used to develop piloting, navigational or weapon-aiming skills in military pilots who progress to training for ”fast jet” flying and will then progress to a jet trainer.) Thus, a wish list has been created for every individual decision maker. An individual value hierarchy was constructed for each DM.

The entire list of the values given by the decision makers are listed below in Table 3.1.

Table 3.1: Entire List of Values

TOP TIER VALUE	SUBTIER VALUE
DESIGN	User Friendly / Throttle
	User Friendly / Avionics
	Simplicity / Standardized Cockpit
	Simplicity / Emergency Procedures
	Robustness / Landing Gears
	Robustness / Airframe Lifetime
	Ergonomics / Cockpit
	Ergonomics / Visibility
	Ergonomics / Noise Level
	Ergonomics / ECS
	Systems Complexity
	Systems Dependency / Engine Start
	Upgradeability
	Styling
	Deactivation Capability
PERFORMANCE	Endurance
	Thrust
	Fuel Efficiency
	Speed
	Range
	Ceiling
	Max Take-off Runway Length
	Power Loading
RELIABILITY	Mean Time Between Failures (MTBF)
MAINTAINABILITY	Mean Time Between Maintenance (MTBM)
	Time Between Overhaul (TBO)
	Recording Capacity
	Maintenance Specialty Requirement
	Civilian Airports Cross Service
SAFETY	Total Safety Incidents (Class A,B,C)
	Engine
	Ejection Seat
	Hook
	Drag Chute
	Collision Avoidance System
FLYING QUALITY	Recoverability
	Stability
	Maneuverability / Roll Rate
	Maneuverability / G_Capacity
	Handling Quality Rating
	Flight Path Stability
TRAINING QUALITY	Instrument Flight
	Formation Flight
	Low Level Flight
	Aerobatics
	Ground Handling
TECHNOLOGY	Consistency With Current
	NAVAIDS
	Comm System
	Radar
COST	Maintenance Cost
	Aircraft Price
SUPPORTING SYSTEMS	Synthetic Training System
	Debriefing System
	Life Support Materials / G-Suit

The initial layout of the decision makers' hierarchies was developed with the use of the silver standard and submitted to the decision makers for their approval. The first interviewed DM: DM-3 (DMs are listed in alphabetical order based on their last names), has given his wish list, which included a user friendly aircraft with easy-to-use throttle and avionics, the ability to forgive inexperienced pilots with its stability, low maintenance, high reliability, safety and enough endurance to provide adequate sortie time to be able to teach the student all the sortie requirements. His values were organized in the value hierarchy below in Figure 3.1.

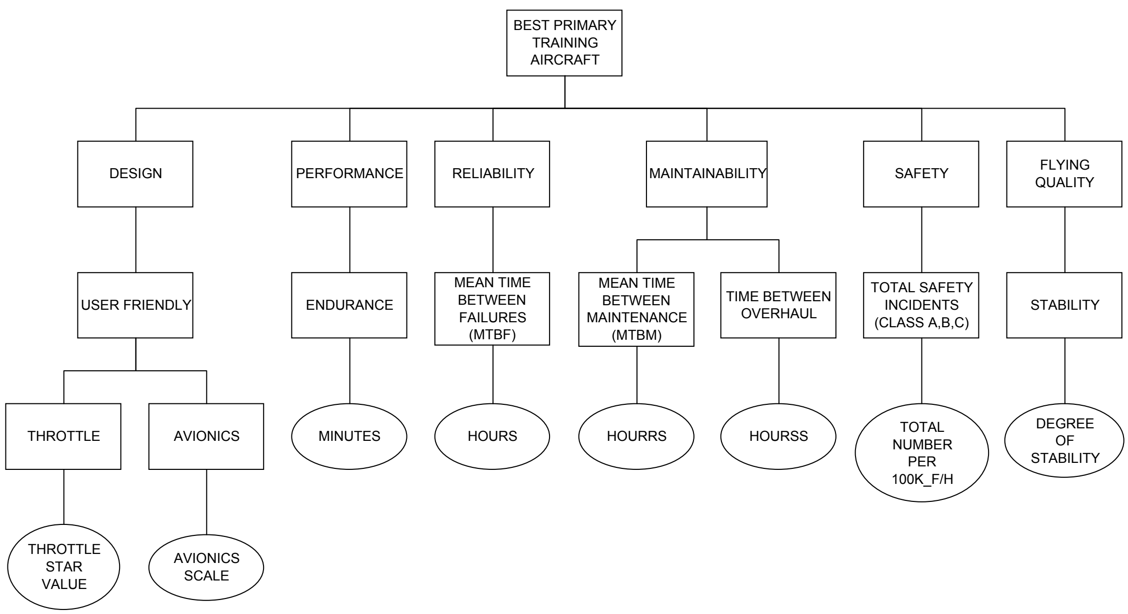

Figure 3.1: DM-3 Value Hierarcy

From this hierarchy, some of the values (i.e. user-friendly, stability) were placed under some other values. Even though the "User Friendly" is one of his main values, it is placed under "Design" in order to make it look more understandable for someone who is not familiar with those terms. "Stability" is placed under "Flying Quality".

Apparently, when all the DMs are taken into consideration, "User Friendly" is not the only value which is under "Design". It's only one out of 9 values meant by 15 DMs (User Friendly, Simplicity, Robustness, Ergonomics, Systems Complexity, Upgradeability, Styling and Deactivation Capability), which can be grouped under "Design". This is a preference in creating the hierarchy to make it look more organized.

After constructing all the individual hierarchies and determining the evaluation measures, the group came together in order to implement the same process altogether. After accomplishing all the interviews with the DMs to create their individual hierarchies, the group session was held on the 13th of December, 2007. The same process has been applied to the group as it was for the individuals. The group was asked to create a wish list in the first 10 minutes of the session. The group's values were organized in the value hierarchy shown in Figure A.1 in Appendix-A.

Though the top-tier values varied slightly among the decision makers' individual hierarchies, there were common values within each of them. Design, performance, reliability, maintainability, safety, flying quality, training quality, technology, cost and supporting systems were the main and most important values for a primary training aircraft selected by the decision makers. Each of these top tier values in return has lower tier values to specify further what the decision makers determined to be important in evaluating the primary training aircraft, leading to mutually exclusive, collectively exhaustive measures. A definition of each value has been presented in Appendix-C in detail.

Design embraces the concept of bringing together all of the aspects of airframe and gear robustness, simplicity of operational procedures, ergonomics, systems complexity and dependency on other systems, upgradeability of the systems, style and user friendliness. Design, as a top-tier value, has been covered by 15 out of 15 DMs.

Performance comprises endurance, thrust, speed, range, service ceiling, maximum take-off runway length, fuel efficiency and power loading which may also be known as power/weight ratio. Performance, as a top-tier value, has been covered by 13 out of 15 DMs.

Reliability, as the ability of a system or component to perform its required functions under stated conditions for a specified period of time, is measured by MTBF (Mean Time Between Failures) which assumes that a system is renewed or fixed after each failure and then returned to service immediately after failure. Reliability, as a top-tier value, has been covered by 6 out of 15 DMs.

Maintainability measures the ease and speed with which a system can be restored to operational status after a failure occurs. It is quantified mainly in terms of MTBM (Mean Time Between Maintenance), but also covers TBO (Time Between Overhaul), recording capacity of the system, maintenance specialty requirements, and civilian airports cross-service as the other components in the sub-tier contributing to maintainability. Maintainability, as a top-tier value, has been covered by 9 out of 15 DMs.

Safety comprises the total safety incident history (class A & B & C), number of engines, ejection seat availability and quality, collision avoidance system availability, hook and drag chute systems availability in the second tier. Safety, as a top-tier value, has been covered by 10 out of 15 DMs.

Flying quality includes stability, recoverability, maneuverability (roll rate and g-capacity), handling quality rating (Cooper-Harper score), and flight path stability. Flying quality, as a top-tier value, has been covered by 15 out of 15 DMs.

Training quality includes instrument, formation, low-level, aerobatics flight training and ground handling quality. Training quality, as a top-tier value, has been covered by 5 out of 15 DMs.

Technology includes NAVAIDS, communication system, radar (if available) and consistency level of those systems with the current systems in use. Technology, as a top-tier value, has been covered by 10 out of 15 DMs.

Cost includes the maintenance cost and the aircraft price. Cost, as a top-tier value, has been covered by 4 out of 15 DMs. Supporting systems include the synthetic training system and debriefing system life support materials used on board (i.e. g-suit). Supporting systems, as a top-tier value, has been covered by 5 out of 15 DMs.

All the necessary, important properties of a good value model were taken into consideration while constructing the value hierarchies. For instance, every value is covered by a correctly identified measure, and each value is connected to the next higher tier in order for each hierarchy to be complete. Overlapping values have been eliminated to avoid double-counting. Eventually, the study involved all the properties that proved to be important to the hierarchy which must be as small as possible, understandable and explainable for each DM. The fundamental and means objectives were determined in the first part of constructing the hierarchy. The hierarchy started with the fundamental objectives and moved downward into the means objectives. Moving down the hierarchy continued until there was nothing left to ask "why is it important?" The decision was covered completely and accurately with many different tier levels of the individuals' hierarchies.

3.4 Step-3: Develop Evaluation Measures

The next step was to develop the evaluation measures for each lowest-level objective after completing the value hierarchy. The measures provide the VFT model the capability to evaluate an alternative in a quantitatively objective manner. Hence, the measure value functions must be clearly defined to eliminate variability as much as possible throughout the evaluation process. These measures were determined to best represent how to achieve the values in the hierarchy while maintaining the integrity of independence and non-redundancy. The decision makers were actively involved in the development of the measures. DM-3 (as the DM of the hierarchy shown in Figure 3.1) has offered his own measures for the user friendly throttle value under "Design" as well as the avionics. Other measures, searched and found through the literature, were presented to him as ones that he might consider to scale his values, and these were approved by him. Since all the measures were set by the end of the individual interviews, everything was ready when it came to the group hierarchy measures.

Each value was measured either quantitatively or qualitatively. These evaluation measures were based on a combination of two different classifications. The classifications are either natural or constructed, and either direct or proxy. While creating the measures, the goal was to achieve as many natural-direct or constructed-direct scales as possible and as few natural-proxy or constructed-proxy scales as possible for ease of use and understanding. Natural-direct is the best to work with because it gives a clear picture of how a value is measured and does not need any subject matter experts to construct scales or proxy measures. However, the natural, direct characteristics could not be met all the time due to the specific nature of the measures listed by some of the decision makers. All the evaluation measures, types and SDVFs are listed in Table 3.2.

Table 3.2: Subtier Values-Evaluation Measures List

SUBTIER VALUE	Measure	SDVF
User Friendly / Throttle	Throttle Star Value	Categorical
User Friendly / Avionics	Avionics Scale	Categorical
Simplicity / Standardized Cockpit	Standardization Level	Categorical
Simplicity / Emergency Procedures	Average Number of Steps in Boldfaces	Categorical
Robustness / Landing Gears	Failure Rate Per 100K F/H	Categorical
Robustness / Airframe Lifetime	Years	Continuous
Ergonomics / Cockpit	Cockpit Star Value	Categorical
Ergonomics / Visibility	Visibility Star Value	Categorical
Ergonomics / Noise Level	dB	Continuous
Ergonomics / ECS	ECS Star Value	Categorical
Systems Complexity	Complexity Level	Categorical
Systems Dependency / Engine Start	Engine Start Dependency Level	Categorical
Upgradeability	Upgradeability Level	Categorical
Styling	Styling Star Value	Categorical
Deactivation Capability	Deactivation Feature Star Value	Categorical
Endurance	Minutes	Continuous
Thrust	Lbs.	Continuous
Fuel Efficiency	Gallons Per F/H	Continuous
Speed	Knots	Continuous
Range	Miles	Continuous
Ceiling	Feet	Continuous
Max Take-off Runway Length	Feet	Continuous
Power Loading	Power/Weight Ratio	Continuous
Mean Time Between Failures (MTBF)	Hours	Continuous
Mean Time Between Maintenance (MTBM)	Hours	Continuous
Time Between Overhaul (TBO)	Hours	Continuous
Recording Capacity	Recording Capacity Level	Categorical
Maintenance Specialty Requirement	Specialty Certificate Requirement Level	Categorical
Civilian Airports Cross Service	Cross Service Support Level	Categorical
Total Safety Incidents (Class A,B,C)	Total Number Per 100K F/H	Categorical
Engine	Number of Engines	Categorical
Ejection Seat	Ejection Seat Star Value	Categorical
Hook	Hook Speed Limit	Continuous
Drag Chute	Drag Chute Speed limit	Continuous
Collision Avoidance System	Avoidance System Star value	Categorical
Recoverability	Stall Warning Before Stall Margin_Knots	Categorical
Stability	Degrees of Stability	Categorical
Maneuverability / Roll Rate	Degrees Per Second	Continuous
Maneuverability / G_Capacity	Gs	Categorical
Handling Quality Rating	Cooper Harper Score	Categorical
Flight Path Stability	Degrees Per Knot	Continuous
Instrument Flight	Instrument Flight Quality Level	Categorical
Formation Flight	Formation Flight Quality Level	Categorical
Low Level Flight	Low Level Quality Level	Categorical
Aerobatics	Aerobatics Quality Level	Categorical
Ground Handling	Ground Handling Quality Level	Categorical
Consistency With Current	Currency Scale	Categorical
NAVAIDS	NAVAIDS Scale	Categorical
Comm System	Comm System Quality Level	Categorical
Radar	Radar Capability Level	Categorical
Maintenance Cost	Hundred Dollars	Continuous
Aircraft Price	Million Dollars	Continuous
Synthetic Training System	Synthetic Trainer Star Value	Categorical
Debriefing System	Debriefing System Star Value	Categorical
Life Support Materials / G-Suit	G-Suit Quality Level	Categorical

The definitions for each of the measures are explained in Appendix-C. The decision makers determined the types of scales to be used along with upper and lower bounds. The detailed list of all evaluation measures and the scales corresponding to those measures under the toptier value "Design" are presented in Table 3.3. The rest of the evaluation measure scores for the other top tier values are shown in tables in Appendix-A.

3.5 Step-4: Create Value Functions

The next step was to create the value functions. The purpose of creating the value functions was to be able to convert the actual scores assigned to the measures to a corresponding value which represents the preference of the decision maker. This is determined by developing single dimensional value functions (SDVF), which are mathematical translations of the measures of the values for each decision maker. In Value Focused Thinking, it is important to take into account every individual decision maker's values and to agree on a specific set of evaluation measures, single-dimensional value functions , and both local and global weights.

The x-axis of the SDVFs were determined in the previous step; this step will determine the corresponding y-axis values for each category element within its respective measure. The y-axis will always range from a value of 0 (least preferred) to a value of 1 (most preferred) to represent the full range of the decision maker's value. The upper and lower bounds of the measures are the equivalent zero (lower) and one (upper) values on the SDVFs. This step converts the qualitative nature of

Table 3.3: Design-Evaluation Measures & Scores List

User Friendly / Throttle	Throttle Star Value	1. Multilever Engine Control (MLEC) 2. Mechanical Single Lever Power Control (SLPC) 3. Digital Single Lever Power Control (SLPC) 4. Combined (Mechanical+ Digital) SLPC
User Friendly / Avionics	Avionics Scale	1. No Avionics 2. Basic Flight Instruments w/ No Nav Sys 3. Navigation System w/ Manual Align 4. Navigation System w/ Auto Align 5. Computer Driven Nav Management System 6. Integrated Avionics System
Simplicity / Standardized Cockpit	Standardization Level	1. Basic 6-Pack Design 2. Common Nav / Common Comm System 3. Integrated Cockpit (Pri Inst + Essen Nav + Essen Comm) 4. Standardized Cockpit
Simplicity / Emergency Procedures	Average Number of Steps in Boldfaces	# steps
Robustness / Landing Gears	Failure Rate Per 100K F/H	# failures
Robustness / Airframe Lifetime	Flight Hours	# flight hours
Ergonomics / Cockpit	Cockpit Star Value	1. 4-Seat Cockpit 2. Side-by-Side 3. Tandem 4. Stepped Tandem
Ergonomics / Visibility	Visibility Star Value	1. Binocular Cockpit Visibility 2. Clam-Shell Type Canopy + Body-view Camera 3. Shoulder Level Canopy 4. Bubble Canopy 5. Bubble Canopy With Transparency
Ergonomics / Noise Level	dB	# dB
Ergonomics / ECS	ECS Star Value	1. No ECS 2. In-Flight Operated ECS System 3. 50% Ground Efficient + In-Flight ECS System 4. Full Ground + In-Flight ECS System 5. Upgraded ECS to Prevent Ice Accumulation, Vaporized Air
Systems Complexity	Complexity Level	1. Uncomplicated 2. Low/Moderate 3. Moderate 4. Moderate/High 5. High
Systems Dependency / Engine Start	Engine Start Dependency Level	1. APU Start 2. 1st_Engine - APU Start 2nd_Engine-By Means of Other Engine Flow 3. Battery-Power Start
Upgradeability	Upgradeability Level	1. No Upgradeability 2. Software Upgradeability 3. Modular Design - Improved 4. Modular Open System 5. Built-in Upgradeability
Styling	Styling Star Value	1. Round Shape Fuselage with Straight Low Wing 2. Bottle Shape Body Type 3. Delta Shape Body Type 4. Sharp Triangular Shape Body Type
Deactivation Capability	Deactivation Feature Star Value	1. No Deactivation Capability 2. Intercom/Radio System Deactivation Capability 3. MFD Modes Deactivation Capability 4. Stall Warning System Deactivation Capability 5. NAVAIDS Deactivation Capability

the evaluation process into quantitative data. This allows the objective analysis to be conducted later in the modeling process.

The SDVFs used in this model are either discrete or continuous. The discrete SDVFs are categorical, meaning they have a finite number of levels, and need to be represented categorically. The continuous SDVFs, which can be either linear, piecewise linear, or exponential, have an infinite number of possible levels. The continuous SDVFs are either increasing functions, having positive slopes, or decreasing functions, having negative slopes. SDVFs put these values into the same units to allow weighting to be applied correctly.

The SDVFs for each measure must be monotonically increasing, having positive slopes, or decreasing, having negative slopes. A monotonically increasing value function is one in which higher values on a measure are preferred by the decision maker. Similarly, monotonically decreasing functions are those for which lower values on evaluation measures are preferred. In the case of continuous functions, increasing functions have positive slopes, and decreasing functions have negative slopes. Figure 3.2) shows the discrete, monotonically increasing SDVF for the "Throttle Star Value" measure in DM-3's hierarchy as an example. DM-3's other 8 SDVFs for the remaining measures are included under figures in Appendix-A.

The decision makers chose a discrete or continuous scale for each evaluation measure. For those measures that were evaluated on a discrete scale, categories were determined and given an associated value by the decision makers. If a measure was determined to be continuous, the decision makers were asked to provide an upper and lower bound representing the best and worst possible scores. Some decision makers chose to use linear while some others chose exponential functions for the continuous functions based on their inclination to either the most or the least preferred side. The

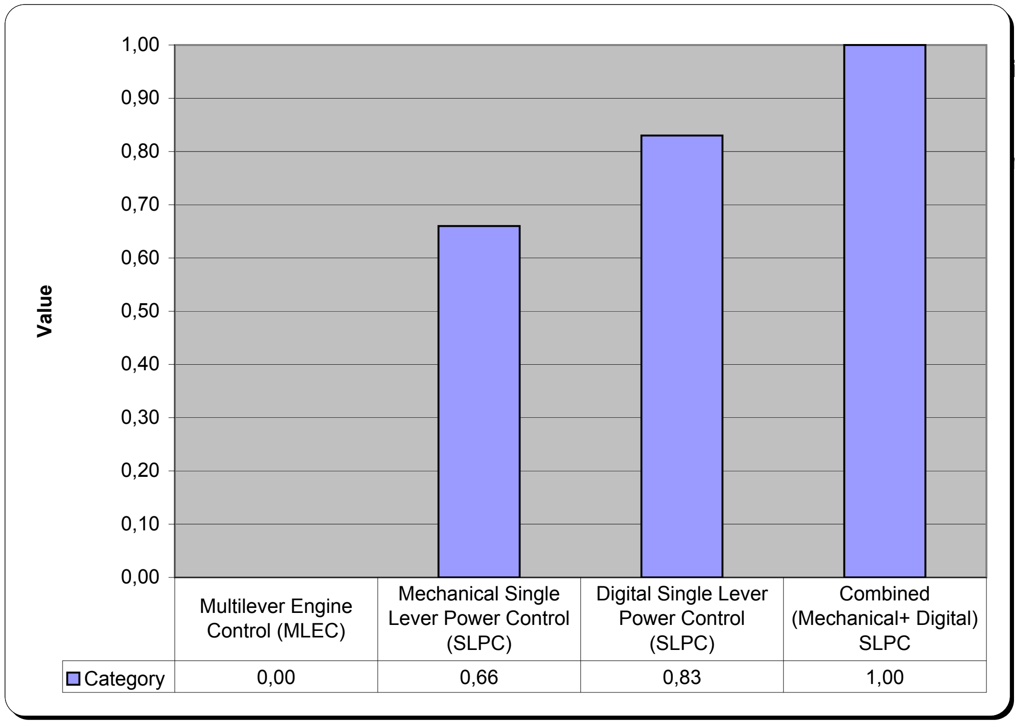

Figure 3.2: SDVF for Throttle Star Value

decision makers based the reference points and categories for the value functions on their personal knowledge and experience.

The process of creating value functions was difficult and took several iterations due to its subjective nature. The decision makers were inclined to assess different categories within the same measure as the same value. After an explanation that an exact value rating for two different categories within the same measure is essentially equating those categories, the decision maker quickly changed the preference values to ensure a differentiation between the categories. The group session was easier from this point, since all the decision makers had a clear idea of the exact value ratings for two different categories from their individual session. On the other hand, the difficulty of the group session was in coming up with consensus over scoring the measures, which was already the main observation purpose of the whole research topic.

VFT as a method of DA has been applied step by step in chapter-3 in order to acquire the DMs' values, evaluation measures and resulting scores, which were then used as the empirical data that yields direct information on the acceptability of the null hypothesis that there is no concordance between group decision making and individual decision making, to run the analysis for evaluating the individual decisions versus group decision. Our decision abut the meaning of the data would lead us to retain, revise or reject the hypothesis. The analysis has been conducted in chapter-4 in order to determine the acceptability of hypothesis. By the end of chapter-4, the discussion has been made on whether the individual decisions differs that much from the group decision on the same topic. The resulting decision and the suggestions on the case study topic: the best primary training aircraft have also been expressed by the end of chapter-4.

After the DMs provided their values, evaluation measures and ranges for the corresponding values were constructed. These ranges, increments, and values were all subjective and based on the DM's individual preference. For the other measures, value increments were used, and the DM was asked which increments were more important than others. In constructing value increments, the least preferred increment is scored at level k, and the rest of the increments are scored based on the least preferred (i.e. two times more important, equal importance). Each k was added to the next and set equal to one. Knowing this information, k can be computed and a value can be placed on each increment.

3.6 Step-5: Weight the Value Hierarchy

After the SDVFs have been created, the DMs were interviewed one last time individually for weighting the value increments and the measures within the hierarchy to score the different alternatives. The purpose of weighting the hierarchy is to apply priorities to the evaluation measures that reflect the importance of each value to the decision maker. The method of swing weighting was used to help the DM determine which value increments were more important than the others.

Local and/or global weighting are two ways to look at this prioritization process. The local weights are determined by examining only the values within the same tier of a branch; the local weights must sum to one. The global weights display how much a particular value contributes to the overall value of an alternative. The swing weighting (or the value increment procedure) was used for this analysis. The swing weighting method begins with the evaluation measures placed from the least to greatest value. Each measure is then represented as a multiple of the least important value measure. All weights are then summed to one, and the resulting equation is solved for the weight of the least valued measure.

In this research, the decision makers determined the weights of the values and measures using a top-down approach. Once they agreed upon the weight values, the local weights were used to calculate the global weights. The local and global weights were applied to the value hierarchies in their entirety. The weightings for each individual and group hierarchy were determined using the swing weight procedure.

The measure "Ejection Seat Star Value" of the value "Ejection Seat" under the top-tier value of "Safety" is the most significant measure in global weighting, which has been weighted globally by 3 decision makers with the highest number. This is to be expected since safety is always going to be a significant factor in training relatively unexperienced pilots or pilot candidates. The measures "Total Number of Safety Incidents per 100K F/H" under the top-tier value of "Safety" and "Endurance in Minutes" under the top-tier value of "Performance", "MTBF in Flight Hours" under the top-tier value of "Reliability", and "Synthetic Trainer System Star Value" under the top-tier value of "Supporting Systems" are the second most significant measures in global weighting, which has been outweighted globally by 2 decision makers. Other than those measures, "Aerobatics Quality Level" under the top-tier value of "Training Quality", "MTBM in Flight Hours" under the top-tier value of "Maintainability", "Maintenance Cost in Hundred Dollars" under the top-tier value of "Cost", "Debriefing System Star Value" under the top-tier value of "Supporting Systems", "Cockpit StarValue" of the value "Ergonomics" under the top-tier value of "Design", "Roll Rate in Degrees per Second" of the value "Maneuverability" under the top-tier value of "Flight Quality", "Instrument Flight Quality Level" under the top-tier value of "Training Quality", and "Fuel Efficiency in Gallons per Flight Hour" under the top-tier value of "Performance" are the other significant measures in global weighting, which has been outweighted globally by 1 decision maker. These are the measures that the decision makers consider the most important in a primary training aircraft.

These measures can be considered the significant attributes. Every competing primary training aircraft is expected to have high scores within these measures as they represent a large portion of what the decision maker values. If the competition is strong, it would not be unusual for several alternatives to be rated evenly based on these measures. The other evaluation measures do not hold significantly high global weights; however, their importance is still significant. These measures are still considered necessary by the decision makers; they just happen to not be rated as important as the top measures. What makes these other measures significant is that they can help to differentiate between highly competitive alternatives. If two or three alternatives score evenly throughout the outweighting measures, those other measures will allow selection of the top alternative.

3.7 Step-6: Alternative Generation

After weighting the hierarchy, the next step was to generate the alternatives. Real world alternatives could change the results either way according to the recommendations in the conclusion part of the study ”Evaluating the need for Group Decision Making versus Individual Decision Making in Value-Focused Thinking” [32]. The real primary training aircraft alternatives, not only the current ones in use or future candidates, but also the old alternatives which have previously been used as a primary trainer. T-34C (Hawker-Beechcraft), T-37B (Cessna), T-35 Pillan (ENAER), KT-1C (KAI), EMB.312 (Embraer), T-6A Texan II (Hawker-Beechcraft) have been selected as the alternatives. The required data have been gathered from open sources (i.e. internet, Jane's) and companies' official representatives who are authorized to disclose the information relating to their aircraft. All the data has been inserted into the measures-alternatives table, showing the primary training aircraft alternatives considered for evaluation. Below in Table 3.4 is the part of this data for the T-6A Texan II aircraft. The detailed list of data for all the alternative aircrafts, including the sources where the data came from is presented in Appendix-A.

3.8 Step-7: Alternative Scoring

The final step before conducting analysis was to score the alternatives. As stated in the previous step, the required data was obtained through several sources. This data was used to score each primary trainer according to the single dimension value functions developed for each measure in the hierarchy of each DM and group. Below is DM-3's alternative scoring as a complete list in Table 3.5 and summary list in Table 3.6.

Table 3.4: T-6A Texan II Values-Measures-Scales List

VALUE		MEASURE	SCALE
DESIGN	User Friendly / Throttle	Throttle Star Value	Digital SLPC
	User Friendly / Avionics	Avionics Scale	Integrated Avionics System
	Simplicity / Standardized Cockpit	Standardization Level	Advanced Cockpit Layout
	Simplicity / Emergency Procedures	Average Number of Steps in Boldfaces	2
	Robustness / Landing Gears	Failure Rate Per 100K F/H	2
	Robustness / Airframe Lifetime	Years	37 Years (18,720 Flight Hours)
	Ergonomics / Cockpit	Cockpit Star Value	Tandem
	Ergonomics / Visibility	Visibility Star Value	Clam-shell Type Canopy
	Ergonomics / Noise Level	dB	90 dB
	Ergonomics / ECS	ECS Star Value	Upgraded ECS to Prevent Ice Accumulation, Vaporized Air
	Systems Complexity	Complexity Level	Moderate
	Systems Dependency / Engine Start	Engine Start Dependency Level	Battery Power Start
	Upgradeability	Upgradeability Level	Built-in Upgradeability
	Styling	Styling Star Value	Round Shape Fuselage with Straight Low Wing
	Deactivation Capability	Deactivation Feature Star Value	MFD Modes Deactivation Capability
PERFORMANCE	Endurance	Minutes	180 min.
	Thrust	Lbs.	3400 lbs.
	Fuel Efficiency	Gallons Per F/H	55 gallons/FH (400 lbs/FH)
	Speed	Knots	350K
	Range	Miles	850 NM
	Ceiling	Feet	31000 ft.
	Max Take-off Runway Length	Feet	1435 ft.
	Power Loading	Power/Weight Ratio	0.523 (3400lbs/6500 pounds)3.60 kg/kW (5.91 lb/shp
RELIABILITY	Mean Time Between Failures (MTBF)	Hours	25 FH
MAINTAINABILITY	Mean Time Between Maintenance (MTB	Hours	10 FH
	Time Between Overhaul (TBO)	Hours	4,500 Hour TBO for Engine
	Recording Capacity	Recording Capacity Level	FDR
	Maintenance Specialty Requirement	Specialty Certificate Requirement Level	No Specialty-Certificate Maintenance Requirement
	Civilian Airports Cross Service	Cross Service Support Level	Stage-A Cross Serviceable
SAFETY	Total Safety Incidents (Class A,B,C)	Total Number Per 100K F/H	21 (3 Class-A over 800K F/H ; Class-B,C - 18)
	Engine	Number of Engines	1
	Ejection Seat	Ejection Seat Star Value	Zero/Zero Ejection Seat
	Hook	Hook Speed Limit	N/A
	Drag Chute	Drag Chute Speed limit	N/A
	Collision Avoidance System	Avoidance System Star value	TCAS
FLYING QUALITY	Recoverability	Stall Warning Before Stall Margin_Knots	5 K
	Stability	Degrees of Stability	Normally (positively) stable
	Maneuverability / Roll Rate	Degrees Per Second	260 degrees/sec
	Maneuverability / G_Capacity	Gs	+7 / -3.5
	Handling Quality Rating	Cooper Harper Score	2
	Flight Path Stability	Degrees Per Knot	0.06 (Level-1
TRAINING QUALITY	Instrument Flight	Instrument Flight Quality Level	Radio Instrument Flight Training
	Formation Flight	Formation Flight Quality Level	Cruise + IFR Formation Flight Training
	Low Level Flight	Low Level Quality Level	AGL-500' / 300K
	Aerobatics	Aerobatics Quality Level	Chndll+Hmmrhd+Loop+Immlmn+Cbn8+Spin
	Ground Handling	Ground Handling Quality Level	Steering With ON/OFF Buttor
TECHNOLOGY	Consistency With Current	Currency Scale	Adv Inst Panel + Adv Nav Sys
	NAVAIDS	NAVAIDS Scale	GPS+TACAN+ILS+INS
	Comm System	Comm System Quality Level	UHF+VHF
	Radar	Radar Capability Level	No Radar Capability
COST	Maintenance Cost	Hundred Dollars	$ 198 (2.06 MMH/FH)
	Aircraft Price	Million Dollars	$ 4.27 M
SUPPORTING SYSTEMS	Synthetic Training System	Synthetic Trainer Star Value	Full Simulator
	Debriefing System	Debriefing System Star Value	Digital Video Debriefing System (DVDS)
	Life Support Materials / G-Suit	G-Suit Quality Level	Standart Anti-G Sui

Table 3.5: DM-3 Alternatives Scoring Complete List

VALUE		MEASURE		ALTERNATIVE SCORES						WEIGHTED SCORES					
			Global Weight	T-34C	T-37B	T-6A	EMB.312	KT-1C	T-35	T-34C	T-37B	T-6A	EMB.312	KT-1C	T-35
DESIGN	User Friendly / Throttle	Throttle Star Value	0,0860	0	0,66	0,83	0,66	1	0,66	0,0000	0,0568	0,0714	0,0568	0,0860	0,0568
	User Friendly / Avionics	Avionics Scale	0,1290	0,7	0,7	1	1	1	0,7	0,0903	0,0903	0,1290	0,1290	0,1290	0,0903
	Simplicity / Standardized Cockpit	Standardization Level													
	Simplicity / Emergency Procedures	Average Number of Steps in Boldfaces													
	Robustness / Landing Gears	Failure Rate Per 100K F/H													
	Robustness / Airframe Lifetime	Years													
	Ergonomics / Cockpit	Cockpit Star Value													
	Ergonomics / Visibility	Visibility Star Value													
	Ergonomics / Noise Level	dB													
	Ergonomics / ECS	ECS Star Value													
	Systems Complexity	Complexity Level													
	Systems Dependency / Engine Start	Engine Start Dependency Level													
	Upgradeability	Upgradeability Level													
	Styling	Styling Star Value													
	Deactivation Capability	Deactivation Feature Star Value													
PERFORMANCE	Endurance	Minutes	0,2140	1	1	1	1	1	1	0,2140	0,2140	0,2140	0,2140	0,2140	0,2140
	Thrust	Lbs.													
	Fuel Efficiency	Gallons Per F/H													
	Speed	Knots													
	Range	Miles													
	Ceiling	Feet													
	Max Take-off Runway Length	Feet													
	Power Loading	Power/Weight Ratio													
RELIABILITY	Mean Time Between Failures (MTBF)	Hours	0,1430	0,5352	0,7135	0,4037	0,2043	0,4636	0,5677	0,0765	0,1020	0,0577	0,0292	0,0663	0,0812
MAINTAINABILITY	Mean Time Between Maintenance (MTBM)	Hours	0,1000	0,3838	0,5	0,5	0,7096	0,5	1	0,0384	0,0500	0,0500	0,0710	0,0500	0,1000
	Time Between Overhaul (TBO)	Hours	0,0430	1	1	1	1	1	1	0,0430	0,0430	0,0430	0,0430	0,0430	0,0430
	Recording Capacity	Recording Capacity Level													
	Maintenance Specialty Requirement	Specialty Certificate Requirement Level													
	Civilian Airports Cross Service	Cross Service Support Level													
SAFETY	Total Safety Incidents (Class A,B,C)	Total Number Per 100K F/H	0,1420	0	0	0	0	0	0	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000
	Engine	Number of Engines													
	Ejection Seat	Ejection Seat Star Value													
	Hook	Hook Speed Limit													
	Drag Chute	Drag Chute Speed limit													
	Collision Avoidance System	Avoidance System Star value													
FLYING QUALITY	Recoverability	Stall Warning Before Stall Margin_Knots													
	Stability	Degrees of Stability	0,1430	1	1	1	1	1	1	0,1430	0,1430	0,1430	0,1430	0,1430	0,1430
	Maneuverability / Roll Rate	Degrees Per Second													
	Maneuverability / G_Capacity	Gs													
	Handling Quality Rating	Cooper Harper Score													
	Flight Path Stability	Degrees Per Knot													
TRAINING QUALITY	Instrument Flight	Instrument Flight Quality Level													
	Formation Flight	Formation Flight Quality Level													
	Low Level Flight	Low Level Quality Level													
	Aerobatics	Aerobatics Quality Level													
	Ground Handling	Ground Handling Quality Level													
TECHNOLOGY	Consistency With Current	Currency Scale													
	NAVAIDS	NAVAIDS Scale													
	Comm System	Comm System Quality Level													
	Radar	Radar Capability Level													
COST	Maintenance Cost	Hundred Dollars													
	Aircraft Price	Million Dollars													
SUPPORTING SYSTEMS	Synthetic Training System	Synthetic Trainer Star Value													
	Debriefing System	Debriefing System Star Value													
	Life Support Materials / G-Suit	G-Suit Quality Level													
														KT-1C	
		GLOBAL WEIGHT TOTAL -------->	1,000	RESULTING SCORES ---------->						0,6052	0,6991	0,7081	0,6859	0,7313	0,7282

Table 3.6: DM-3 Alternatives Scoring Summary List

VALUE		MEASURE		ALTERNATIVE SCORES						WEIGHTED SCORES					
			Global Weight	T-34C	T-37B	T-6A	EMB.312	KT-1C	T-35	T-34C	T-37B	T-6A	EMB.312	KT-1C	T-35
DESIGN	User Friendly / Throttle	Throttle Star Value	0,0860	0	0,66	0,83	0,66	1	0,66	0,0000	0,0568	0,0714	0,0568	0,0860	0,0568
	User Friendly / Avionics	Avionics Scale	0,1290	0,7	0,7	1	1	1	0,7	0,0903	0,0903	0,1290	0,1290	0,1290	0,0903
PERFORMANCE	Endurance	Minutes	0,2140	1	1	1	1	1	1	0,2140	0,2140	0,2140	0,2140	0,2140	0,2140
RELIABILITY	Mean Time Between Failures (MTBF)	Hours	0,1430	0,5352	0,7135	0,4037	0,2043	0,4636	0,5677	0,0765	0,1020	0,0577	0,0292	0,0663	0,0812
MAINTAINABILITY	Mean Time Between Maintenance (MTBM)	Hours	0,1000	0,3838	0,5	0,5	0,7096	0,5	1	0,0384	0,0500	0,0500	0,0710	0,0500	0,1000
	Time Between Overhaul (TBO)	Hours	0,0430	1	1	1	1	1	1	0,0430	0,0430	0,0430	0,0430	0,0430	0,0430
SAFETY	Total Safety Incidents (Class A,B,C)	Total Number Per 100K F/H	0,1420	0	0	0	0	0	0	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000
FLYING QUALITY	Stability	Degrees of Stability	0,1430	1	1	1	1	1	1	0,1430	0,1430	0,1430	0,1430	0,1430	0,1430
														KT-1C	
		GLOBAL WEIGHT TOTAL -------->	1,000	RESULTING SCORES ---------->						0,6052	0,6991	0,7081	0,6859	0,7313	0,7282

After constructing all the individual hierarchies and determining the evaluation measures, the group came together on the 13th of December, 2007 in order to implement the same process altogether. After creating the hierarchy, the group was asked to weigh the value increments and score the different alternatives in the same way.

The alternative scorings for the group and the other DMs are given in tables in Appendix-A.

3.9 Summary

This chapter covered Steps 1 through 7 of the Value-Focused Thinking Process. It presented how the value model was created and discussed the development of the evaluation measures, single dimension value functions, and weighting of the value hierarchy. Chapter 4 will discuss steps 8 and 9 of the VFT process with deterministic and sensitivity analysis of the alternatives.

IV. Results and Analysis

4.1 Overview

This chapter presents the analysis of the model that was described in Chapter 3. The hierarchical models determine a rank ordered list of 6 alternative primary training aircrafts selected for the study. While additional alternatives may be added at any time in order to view the ranking amongst the previously selected alternatives, the results of this study are limited to the real alternatives selected. Overall values of each alternative for both the individual DMs and group scoring were determined. The alternatives with the highest values are the most preferred primary training aircraft based on the decision makers values. A sensitivity analysis was also performed to see how sensitive the results are to changes in weights of the hierarchy.

4.2 Step 8: Deterministic Analysis

The scores from the measures are combined to form an overall value for each of the alternatives. Kirkwood stated that overall value combined from the measures represents how much the alternative fulfills the objectives of the decision maker [25]. The overall value is the sum of the values of each measure multiplied by the global weight. Below is group's overall values for each alternative scoring are shown as complete list in Table 4.1 and summary list in Table 4.2.

Table 4.1: Group Alternatives Scoring Complete List

VALUE		MEASURE		ALTERNATIVE SCORES						WEIGHTED SCORES					
			Global Weight	T-34C	T-37B	T-6A	EMB.312	KT-1C	T-35	T-34C	T-37B	T-6A	EMB.312	KT-1C	T-35
DESIGN	User Friendly / Throttle	Throttle Star Value	0,0100	0	0,63	0,75	0,63	1	0,63	0,0000	0,0063	0,0075	0,0063	0,0100	0,0063
	User Friendly / Avionics	Avionics Scale													
	Simplicity / Standardized Cockpit	Standardization Level	0,0290	0,8	0,8	1	1	1	0,8	0,0232	0,0232	0,0290	0,0290	0,0290	0,0232
	Simplicity / Emergency Procedures	Average Number of Steps in Boldfaces													
	Robustness / Landing Gears	Failure Rate Per 100K F/H													
	Robustness / Airframe Lifetime	Years	0,0580	0,35	1	0,85	0,6	0,5	0,5	0,0203	0,0580	0,0493	0,0348	0,0290	0,0290
	Ergonomics / Cockpit	Cockpit Star Value	0,0100	0,8	1	0,8	1	1	0,8	0,0080	0,0100	0,0080	0,0100	0,0100	0,0080
	Ergonomics / Visibility	Visibility Star Value	0,0190	0,63	0,63	0,63	0,63	0,63	0,63	0,0120	0,0120	0,0120	0,0120	0,0120	0,0120
	Ergonomics / Noise Level	dB													
	Ergonomics / ECS	ECS Star Value													
	Systems Complexity	Complexity Level													
	Systems Dependency / Engine Start	Engine Start Dependency Level													
	Upgradeability	Upgradeability Level													
	Styling	Styling Star Value													
	Deactivation Capability	Deactivation Feature Star Value													
PERFORMANCE	Endurance	Minutes													
	Thrust	Lbs.													
	Fuel Efficiency	Gallons Per F/H	0,1050	1	0	0,084	0	0,145	1	0,1050	0,0000	0,0088	0,0000	0,0152	0,1050
	Speed	Knots													
	Range	Miles													
	Ceiling	Feet													
	Max Take-off Runway Length	Feet													
	Power Loading	Power/Weight Ratio													
RELIABILITY	Mean Time Between Failures (MTBF)	Hours													
MAINTAINABILITY	Mean Time Between Maintenance (MTBM)	Hours	0,0570	0,1169	0,2781	0,2781	0,7883	0,2781	1	0,0067	0,0159	0,0159	0,0449	0,0159	0,0570
	Time Between Overhaul (TBO)	Hours	0,0570	0	0	0,75	0	0,5	0	0,0000	0,0000	0,0428	0,0000	0,0285	0,0000
	Recording Capacity	Recording Capacity Level													
	Maintenance Specialty Requirement	Specialty Certificate Requirement Level	0,0110	0,6	0,6	1	0	0	0	0,0066	0,0066	0,0110	0,0000	0,0000	0,0000
	Civilian Airports Cross Service	Cross Service Support Level													
SAFETY	Total Safety Incidents (Class A,B,C)	Total Number Per 100K F/H													
	Engine	Number of Engines	0,1320	0	0,8	0	0	0	0	0,0000	0,1056	0,0000	0,0000	0,0000	0,0000
	Ejection Seat	Ejection Seat Star Value	0,0660	0	0,71	1	0,71	1	0	0,0000	0,0469	0,0660	0,0469	0,0660	0,0000
	Hook	Hook Speed Limit													
	Drag Chute	Drag Chute Speed limit													
	Collision Avoidance System	Avoidance System Star value	0,0130	0,78	0	0,78	0	0,78	0	0,0101	0,0000	0,0101	0,0000	0,0101	0,0000
FLYING QUALITY	Recoverability	Stall Warning Before Stall Margin_Knots	0,1430	0,89	1	0,89	0,89	0,89	0,89	0,1273	0,1430	0,1273	0,1273	0,1273	0,1273
	Stability	Degrees of Stability													
	Maneuverability / Roll Rate	Degrees Per Second													
	Maneuverability / G_Capacity	Gs													
	Handling Quality Rating	Cooper Harper Score	0,0360	0,92	0,97	1	0,97	1	0,97	0,0331	0,0349	0,0360	0,0349	0,0360	0,0349
	Flight Path Stability	Degrees Per Knot													
TRAINING QUALITY	Instrument Flight	Instrument Flight Quality Level													
	Formation Flight	Formation Flight Quality Level													
	Low Level Flight	Low Level Quality Level													
	Aerobatics	Aerobatics Quality Level	0,1580	1	1	1	1	1	1	0,1580	0,1580	0,1580	0,1580	0,1580	0,1580
	Ground Handling	Ground Handling Quality Level													
TECHNOLOGY	Consistency With Current	Currency Scale	0,0320	0,38	0,63	1	1	1	0,38	0,0122	0,0202	0,0320	0,0320	0,0320	0,0122
	NAVAIDS	NAVAIDS Scale													
	Comm System	Comm System Quality Level													
	Radar	Radar Capability Level													
COST	Maintenance Cost	Hundred Dollars	0,0110	0,664	0,38	0	0,08	0,021	0,42	0,0073	0,0042	0,0000	0,0009	0,0002	0,0046
	Aircraft Price	Million Dollars													
SUPPORTING SYSTEMS	Synthetic Training System	Synthetic Trainer Star Value	0,0450	0,33	0,33	1	0	1	0	0,0149	0,0149	0,0450	0,0000	0,0450	0,0000
	Debriefing System	Debriefing System Star Value	0,0080	0	0	0,74	0	0,74	0	0,0000	0,0000	0,0059	0,0000	0,0059	0,0000
	Life Support Materials / G-Suit	G-Suit Quality Level													
												T-6A TEXAN II			
		GLOBAL WEIGHT TOTAL →	1,000	RESULTING SCORES →						0,5446	0,6595	0,6645	0,5369	0,6301	0,5774

Table 4.2: Group Alternatives Scoring Summary List

VALUE		MEASURE		ALTERNATIVE SCORES						WEIGHTED SCORES					
			Global Weight	T-34C	T-37B	T-6A	EMB.312	KT-1C	T-35	T-34C	T-37B	T-6A	EMB.312	KT-1C	T-35
DESIGN	User Friendly / Throttle	Throttle Star Value	0,0100	0	0,63	0,75	0,63	1	0,63	0,0000	0,0063	0,0075	0,0063	0,0100	0,0063
	Simplicity / Standardized Cockpit	Standardization Level	0,0290	0,8	0,8	1	1	1	0,8	0,0232	0,0232	0,0290	0,0290	0,0290	0,0232
	Robustness / Airframe Lifetime	Years	0,0580	0,35	1	0,85	0,6	0,5	0,5	0,0203	0,0580	0,0493	0,0348	0,0290	0,0290
	Ergonomics / Cockpit	Cockpit Star Value	0,0100	0,8	1	0,8	1	1	0,8	0,0080	0,0100	0,0080	0,0100	0,0100	0,0080
	Ergonomics / Visibility	Visibility Star Value	0,0190	0,63	0,63	0,63	0,63	0,63	0,63	0,0120	0,0120	0,0120	0,0120	0,0120	0,0120
	Fuel Efficiency	Gallons Per F/H	0,1050	1	0	0,084	0	0,145	1	0,1050	0,0000	0,0088	0,0000	0,0152	0,1050
MAINTAINABILITY	Mean Time Between Maintenance (MTBM)	Hours	0,0570	0,1169	0,2781	0,2781	0,7883	0,2781	1	0,0067	0,0159	0,0159	0,0449	0,0159	0,0570
	Time Between Overhaul (TBO)	Hours	0,0570	0	0	0,75	0	0,5	0	0,0000	0,0000	0,0428	0,0000	0,0285	0,0000
	Maintenance Specialty Requirement	Specialty Certificate Requirement Level	0,0110	0,6	0,6	1	0	0	0	0,0066	0,0066	0,0110	0,0000	0,0000	0,0000
	Engine	Number of Engines	0,1320	0	0,8	0	0	0	0	0,0000	0,1056	0,0000	0,0000	0,0000	0,0000
	Ejection Seat	Ejection Seat Star Value	0,0660	0	0,71	1	0,71	1	0	0,0000	0,0469	0,0660	0,0469	0,0660	0,0000
	Collision Avoidance System	Avoidance System Star value	0,0130	0,78	0	0,78	0	0,78	0	0,0101	0,0000	0,0101	0,0000	0,0101	0,0000
FLYING QUALITY	Recoverability	Stall Warning Before Stall Margin_Knots	0,1430	0,89	1	0,89	0,89	0,89	0,89	0,1273	0,1430	0,1273	0,1273	0,1273	0,1273
	Handling Quality Rating	Cooper Harper Score	0,0360	0,92	0,97	1	0,97	1	0,97	0,0331	0,0349	0,0360	0,0349	0,0360	0,0349
	Aerobatics	Aerobatics Quality Level	0,1580	1	1	1	1	1	1	0,1580	0,1580	0,1580	0,1580	0,1580	0,1580
TECHNOLOGY	Consistency With Current	Currency Scale	0,0320	0,38	0,63	1	1	1	0,38	0,0122	0,0202	0,0320	0,0320	0,0320	0,0122
COST	Maintenance Cost	Hundred Dollars	0,0110	0,664	0,38	0	0,08	0,021	0,42	0,0073	0,0042	0,0000	0,0009	0,0002	0,0046
SUPPORTING SYSTEMS	Synthetic Training System	Synthetic Trainer Star Value	0,0450	0,33	0,33	1	0	1	0	0,0149	0,0149	0,0450	0,0000	0,0450	0,0000
	Debriefing System	Debriefing System Star Value	0,0080	0	0	0,74	0	0,74	0	0,0000	0,0000	0,0059	0,0000	0,0059	0,0000
												T-6A TEXAN II			
		GLOBAL WEIGHT TOTAL →	1,000	RESULTING SCORES →						0,5446	0,6595	0,6645	0,5369	0,6301	0,5774

Table 4.1 shows the subtier values and corresponding measures considered by the group in turquoise color. The uncolored lines mean that they weren't considered by the group when its wish list was created in order to build the group hierarchy. Right next to the measures are the global weights for each value measure to be multiplied by each alternative's corresponding score. Next to it, the weighted scores are given. At the bottom of each weighted score column is given the sum of the weighted value measure scores for that aircraft type. As it's seen in the purple-colored cell, T-6A Texan II is the alternative with the highest value score of 0.6645, the most preferred primary training aircraft for the group. The same operation has been done for all the individual DMs and the results in summarized form have been shown in Appendix-A. All the scores for both the individual DMs and group have been gathered below in Table 4.3

Table 4.3: Group & Individual DMs Alternative Scores

	ALTERNATIVES					
	1	2	3	4	5	6
DECISION MAKERS	T-34C	T-37B	T-6A	EMB.312	KT-1C	T-35
GROUP	0,5446	0,6595	0,6645	0,5369	0,6301	0,5774
DM-1	0,2804	0,3455	0,3440	0,2802	0,3338	0,3926
DM-2	0,3048	0,7075	0,5815	0,5149	0,5765	0,3048
DM-3	0,6052	0,6991	0,7008	0,6859	0,7313	0,7282
DM-4	0,3024	0,4938	0,5296	0,4608	0,5208	0,3208
DM-5	0,2137	0,3082	0,3678	0,3098	0,3382	0,3158
DM-6	0,7454	0,7377	0,8151	0,7258	0,7980	0,7007
DM-7	0,5662	0,7377	0,8482	0,6989	0,8234	0,4754
DM-8	0,4311	0,7189	0,7526	0,5638	0,6274	0,3497
DM-9	0,5429	0,5496	0,6566	0,5173	0,7084	0,4158
DM-10	0,4993	0,6164	0,6129	0,5650	0,5715	0,5371
DM-11	0,7480	0,6797	0,9125	0,9297	0,9475	0,7827
DM-12	0,5557	0,4934	0,4572	0,2291	0,5775	0,4838
DM-13	0,5674	0,5061	0,7081	0,5359	0,7245	0,5298
DM-14	0,5642	0,6203	0,8012	0,5244	0,7985	0,4507
DM-15	0,3525	0,4225	0,3764	0,3354	0,3791	0,2877

The scores in Table 4.3 has been ranked in Table 4.4 from best to worst, the highest score (the most preferred) being 1 and the lowest score (the least preferred) being 6. For the analysis, which has been implemented by using Kendall's Coefficient of Concordance in this study, ranking of the alternatives is the only information to be needed.

Table 4.4: Group & Individual DMs Alternative Ranks

	ALTERNATIVES					
	1	2	3	4	5	6
DECISION MAKERS	**T-34C**	**T-37B**	**T-6A**	**EMB.312**	**KT-1C**	**T-35**
GROUP	5	2	1	6	3	4
DM-1	5	2	3	6	4	1
DM-2	5	1	2	4	3	6
DM-3	6	4	3	5	1	2
DM-4	6	3	1	4	2	5
DM-5	6	5	1	4	2	3
DM-6	3	4	1	5	2	6
DM-7	5	3	1	4	2	6
DM-8	5	2	1	4	3	6
DM-9	4	3	2	5	1	6
DM-10	6	1	2	4	3	5
DM-11	5	6	3	2	1	4
DM-12	2	3	5	6	1	4
DM-13	3	6	2	4	1	5
DM-14	4	3	1	5	2	6
DM-15	4	1	3	5	2	6
Rank Sum (Rj)	74	49	32	73	33	75

4.2.1 Nonparametric Statistical Methods. The ranking of the alternatives was analyzed by using a nonparametric statistical test, Kendall's Coefficient of Concordance. Siegel defines a nonparametric statistical test as: "a test whose model does not specify conditions about the parameters of the population from which the sample was drawn" [35]. Nonparametric procedures are robust, distribution-free techniques that are particularly useful when the N is small, as in this case where there are only

6 subjects (alternative aircrafts). There are many additional advantages to using nonparametric procedures, such as minimal assumptions concerning the underlying populations, insensitivity to outliers, and the ability to analyze an unequal number of judges in experimental samples.

Kendall's Coefficient of Concordance (W) was used to analyze these results to determine if the DMs' resulting decisions to choose the best alternative are similar to each other. In this analysis, n=6 and m varied based on the selected sample to be tested. All 15 individual DMs and the group were tested against one another and different samples were tested to determine if there is any consistency. As it has been stated before, the main purpose of the research was to determine if there was any concordance among the decision makers, who state their values and preferences individually, and the group, which came together to discuss about the same topic.

These experimental samples included all DMS and the group, USAF pilots and the group, USN & USMC pilots and the group, TUAF pilots and the group, instructor pilots and the group, non-instructor pilots and the group; 6 samples in total. Normally, when $n \leq 7$ and $m \leq 20$, the "Table of Critical Values of S in the Kendall's Coefficient of Concordance" [35], which was obtained by the method of complete permutations, is recommended to use to test the statistic (Kendall's W) for statistical significance according to Siegel and Castellan [34]. However, in this research, both testing the significance of Kendall's coefficient of concordance (W) with the table of critical values and with the chi-square approximation test of the sampling distribution were implemented in order to double-check and confirm the results.

Nonparametric techniques for measuring the degree of correlation method are the contingency coefficient, the Crammer' V correlation coefficient, the Spearman rank correlation coefficient, the Kendall rank correlation coefficient, the Kendall partial rank correlation coefficient, Phi correlation coefficient and the Kendall's coefficient of concordance (W).

The coefficient of contingency and the Crammer' V correlation coefficient are uniquely applicable when the data are in a nominal scale. The contingency coefficient will have the same value regardless of how the categories are arranged in the rows and columns.

For the bivariate case two rank correlation coefficient, the Spearman rank correlation coefficient and the Kendall rank correlation coefficient are applicable. The Spearman rank correlation coefficient is somewhat easier to compute. However, the Kendall rank correlation coefficient has the advantages of being generalizable to a partial correlation coefficient. Both the Spearman rank correlation coefficient and the Kendall rank correlation coefficient have a sampling distribution which is practically indistinguishable from a normal distribution for large sample size and test of the significance is Z - test

The Kendall partial rank correlation coefficient measures the degree of relation between two variables, X and Y, when a third variable, Z is held constant. This statistic is sometimes called Phi correlation coefficient.

The Kendall's coefficient of concordance (W) measures the extent of agreement among several (m) sets of ranking of n entities. Depending on the application field, the entities can be variables, characters, judges, DMs etc. It is useful in determining the agreement among several judges or the association among three or more variables. Kendall's W makes no assumptions regarding the nature of the probability distribution and can handle any number of distinct outcomes. W may take values only between 0 and +1. This is because when more than two judges are involved, agreement and disagreement are not symmetrically opposites.

There is a close relationship between Friedman's two-way analysis of variance without replication by ranks and Kendall's coefficient of concordance. They address hypotheses concerning the same data table and they use the same χ^2 statistic for testing. They differ only in the formulation of their respective null hypothesis. In Friedman's test, the null hypothesis is that, n objects are drawn from the same statistical population, which are the rows of the data table. Under H_0, they should have received random ranks from the various judges, so that their sums of ranks should be approximately equal. Kendall's test focuses on the m judges. If the null hypothesis of Friedman's test is true, this means that the judges have produced rankings that are unrelated of one another. This is the null hypothesis of Kendall's test [34].

* Friedman's H_0: The n objects are drawn from the same statistical population.

* Kendall's H_0: The m judges produced unrelated rankings of the objects.

Test of the significance of Kendall's coefficient of concordance is Chi - square test with df = n-1.

When $n \leq 7$ and $m \leq 20$, Siegel and Castellan [34] recommended using their table of critical values for S, which was obtained by the method of complete permutations.

Siegel and Castellan listed the following advantages of nonparametric tests:

1. "If the sample size is very small, there may be no alternative to using a non-parametric statistical test unless the nature of the population distribution is known exactly".

2. "Nonparametric tests typically make fewer assumptions about the data and may be more relevant to a particular situation. In addition, the hypothesis tested by the nonparametric test may be more appropriate for the research investigation".

3. "Nonparametric tests are available to analyze data which are inherently in ranks as well as data whose seemingly numerical scores have the strength of ranks. That is, the researcher may only be able to say of his or her subjects that one has more or less of the characteristic than another, without being able to say how much more or less. For example, in studying such a variable as anxiety, we may be able to state that subject A is more anxious than subject B without knowing at all exactly how much more anxious A is. If data are inherently in ranks, or even if they can be categorized only as plus or minus (more or less, better or worse), they can be treated by nonparametric methods, whereas they cannot

be treated by parametric methods unless precarious and, perhaps, unrealistic assumptions are made about the underlying distributions".

4. "Nonparametric methods are available to treat data which are simply categorical, i.e., are measured in a nominal scale. No parametric technique applies to such data".

5. "There are suitable nonparametric statistical tests for treating samples made up of observations from several different populations. Parametric tests often cannot handle such data without requiring us to make seemingly unrealistic assumptions or requiring cumbersome computations".

6. "Nonparametric statistical tests are typically much easier to learn and to apply than are parametric tests. In addition, their interpretation often is more direct than the interpretation of parametric tests".

Given the information relating to nonparametric statistical methods, the focus returns to the research data. In this study the degree of association among the rankings of alternative aircrafts of the 18 DMs was measured. According to Kendalls method, the alternatives are ranked from the lowest rank sum to the highest. Thus T-6A (with a rank sum of 32) is the first, followed by KT-1C, then T-37B, then EMB.312, then T-34C, and the last alternative, T-35 (with a rank sum of 75). If all 16 DMs each ranked the six aircrafts in the same order, then one aircraft would have received sixteen ranks of 1 and thus its sum of ranks, R_j, would be 1+1+...+1=16=m. The least promising aircraft would have R_j=6+6+...+6=96=6m. In fact, with perfect agreement among the executives, the various sums of ranks, R_j, would be these: 16, 32, 48, 64, 80, 96, though not necessarily in that order. In general, when there is a perfect agreement among k sets of rankings, we get, for the R_j, the series: m, 2m, 3m, Nm. On the other hand, if there had been no agreement among the three executives, then the various R_j's would be approximately equal.

The following steps have been followed to compute W:

1) Find the sum of ranks, R_j, in (m x n = 16 x 6) table→ 74, 49, 32, 73, 33, 75.

2) Sum the R_j and divide that sum by "n" to obtain the mean value of the R_j. → (74+49+32+73+33+75)=336 , (336/6)= 56. (Another way to compute the sum of all ranks is 336=(16×6×7)/2 in this case, or in general;

$$m \times n \times (n+1)/2 \tag{4.1}$$

3) Each of the R_j may then be expressed as a deviation from the mean value. The deviations of the rank sums from this mean are: 18, −7, −24, 17, −23, and 19. (The larger are these deviations, the greater is the degree of association among the m sets of ranks.)

3) S, the sum of squares of these deviations, is found. S represent the sum of the squares of the deviations, S=(324+49+576+289+529+361)= 2128 in this case.

4) Knowing the observed value of S, the value of W for the data can be found:

$$W = \frac{12 \times S}{m^2 \times (n^3 - n)} \tag{4.2}$$

$$W = \frac{12 \times 2128}{16^2 \times (6^3 - 6)} = 0.475 \tag{4.3}$$

The degree of agreement among the 16 DMs is reflected by the degree of variance among the 6 sums of ranks. The degree of agreement among the 16 DMs in ranking the 6 aircrafts is expressed by W=0.475. The Kendall W for this example showed a moderate agreement on the alternative aircraft rankings. If they all agree W=1. According to Gibbons and Kendall, "if they differ among themselves the sums of ranks will be more or less equal, and consequently the sum of squares S becomes small compared with the maximum possible value, so that the W is small. As W increases from 0 to 1 the deviations become more different and there is a greater measure of agreement in the rankings." [19]

4.2.1.1 Testing the Significance of Kendall's Coefficient of Concordance (W) with the Table of Critical Values for S:

The significance of any observed value of W can be tested by determining the probability associated with the occurrence under H_0 of a value as large as the S with which it is associated [35].

H_0=16 Sets of rankings are independent by taking from this distribution the probability associated wih the occurence under H_0 of a value as large as an observed sum of square (S).

By this method, the distribution of S under H_0 has been worked out and certain critical values have been tabled by Friedman (1940), which then extracted by Sidney Siegel ("Nonparametric Statistics for the Behavioral Sciences", Table-R: Table of Critical Values of S in the Kendall Coefficient of Concordance). The table, applicable for m from 3 to 20, and for n from 3 to 7, gives values of S for W's significance at the .05 and .01 levels. If an observed S is equal to or greater than that shown in the table for a particular level of significance, then H_0 may be rejected at that level of significance.

In this example (all DMs and the group) above , m=16 DMs ranked n=6 aircrafts, their agreement was W=0.475 .

H_0: W = 0 , H_1: W $\neq$ 0

- The Table of Critical Values of S [36] in Appendix-A reveals that the S associated with that value of W (S=2128) is significant at the .05 level since it is greater than Scrit = 602.8 ;

  S > Scrit $\Rightarrow$ REJECT THE NULL.

- S associated with that value of W (S=2128) is significant at the .01 level since it is greater than Scrit = 811

  S > Scrit $\Rightarrow$ REJECT THE NULL.

4.2.1.2 Testing the Significance of Kendall's Coefficient of Concordance (W) with the Chi-Square Approximation Test of the Sampling Distribution:

When exact tables for W (or S) are not available, the chi-square distribution provides a reasonably good approximation of the sampling distribution of W. The chi-square approximation of the sampling distribution of W is computed with Equation 4.4. The degrees of freedom employed for Equation 4.4 are dof=n-1.

$$\chi^2_F = m \times (n-1) \times W \tag{4.4}$$

If the value of χ^2_F as computed from Equation 4.4 equals or exceeds the tabled value from the Table of Critical Values of Chi-Square Distribution ("Nonparametric Statistics for the Behavioral Sciences", Page-249) for a particular level of significance and a particular value of dof=n-1, then the null hypothesis, H_0= m rankings are unrelated, may be rejected at that level of significance.

In our sample (all DMs and the group) above , m=16 DMs ranked n=6 aircrafts, their agreement was W=0.475 .

$$\chi^2_F = 16 \times (6-1) \times 0.475 = 38 \qquad\qquad (dof = 6-1 = 5)$$

The value χ^2_F=38 is evaluated with the Table of Critical Values of Chi-Square Distribution ("Nonparametric Statistics for the Behavioral Sciences", Page-249).

H_0= 16 rankings are unrelated (independent)

In order to reject the null hypothesis, the obtained value of chi-square must be equal to or greater than the tabled critical value at the prescribed level of significance. For dof=5, the tabled critical values are :

$\chi^2_{0.05}$ = 11.07 (The chi-square value at the 95th percentile)

$\chi^2_{0.01}$ = 15.09 (The chi-square value at the 99th percentile)

H_0: W = 0 , H_1: W $\neq$ 0

Since χ^2_F=38 is greater than both of the aforementioned critical values (χ^2_Fcrit), the null hypothesis H_0=16 rankings are unrelated (independent)is $\Rightarrow$ REJECTED at both .05 and .01 levels. We can conclude with considerable assurance that that the agreement among the 16 DMs is higher than it would be by chance. The very low probability under H_0 associated with the observed value of W enables us to reject the null hypothesis that the DMs' ratings are unrelated to each other.

The results of the Kendall's Coefficient of Concordance analysis for all the samples are tabled below for both testing the significance with the table of critical values of W (Table 4.5) and with the chi-square approximation test of the sampling distribution separately (Table 4.6). The best estimates for the samples according to the rankings are also given at the end of the tables.

As it's seen in the tables, the "best estimate" for 5 out of 6 samples ('all DMs + group' sample, 'USAF DMs + group' sample, 'USN & USMC DMs + group' sample,

Table 4.5: Testing the Significance of Kendall's Coefficient of Concordance with the Table of Critical Values for S - Results

SAMPLE NAME	NUMBER OF DMs	NUMBER OF ALTs	W	S	CRITICAL VALUE FOR "S" (S_{crit}) AT SIGNIFICANCE LEVEL 0.05	0.01	NULL HYPOTHESIS (H_0) FOR "W" AT SIGNIFICANCE LEVEL 0.05	0.01	BEST ALTERNATIVE AIRCRAFT
All DMs+GROUP	16	6	0.475	2128	602.8	811.0	REJECT	REJECT	T-6A
USAF DMs+GROUP	8	6	0.466071	522	299.0	388.3	REJECT	REJECT	T-6A
USN&USMC DMs+GROUP	5	6	0.634285	277.5	182.4	229.4	REJECT	REJECT	T-6A
TUAF DMs+GROUP	5	6	0.638857	279.5	182.4	229.4	REJECT	REJECT	KT-1C
INSTRUCTOR DMs+GROUP	10	6	0.465143	814	376.7	494.0	REJECT	REJECT	T-6A
NON-INSTRUCTOR DMs+GROUP	7	6	0.554519	475.5	260.2	335.35	REJECT	REJECT	T-6A

Table 4.6: Testing the Significance of Kendall's Coefficient of Concordance with the Chi-Square Approximation Test of the Sampling Distribution - Results

SAMPLE NAME	NUMBER OF DMs	NUMBER OF ALTs	W	$\chi 2 = m.(n-1).W$	dof	CRITICAL VALUE FOR χ^2 (χ^2_{crit}) AT SIGNIFICANCE LEVEL 0.05	0.01	NULL HYPOTHESIS (H0) FOR "W" AT SIGNIFICANCE LEVEL 0.05	0.01	P-value	BEST ALTERNATIVE AIRCRAFT
All DMs+GROUP	16	6	0.475	38	5	11.07	15.09	REJECT	REJECT	< 0.0001	T-6A
USAF DMs+GROUP	8	6	0.466071	18.64284	5	11.07	15.09	REJECT	REJECT	0.0023	T-6A
USN&USMC DMs+GROUP	5	6	0.634285	15.857125	5	11.07	15.09	REJECT	REJECT	0.0073	T-6A
TUAF DMs+GROUP	5	6	0.638857	15.971425	5	11.07	15.09	REJECT	REJECT	0.0069	KT-1C
INSTRUCTOR DMs+GROUP	10	6	0.465143	23.25715	5	11.07	15.09	REJECT	REJECT	0.0003	T-6A
NON-INSTRUCTOR DMs+GROUP	7	6	0.554519	19.408165	5	11.07	15.09	REJECT	REJECT	0.0016	T-6A

'instructor DMs + group' sample, 'non-instructor DMs + group' sample) is T-6A, whereas the same "best estimate" for 'TUAF DMs + group' sample is KT-1C.

Consequently, it can be concluded at the end of both significance tests that there is a significant association among the 16 DMs (fifteen individual DMs and the group) with respect to how they rank the 6 alternative primary training aircrafts.

4.2.2 Additional Analysis. After accomplishing the analysis for testing the significance among the randomly formed samples, each including "group" in it, we decided to test if there is any concordance between "the group's ranking" and the resulting ranking of the other DMs' in the same sample.

For instance, the first sample was "all DMs + group" (including 16 rankings). We wanted to see if there is any concordance between group's ranking and the total resulting ranking of the other 15 DM's ranking together.

Table 4.7: Group Ranking

RANKING	T-34C	T-37B	T-6A	EMB.312	KT-1C	T-35
GROUP	5	2	1	6	3	4

The rest of this sample was all of the 15 individual DMs. Their rankings were combined in a table and a resulting ranking has been determined based on their sum of ranks.

Table 4.8: All DMs' Resulting Ranking

RANKING	T-34C	T-37B	T-6A	EMB.312	KT-1C	T-35
DM-1	5	2	3	6	4	1
DM-2	5	1	2	4	3	6
DM-3	6	4	3	5	1	2
DM-4	6	3	1	4	2	5
DM-5	6	5	1	4	2	3
DM-6	3	4	1	5	2	6
DM-7	5	3	1	4	2	6
DM-8	5	2	1	4	3	6
DM-9	4	3	2	5	1	6
DM-10	6	1	2	4	3	5
DM-11	5	6	3	2	1	4
DM-12	2	3	5	6	1	4
DM-13	3	6	2	4	1	5
DM-14	4	3	1	5	2	6
DM-15	4	1	3	5	2	6
Total of Ranks	69	47	31	67	30	71

RANKING	T-34C	T-37B	T-6A	EMB.312	KT-1C	T-35
ALL DMs	5	3	2	4	1	6

Kendall's Coefficient of Concordance (W) had been used for the previous analysis since there were more than two rankings in all of those 6 samples. But, since there is only 2 rankings to be tested here, another nonparametric statistical test, Kendall Rank Correlation Coefficient (τ-tau), has been used to test whether there is any relation among these 2 rankings.

Kendall's tau is a non-parametric statistic used to measure the degree of correspondence (a measure of correlation) between two rankings and assessing the significance of this correspondence , and so measures the strength of the relationship between two variables. That is, for each variable separately the values are put in order and numbered, 1 for the lowest value, 2 for the next lowest and so on. Siegel [35] gives details of how to calculate Kendall's tau. Kendall's tau will take values between +1 and -1, with a positive correlation indicating that the ranks of both variables increase together whilst a negative correlation indicates that as the rank of one variable increases the other one decreases. It is possible to calculate confidence intervals and carry out hypothesis tests on Kendall's tau. The main advantages of using Kendall's tau are that the distribution of this statistic has slightly better statistical properties and there is a direct interpretation of Kendall's tau in terms of probabilities of observing concordant and discordant pairs.

To compute tau, the order of the ranks should be rearranged, so that the rankings on the primary training aircrafts occur in the natural order:

Table 4.9: Group versus All DMs Ranking - Rearranged

RANKING	T-6A	T-37B	KT-1C	T-35	T-34C	EMB.312
GROUP	1	2	3	4	5	6
ALL DMs	2	3	1	6	5	4

Having arranged the ranks on "Group Ranking" in their natural order, the value of S is determined for the corresponding order of ranks on "ALL DMs Ranking".

S = (4-1) + (3-1) + (3-0) + (0-2) + (0-1) = 5

(The "All DMs Ranking" which is farthest to the left is 2. It has 4 ranks to its right which are larger and 1 to its right which is smaller, so that its contribution to S is (4-1). By proceeding in this way, we obtain the various values shown above, which we have summed to yield S = 5.) Knowing that S = 5 and N = 6 , we may use the formula below to compute τ (tau):

$$\tau = \frac{S}{(1/2)N(N-1)} \tag{4.5}$$

$$\tau = \frac{5}{(1/2)6(6-1)} = 0.33 \tag{4.6}$$

When there are tied (same value) observations, then τ_b is used:

$$\tau_b = \frac{S}{\sqrt{\left[N(N-1)/2 - \sum_{i=1}^{t} t_i(t_i-1)/2\right]\left[N(N-1)/2 - \sum_{i=1}^{u} u_i(u_i-1)/2\right]}} \tag{4.7}$$

where t_i is the number of observations tied at a particular rank and u is the number tied at a rank.

Testing the Significance of Tau:

H_0: Two sets of ranking are unrelated.

H_1: Two sets of ranking are related or associated.

When N is 10 or less, "Table of Probabilities Associated With Values As Large As Observed Values of S In The Kendall Rank Correlation Coefficient" (Nonparametric Statistics For The Behavioral Sciences-Sidney Siegel,1956) may be used to determine the exact probability associated with the occurrence (one-tailed) under H_0 of any value as extreme as an observed S. (The sampling distributions of S and τ are identical, in a probability sense. Inasmuch as τ is a function of S, either might be tabled. It is more convenient to tabulate S.)

For such small samples, the significance of an observed relation between two samples of ranks may be determined by simply finding the value of S and then referring to the table to determine the probability (one-tailed) associated with that value. If the p $\leq \alpha$, H_0 may be rejected.

For this one, S=5 and N= 6 ; table shows that probability of occurrence under H_0 of p = 0.235

Since p=0.235 is NOT smaller than or equal to $\alpha = 0.05$;

we "FAIL TO REJECT" H_0 at this level of significance.

Since p=0.235 is NOT smaller than or equal to $\alpha = 0.01$;

we "FAIL TO REJECT" H_0 at this level of significance.

The other rank sets to be tested are as followed:

Table 4.10: Group versus USAF DMs Ranking

RANKING	T-6A	T-37B	KT-1C	T-35	T-34C	EMB.312
GROUP	1	2	3	4	5	6
USAF DMs	1	2	1	3	5	4

Table 4.11: Group versus USN & USMC DMs Ranking

RANKING	T-6A	T-37B	KT-1C	T-35	T-34C	EMB.312
GROUP	1	2	3	4	5	6
USN&USMC DMs	1	3	2	5	4	4

Table 4.12: Group versus TUAF DMs Ranking

RANKING	T-6A	T-37B	KT-1C	T-35	T-34C	EMB.312
GROUP	1	2	3	4	5	6
TUAF DMs	2	2	1	5	3	4

Table 4.13: Group versus Instructor DMs Ranking

RANKING	T-6A	T-37B	KT-1C	T-35	T-34C	EMB.312
GROUP	1	2	3	4	5	6
INSTRUCTOR DMs	2	3	1	4	6	5

Table 4.14: Group versus Non-Instructor DMs Ranking

RANKING	T-6A	T-37B	KT-1C	T-35	T-34C	EMB.312
GROUP	1	2	3	4	5	6
NON-INSTRUCTOR DMs	1	1	1	4	2	3

The results of all of those significance tests are shown below in a table:

According to these results, we don't have enough significance to reject the null hypothesis, two sets of rankings are unrelated to each other. However, that doesn't

Table 4.15: Kendall's Tau Test of Significance Results

SETS OF RANKINGS	TAU	S	P-Value	α = 0.05	α = 0.01
Group vs All DMs	0.33	5	0.235	FAIL TO REJECT	FAIL TO REJECT
Group vs USAF DMs	0.69	10	0.056	FAIL TO REJECT	FAIL TO REJECT
Group vs USN&USMC DMs	0.55	8	0.126	FAIL TO REJECT	FAIL TO REJECT
Group vs TUAF DMs	0.41	6	0.251	FAIL TO REJECT	FAIL TO REJECT
Group vs Instructor DMs	0.60	9	0.068	FAIL TO REJECT	FAIL TO REJECT
Group vs Non-Instructor DMs	0.59	8	0.107	FAIL TO REJECT	FAIL TO REJECT

necessarily mean that the null hypothesis is true. It only suggests that there is not sufficient evidence against H_0 in favor of H_1.

There is one important fact to point out here in this additional study: The sample rankings that are being compared to group ranking are a resulting ranking of the sum of the mentioned ranks. And these samples are subsets of all DMs group. It is not known whether summing the ranks of the DMs' in the sample and creating a resulting ranking based on those sums causes a dependency problem. There is not a clear statement relating to this situation in the literature. Therefore, more research on this specific matter can be done as an objective of a future study.

4.2.3 Conclusions for the Deterministic Analysis. Siegel cites [35] that Kendall suggests, "the best estimate of the "true" ranking of the "n" objects is provided, when W is significant, by the order of the various sums of ranks, R_j" [24]. If one accepts the criterion which the various judges have agreed upon (as evidenced by the magnitude and the significance of W) in ranking the "n" entities, the best estimate of the "true" ranking of those entities according to that criterion provided by the order of the sums of ranks. This "best estimate" is associated, in a certain sense, with least squares. Thus our best estimate would be that T-6A should be chosen, for R_j=32, the lowest value observed, for the "all DMs + group" sample.

Given the sample size, Kendall's Coefficient of Condordance (W) was used to check for statistical differences between the individual DMs' rankings and group ranking as a nonparametric statistical method. No significant differences were found between the individuals and group (Kendall's coefficient of concordance, alpha = 0.05 and 0.01).There is a substantial confidence that the agreement among the DMs in these samples is higher than it would be by chance. All of the probabilities corresponding to the samples under H_0 (p-values) associated with the observed value of W are very low (< 0.01)which enables the null hypothesis,DMs' ratings are unrelated to each other, to be rejected.

On the other hand, when Kendall's Tau statistic was used (as it's presented in "Additional Analysis") as the nonparametric statistical method to measure the degree of correspondence and the strength of the relationship between two rankings (i.e. the group ranking versus USAF DMs sampling group ranking, the group ranking versus instructor DMs sampling group ranking etc.), the results show that there is not sufficient significance to reject the null hypothesis: two sets of rankings are unrelated to each other. However, that doesn't necessarily mean that the null hypothesis is true. It only suggests that there is not sufficient evidence against H_0 in favor of H_1. There is one important fact to point out here in this additional study. The sample group rankings that are being compared to group ranking are the resulting rankings of the sum of the mentioned ranks belonging to the individuals who formed the sample group. And these sample groups are a subset of "all DMs" group. It is not known whether summing the ranks of the DMs' in those sample group and creating a resulting ranking based on those sums causes a dependency problem. There is not a clear statement relating to this situation in the literature. Therefore, more research on this specific matter can be done as an objective of a future study.

When we examine the individual DMs' resulting decision for the best primary training aircraft statistics, T-6A has been chosen by 6 DMs, KT-1C has been chosen by 5 DMs, T-37B has been chosen by 3 DMs and T-35 has been chosen by 1 DM. T-35 is in a position of outlier, that is numerically distant from the rest of the data. This alternative has been chosen by the most senior officer of the group. As it has been mentioned in the earlier discussion of group decision making in chapter-2; the older, more experienced, higher ranked are decision makers, the more free they feel themselves to express relatively radical or extreme opinions in comparison to the other average status participants of the decision making platform. That results in distinctive decisions. When we look at the tables again, T-6A has come up as the "best estimate" for 5 samples and KT-1C has come up for 1 sample.

The group decision making session did not change the individual DMs' values and preferences toward certain alternative. It can be clearly observed that the tie between the two leading aircraft remained even when various combination of decision maker sample groups were analyzed. While there is strong concordance among the individual DMs' decisions relating to the same topic, the group decision making session took three times longer than the average individual DM decision process.

An interesting observation relating to the group decision making process is that, even though it was a group of military personnel gathering to discuss about a topic and come up with a decision and the senior officers are supposed to lead the whole session, it hasn't been this way. There was no high-ranked group leader pressure during the group session felt by the members of the group. Because, the most senior officer of the group did not express any kind of behavior which could make the other DMs feel like the session was going to be led by himself. However some members of the group did not fully attend the process other than observing and approving the ideas with their gestures while some others eagerly tried to express their opinions in all steps of the process. After creating the wish list at the beginning of the session, when the discussion relating to the values and measures started, it has been observed that some decision makers had quite a big disagreement on most of the values. So, that caused the discussion time to take longer than it was planned. Of note, instructor pilots in particular expressed very similar opinions and thoughts throughout the session.

As the result of the observations and analysis, it can be said that the samples' decisions highly reflect the preferences of their members. Since, there is such a concordance between the group decision and decisions of the individual DMs who constitute the group, there is no need to spend more time to come up with almost the similar decision in a group environment spending a huge amount of valuable time of the individuals who attend the group meeting. The same process can be handled individually. The members of the group can express their opinions about the topic individually and the process can be handled by an analyst while the members can keep up with their other responsibilities. That would be a very time-efficient decision process at the end.

The results show that there is a high consensus in the samples about which aircraft characteristics are important for the preference of users when deciding for a primary trainer. Turkish Air Force officers were the only group which came up with a different type of aircraft as a primary trainer at the end of the statistical analysis. So, it can be concluded that the samples' decisions will reflect different requirements in new technology (arm, aircraft, systems etc.) selection resulting from the country, region, force variety. If so, the individual decision makers reflect the parallel values and preferences of the group to which they belong. That means, both individual or group decisions will be close to each other.

Consequently, at the end of our research process; the group seemed to produce parallel decisions with the individuals who constitute it. However, groups appear to be slower in reaching decisions than individuals are. The group decision can be produced in at least twice the amount of average individual decision makers's decision process time. It may be much easier and less wasteful of time for us to make a decision as an individual than to involve a group. Sometimes individuals working alone can be more effective than those working together as it has been observed during our research. There were some individuals as it has been expressed before, who preferred not to contribute or present an opinion at all during the group meeting even though they had created their own wish lists independently. They have the opinions about the issue, yet do not feel themselves either comfortable enough or a real part of the group to present an idea. There were also some decision makers who had to try really hard to persuade others while creating the value hierarchy and evaluating measures in order to have the others accepted his opinions since they were presenting relatively different opinions then the majority of the group. And some of those quit trying hard after some point and did not continue contributing to the rest of the process.

The quality of a group decision varies according to the capabilities of its members and how effectively members work together. It is a very important factor to create a worthy result at the end of the group meeting. As we have confirmed during our observations, we can not expect all the individuals in the group to handle the issue during the meeting as well as they do it individually. Because, they are taking the whole responsibility of the result while they are handling it individually. In general, there is an assumption that group provides more important resources since it has greater total knowledge and information than its individual members. But, during our group meeting we have observed the opposite. We have seen that the group resources are limited to its members' contribution to this. If a member does not feel comfortable offering new ideas, the resources will be missing from his knowledge, values, etc. Further, the individual behavior of members can affect the quality of the decision. Some tend to dominate the discussion, preventing others from participating.

As the result of the analysis part, we can state with strong statistical significance for this case study that the individual DMs can create very close decisions to each other and group. The resulting suggestion for the best primary training aircraft is T-6A Texan II.

After all the alternatives were generated in Step-6 and scored in Step-7, they were measured against each other. Below, Figure 4.1 displays the outputs for "Group" as an example of a graph of comparing alternatives. The larger the area shown in a specific color correlates to the larger influence that the value has on specific alternative.

Examining this figure, we can see that the group values aerobatic training quality the most and debriefing system the least in a primary training aircraft.

4.3 Step 9: Sensitivity Analysis

Sensitivity analysis can be viewed in Appendix-D.

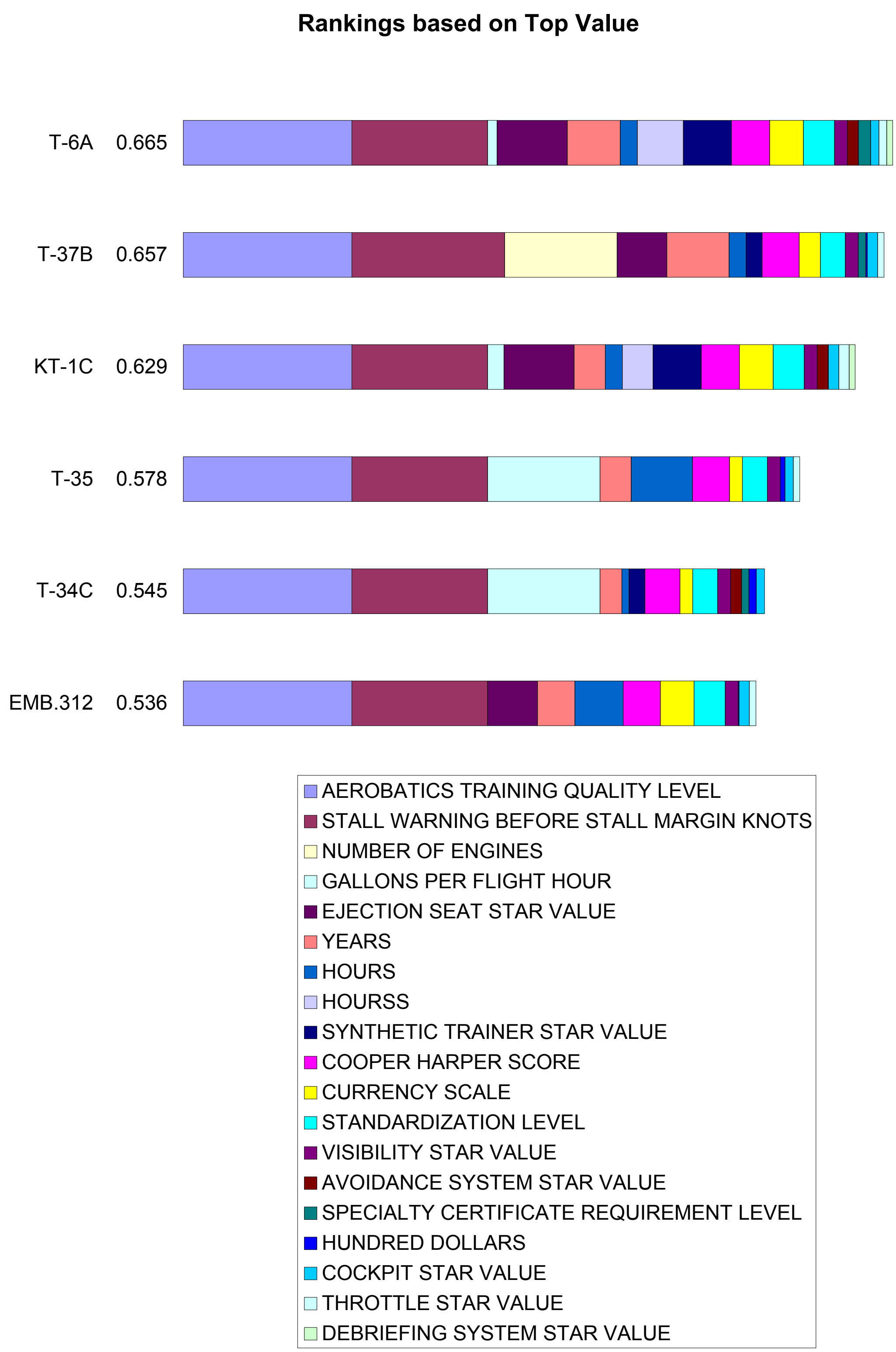

Figure 4.1: Group Rankings based on Top Value (Best Primary Training Aircraft)

V. Conclusions

This chapter reviews the significance of this research. The key points are reviewed, the significant contributions are outlined, and recommendations for future research are suggested.

5.1 Research

The research in this thesis explored the commonly held conception that decisions made by a group differ from the decisions made by the individuals who form this group.

First, the nature and the scope of the decision making problem were defined by examining the individual and group decisions, advantages and disadvantages, and the comparison of the natures of these two decision processes. A group decision takes a large amount of time and effort, it requires organization and consumes valuable work force times are the number of participants. Second, the research investigated the concepts of the value focused thinking method to apply the procedure with a case study problem in order to assemble the required data. Lastly, the research delved into nonparametric statistical procedures in order to process, analyze and compare the data coming as the result of the value focused thinking method in the case study.

The value focused thinking procedure displays similar characteristics to any other DA applications.

The case study problem was quite an interesting topic: choosing the best primary training aircraft. The decision of choosing a primary training aircraft to train new military pilots has always been a challenging and important process for the military forces throughout the world. What are the characteristics of an ideal primary training aircraft?

Decision makers were all military pilots from different military forces, different career fields and different experience levels. They have either been in such a procurement process earlier or can expectedly become a potential member of any procurement phase for the forces they serve sometime in their future career.

The primary training aircraft decision at the end of a procurement phase influences a great number of pilot generations going through the flight training. Therefore, this decision requires attentive contribution of each steak holder. The group decision environment may not always be the ideal atmosphere to encourage the members to express their opinions about the topic. And this point brings us to the main purpose of the research: Are the individual decisions really that much different from the group decision? If there is a concordance among the decisions of the individuals and the group, we can make the same decisions individually and the analyst can implement this process for all the stakeholders. This can allow the people to fully express their real values, preferences without any pressure and allow them to accomplish this in a much shorter time in comparison to the group decision process.

5.2 Contributions

This research has provided some important contributions.

The first contribution is that it's an experiment based on a real world problem analyzing the results on real world alternatives at the end, in contrary to many other laboratory experiments based either on a statistical urn problem or a monetary policy experiment in the literature as it was discussed in chapter-2.

Second, several criteria related to a primary training aircraft has been organized and classified in this study. Additional criteria and subcriteria for a future study can be added at any time and the margins of the database can be enlarged. The major guidelines are drawn in this study.

Third, this research is a current guide on the primary training aircraft selection covering some of the the newest types as the alternatives for a procurement phase. The database relating to the trainers have been collected through January-February 2008 from several sources.

Fourth, this is a unique study observing a military decision making process in addition to statistically testing the concordance of those members forming the group. Observing the group atmosphere, the highest ranked member of the group meeting for a potential leader pressure and the participation of the individuals in the group discussion were accomplished.

The research method incorporates aspects of a DA method; value focused thinking, and a nonparametric statistical methods. The VFT process is performed with any individual DM and gives out the value hierarchy in order to score any given alternative. New DMs be added for a future research at any point and the size of the experiment can be enlaged.

Overall, the research results are presented to recommend a primary training aircraft for the primary flight training. This study, with 15 decision makers, can give a strong insight for a future procurement project which alternative aircrafts to take into account for the evaluation. In addition to that, since the results of the study are statistically significant, a real procurement phase for any type of the aircraft in the future can be implemented with an extended number of participants.

5.3 Recommendations for Future Work

The research contained within this thesis may be extended in a number of directions. Some of these are:

1. The experiment can be improved by extending the number of DMs participating in.
2. This research has applied the method in the order of interviewing the DMs first and then implementing the group meeting and observing the process. The same process can be done just in the opposite direction, first implementing a group meeting and then interviewing the DMs individually afterward to get their decisions. And, the results can be compared to the results of this study.
3. The date about the selected alternatives have been collected from several sources (manufacturer point of contacts, Jane's, open sources, etc.). It would be more consistent and convenient if all the data (at least the data for a single value for all the alternatives) could be collected from the same source. (

4. The DMs in the study had widely varied backgrounds (different military forces, ages, experience levels, etc.),but they were all male pilots due to the limited number of pilots attending AFIT this term, where the DMs of this study have been selected. For future research, it would be desirable to include female pilots in a study, thus; demographic variety of the group could also be satisfied.

5.4 Summary

A statistical method has been executed in order to explore whether there is any concordance or difference between the individual and group decisions on a case study: Best primary training aircraft. This method can be applied to the other aircraft types as well as other case study fields. The conclusions of the research will make valuable contributions to the previous studies and findings in this field.

As the conclusion; groups produce parallel decisions with the individuals who constitute them. However, groups appear to be slower in reaching decisions than individuals are. Since, there is such a concordance between the group decision and decisions of the individual DMs who constitute the group, there is no need to spend more time to come up with almost the similar decision in a group environment spending a huge amount of valuable time of the individuals who attend the group meeting. The members of the group can express their opinions about the topic individually and the process can be handled by an analyst while the members can keep up with their other responsibilities. That would be a very time-efficient decision process at the end.

Table A.1: Subtier Values-Evaluation Measures List

SUBTIER VALUE	Measure	SDVF
User Friendly / Throttle	Throttle Star Value	Categorical
User Friendly / Avionics	Avionics Scale	Categorical
Simplicity / Standardized Cockpit	Standardization Level	Categorical
Simplicity / Emergency Procedures	Average Number of Steps in Boldfaces	Categorical
Robustness / Landing Gears	Failure Rate Per 100K F/H	Categorical
Robustness / Airframe Lifetime	Years	Continuous
Ergonomics / Cockpit	Cockpit Star Value	Categorical
Ergonomics / Visibility	Visibility Star Value	Categorical
Ergonomics / Noise Level	dB	Continuous
Ergonomics / ECS	ECS Star Value	Categorical
Systems Complexity	Complexity Level	Categorical
Systems Dependency / Engine Start	Engine Start Dependency Level	Categorical
Upgradeability	Upgradeability Level	Categorical
Styling	Styling Star Value	Categorical
Deactivation Capability	Deactivation Feature Star Value	Categorical
Endurance	Minutes	Continuous
Thrust	Lbs.	Continuous
Fuel Efficiency	Gallons Per F/H	Continuous
Speed	Knots	Continuous
Range	Miles	Continuous
Ceiling	Feet	Continuous
Max Take-off Runway Length	Feet	Continuous
Power Loading	Power/Weight Ratio	Continuous
Mean Time Between Failures (MTBF)	Hours	Continuous
Mean Time Between Maintenance (MTBM)	Hours	Continuous
Time Between Overhaul (TBO)	Hours	Continuous
Recording Capacity	Recording Capacity Level	Categorical
Maintenance Specialty Requirement	Specialty Certificate Requirement Level	Categorical
Civilian Airports Cross Service	Cross Service Support Level	Categorical
Total Safety Incidents (Class A,B,C)	Total Number Per 100K F/H	Categorical
Engine	Number of Engines	Categorical
Ejection Seat	Ejection Seat Star Value	Categorical
Hook	Hook Speed Limit	Continuous
Drag Chute	Drag Chute Speed limit	Continuous
Collision Avoidance System	Avoidance System Star value	Categorical
Recoverability	Stall Warning Before Stall Margin_Knots	Categorical
Stability	Degrees of Stability	Categorical
Maneuverability / Roll Rate	Degrees Per Second	Continuous
Maneuverability / G_Capacity	Gs	Categorical
Handling Quality Rating	Cooper Harper Score	Categorical
Flight Path Stability	Degrees Per Knot	Continuous
Instrument Flight	Instrument Flight Quality Level	Categorical
Formation Flight	Formation Flight Quality Level	Categorical
Low Level Flight	Low Level Quality Level	Categorical
Aerobatics	Aerobatics Quality Level	Categorical
Ground Handling	Ground Handling Quality Level	Categorical
Consistency With Current	Currency Scale	Categorical
NAVAIDS	NAVAIDS Scale	Categorical
Comm System	Comm System Quality Level	Categorical
Radar	Radar Capability Level	Categorical
Maintenance Cost	Hundred Dollars	Continuous
Aircraft Price	Million Dollars	Continuous
Synthetic Training System	Synthetic Trainer Star Value	Categorical
Debriefing System	Debriefing System Star Value	Categorical
Life Support Materials / G-Suit	G-Suit Quality Level	Categorical

Table A.2: Performance-Evaluation Measures & Scores List

Endurance	Minutes	# minutes
Thrust	Lbs.	# lbs.
Fuel Efficiency	Gallons Per F/H	# gallons per F/H
Speed	Knots	# Knots
Range	Miles	# NM
Ceiling	Feet	# Feet
Max Take-off Runway Length	Feet	# Feet
Power Loading	Power/Weight Ratio	# (Ratio)

Table A.3: Reliability & Maintainability-Evaluation Measures & Scores List

Mean Time Between Failures (MTBF)	Hours	# Hours
Mean Time Between Maintenance (MTBM)	Hours	# Hours
Time Between Overhaul (TBO)	Hours	# Hours
Recording Capacity	Recording Capacity Level	1. No Recording Capability 2. Cockpit Voice Recorder (CVR) 3. Flight Data Recorder (FDR) 4. CVR + FDR
Maintenance Specialty Requirement	Specialty Certificate Requirement Level	1. All Specialty-Certificate Maintenance Requirement 2. No Safety-Flight Issues Maintenance Requirement 3. No Specialty-Certificate Maintenance Requirement
Civilian Airports Cross Service	Cross Service Support Level	1. No Cross Service 2. Stage-A Cross Servicing 3. Stage-B Cross Servicing

Table A.4: Safety-Evaluation Measures & Scores List

Total Safety Incidents (Class A,B,C)	Total Number Per 100K F/H	# of incidents
Engine	Number of Engines	# of engines
Ejection Seat	Ejection Seat Star Value	1. No Ejection Seat 2. Ejection Seat With a Flight Envelope 3. 0-Feet / 0-Knot
Hook	Hook Speed Limit	# Knots
Drag Chute	Drag Chute Speed limit	# Knots
Collision Avoidance System	Avoidance System Star value	1. No Avoidance System 2. GCAS 3. TCAS 4. GCAS + TCAS

Table A.5: Flying Quality-Evaluation Measures & Scores List

Recoverability	Stall Warning Before Stall Margin_Knots	1. 0-Knot 2. 5-Knots 3. 10-Knots 4. 15-Knots 5. 20-Knots
Stability	Degrees of Stability	1. Negatively Stable 2. Neutrally Stable 3. Normally Stable 4. Totally Stable
Maneuverability / Roll Rate	Degrees Per Second	# of degrees/second
Maneuverability / G_Capacity	Gs	1. +3 / -2 G 2. +5 / -3 G 3. +7 / -5 G 4. +9 / -6 G
Handling Quality Rating	Cooper Harper Score	# (1-to-10)
Flight Path Stability	Degrees Per Knot	# of degrees/knot

Table A.6: Training Quality-Evaluation Measures & Scores List

Instrument Flight	Instrument Flight Quality Level	1. No Instrument Flight Rating 2. Basic Instrument Flight Training Capability 3. Radio Instrument Flight Training Capability 4. No Visual / IFR Training Capability
Formation Flight	Formation Flight Quality Level	1. No Formation Flight 2. IFR Formation Flight Training Capability 3. Basic Formation Flight Training Capability 4. Cruise Formation Flight Training Capability
Low Level Flight	Low Level Quality Level	1. AGL1000Feet 300K 2. AGL100Feet 500K 3. AGL250Feet 500K 4. AGL250Feet 300K 5. AGL500Feet 300K 6. AGL500Feet 500K
Aerobatics	Aerobatics Quality Level	1. No Aerobatics Capability 2. Chandelle 3. Chndll+ Hammerhead 4. Chndll+Hmmrhd+ Loop 5. Chndll+Hmmrhd+Loop+Immelman 6. Chndll+Hmmrhd+Loop+Immlmn+Cuban8 7. Chndll+Hmmrhd+Loop+Immlmn+Cbn8+Spin
Ground Handling	Ground Handling Quality Level	1. No Steering Capability 2. Reverse Taxi Capability 3. Steering With ON/OFF Button 4. Steering With Press-Hold Button 5. Castering Nosewheel 6. Linked Rudder Pedals

Table A.7: Technology Quality-Evaluation Measures & Scores List

Consistency With Current	Currency Scale	1. Basic Flight Instruments 2. Basic Flt Inst + Basic Nav Sys 3. Basic Flt Inst + Adv Nav Sys 4. MFDs + Adv Nav Sys 5. Adv Inst Panel + Adv Nav Sys
NAVAIDS	NAVAIDS Scale	1. No Avionics 2. NDB 3. NDB+ DME 4. NDB+ TACAN 5. NDB+ TACAN+ VOR/DME 6. TACAN+ ILS 7. TACAN+ ILS+ INS 8. GPS+ TACAN+ ILS+ INS
Comm System	Comm System Quality Level	1. UHF Only 2. VHF Only 3. UHF + VHF 4. UHF + VHF + HaveQuick 5. UHF + VHF + Backup Radio
Radar	Radar Capability Level	1. No Radar capability 2. Search-Only Radar Capability 3. Search&Track Radar Capability

Table A.8: Cost-Evaluation Measures & Scores List

Maintenance Cost	Hundred Dollars	# Hundred dollars
Aircraft Price	Million Dollars	# Million Dollars

Table A.9: Supporting Systems-Evaluation Measures & Scores List

Synthetic Training System	Synthetic Trainer Star Value	1. No Synthetic Trainer 2. Part Task Trainer (PTT) 3. Flight&Navigation Procedures Trainer (FNPT) 4. Flight Training Device (FTD) 5. Full Simulator
Debriefing System	Debriefing System Star Value	1. No Debrief System 2. GPS Data Recorder 3. Digital Video Debriefing System (DVDS) 4. ACMI Debrifing System 5. ACMI + DVDS
Life Support Materials / G-Suit	G-Suit Quality Level	1. No Anti-G Suit 2. Standart Anti-G Suit 3. Advanced Technology Anti-G Suit

Table A.10: Data Source for T-34C, T-37B, T-6A (Pg-1/3)

VALUE		MEASURE	T-34C	T-37B	T-6A
DESIGN	User Friendly / Throttle	Throttle Star Value	Multilever Engine Control (MLEC) SME - LCDR John ROTTER	Mechanical SLPC (Jane's 1977-1978 Pg-276)	Digital SLPC (Jane's 2007-2008 Pg-644)
	User Friendly / Avionics	Avionics Scale	Navigation System With Auto Alignment SME - LCDR John ROTTER	Navigation System With Auto Alignment T-37B FLIGHT MANUAL T.O. 1T-37B-1	Integrated Avionics System (Jane's 2007-2008 Pg-645)
	Simplicity / Standardized Cockpit	Standardization Level	Integrated Cockpit (Pri Inst + Essen Nav + Essen Comm) SME - LCDR John ROTTER	Integrated Cockpit (Pri Inst + Essen Nav + Essen Comm) (Jane's 1977-1978 Pg-276)	Advanced Cockpit Layout (Jane's 2007-2008 Pg-645)
	Simplicity / Emergency Procedures	Average Number of Steps in Boldfaces	6 SME - LCDR John ROTTER	3 T-37B FLIGHT MANUAL T.O. 1T-37B-1	2 JD O'Malley Regional Manager, North America Hawker Beechcraft Corporation
	Robustness / Landing Gears	Failure Rate Per 100K F/H	5 http://www.safetycenter.navy.mil/MEDIA/mech/issues/fall04/pdf/crossfeed.pdf	6 http://findarticles.com/p/articles/mi_m0IBT/is_6_57/ai_75645352	2 http://www.columbus.af.mil/shared/media/document/AFD-070501-074.pdf
	Robustness / Airframe Lifetime	Years	27 Years Tom Calhoun Manager, T-34/T-44/C-12 Programs Hawker Beechcraft Corporation	40 Years T-37 AIRCRAFT STRUCTURAL INTEGRITY PROGRAM MASTER PLAN UPDATE – FY 2003	37 Years (18,720 Flight Hours) JD O'Malley Regional Manager, North America Hawker Beechcraft Corporation
	Ergonomics / Cockpit	Cockpit Star Value	Tandem (Jane's 1989-1990 Pg-349)	Side-by-Side (Jane's 1977-1978 Pg-276)	Tandem JD O'Malley Regional Manager, North America Hawker Beechcraft Corporation
	Ergonomics / Visibility	Visibility Star Value	Clam-shell Type Canopy Tom Calhoun Manager, T-34/T-44/C-12 Programs Hawker Beechcraft Corporation	Clam-shell Type Canopy (Jane's 1977-1978 Pg-276)	Clam-shell Type Canopy JD O'Malley Regional Manager, North America Hawker Beechcraft Corporation
	Ergonomics / Noise Level	dB	105 dB The Effect of Noise Exposure during Primary Flight Training Ronald M. Robertson Naval Aerospace Medical Research Laboratory	115 dB Defining the Cockpit Noise Hazard, Aircrew Hearing Damage Risk Miss S. James Future Systems & Technology Division	90 dB http://www.aviationweek.com/aw/generic/story_generic.jsp?channel=awst&id=news/04283top.xml
	Ergonomics / ECS	ECS Star Value	50% Ground Efficient + In-Flight Operated ECS System (Jane's 1989-1990 Pg-349)	50% Ground Efficient+ In-Flight Operated ECS System T-37B FLIGHT MANUAL T.O. 1T-37B-1	Upgraded ECS to Prevent Ice Accumulation, Vaporized Air JD O'Malley Regional Manager, North America Hawker Beechcraft Corporation
	Systems Complexity	Complexity Level	Low / Moderate SME - LCDR John ROTTER	Low / Moderate SME - 1st Lieutenant Tufan YELESER	Moderate SME - LCDR Theodore DIAMOND
	Systems Dependency / Engine Start	Engine Start Dependency Level	Battery-Power Start SME - LCDR John ROTTER	Battery Power Start T-37B FLIGHT MANUAL T.O. 1T-37B-1	Battery Power Start JD O'Malley Regional Manager, North America Hawker Beechcraft Corporation
	Upgradeability	Upgradeability Level	Modular design improved upgradeability SME - LCDR John ROTTER	Modular design improved upgradeability SME - 1st Lieutenant Tufan YELESER	Built-in Upgradeability JD O'Malley Regional Manager, North America Hawker Beechcraft Corporation
	Styling	Styling Star Value	Round Shape Fuselage with Straight Low Wing SME - LCDR John ROTTER	Round Shape Fuselage with Straight Low Wing SME - 1st Lieutenant Tufan YELESER	Round Shape Fuselage with Straight Low Wing SME - LCDR Theodore DIAMOND
	Deactivation Capability	Deactivation Feature Star Value	NAVAIDS (Flight Instruments) Deactivation Capability SME - LCDR John ROTTER	Intercom/Radio System Deactivation Capability T-37B FLIGHT MANUAL T.O. 1T-37B-1	MFD Modes Deactivation Capability JD O'Malley Regional Manager, North America Hawker Beechcraft Corporation
PERFORMANCE	Endurance	Minutes	285 min. Tom Calhoun Manager, T-34/T-44/C-12 Programs Hawker Beechcraft Corporation	210 min. T-37B FLIGHT MANUAL T.O. 1T-37B-1	180 min. (Jane's 2007-2008 Pg-645)
	Thrust	Lbs.	1000 lbs. Tom Calhoun Manager, T-34/T-44/C-12 Programs Hawker Beechcraft Corporation	2050 lbs. (Jane's 1977-1978 Pg-276)	3400 lbs. JD O'Malley Regional Manager, North America Hawker Beechcraft Corporation
	Fuel Efficiency	Gallons Per F/H	30 gallons/FH Tom Calhoun Manager, T-34/T-44/C-12 Programs Hawker Beechcraft Corporation	83 gallons/FH (600 lbs/FH) T-37B FLIGHT MANUAL T.O. 1T-37B-1	55 gallons/FH (400 lbs/FH) JD O'Malley Regional Manager, North America Hawker Beechcraft Corporation
	Speed	Knots	182K (Jane's 1989-1990 Pg-349)	349K (Jane's 1977-1978 Pg-276)	350K (Jane's 2007-2008 Pg-645)

Table A.11: Data Source for T-34C, T-37B, T-6A (Pg-2/3)

	Range	Miles	708 NM (Jane's 1989-1990 Pg-349)	819 NM (Jane's 1977-1978 Pg-276)	850 NM (Jane's 2007-2008 Pg-645)
	Ceiling	Feet	25000 ft Tom Calhoun Manager, T-34/T-44/C-12 Programs Hawker Beechcraft Corporation	29900 ft (Jane's 1977-1978 Pg-276)	31000 ft. JD O'Malley Regional Manager, North America Hawker Beechcraft Corporation
	Max Take-off Runway Length	Feet	1030 ft Tom Calhoun Manager, T-34/T-44/C-12 Programs Hawker Beechcraft Corporation	2750 ft (Jane's 1977-1978 Pg-276)	1435 ft. (Jane's 2007-2008 Pg-645)
	Power Loading	Power/Weight Ratio	0.231 Tom Calhoun Manager, T-34/T-44/C-12 Programs Hawker Beechcraft Corporation	0.31 (373 kb/kN (3.65 lb/lb st)) (Jane's 1977-1978 Pg-276)	0.523 (3400lbs/6500pounds) 3.60 kg/kW (5.91 lb/shp) (Jane's 2007-2008 Pg-645)
RELIABILITY	Mean Time Between Failures (MTBF)	Hours	32 FH http://www.safetycenter.navy.mil/MEDIA/mech/issues/fall04/pdf/crossfeed.pdf	45 FH http://findarticles.com/p/articles/mi_m0IBT/is_6_57/ai_75645352	25 FH http://www.usaviation.com/forums/index.php?showuser=13938
MAINTAINABILITY	Mean Time Between Maintenance (MTBM	Hours	8 FH http://www.safetycenter.navy.mil/MEDIA/mech/issues/fall04/pdf/crossfeed.pdf	10 FH http://findarticles.com/p/articles/mi_m0IBT/is_6_57/ai_75645352	10 FH http://www.usaviation.com/forums/index.php?showuser=13938
	Time Between Overhaul (TBO)	Hours	3000 Flight Hour TBO for Engine Tom Calhoun Manager, T-34/T-44/C-12 Programs Hawker Beechcraft Corporation	1000 Flight Hours TBO for Engine Tony Evans USAF AETC AETC/A4MAP	4,500 Hour TBO for Engine JD O'Malley Regional Manager, North America Hawker Beechcraft Corporation
	Recording Capacity	Recording Capacity Level	No Recording Capability SME - LCDR John ROTTER	No Recording Capability T-37B FLIGHT MANUAL T.O. 1T-37B-1	FDR (Jane's 2007-2008 Pg-645)
	Maintenance Specialty Requirement	Specialty Certificate Requirement Level	No safety-flight issues MX requirement SME - LCDR John ROTTER	No safety-flight issues MX requirement SME - 1st Lieutenant Tufan YELESER	No Specialty-Certificate Maintenance Requirement JD O'Malley Regional Manager, North America Hawker Beechcraft Corporation
	Civilian Airports Cross Service	Cross Service Support Level	Stage-A cross serviceable SME - LCDR John ROTTER	Stage-A cross serviceable SME - 1st Lieutenant Tufan YELESER	Stage-A Cross Serviceable JD O'Malley Regional Manager, North America Hawker Beechcraft Corporation
SAFETY	Total Safety Incidents (Class A,B,C)	Total Number Per 100K F/H	54 http://findarticles.com/p/articles/mi_m0IAX/is_4_86/ai_117626523	162 Improving Aircraft Accident Forecasting Michael T. McNerney and Tracy A. Turen Center for Transportation Research	21 (3 Class-A over 800K F/H ; Class-B,C - 18) JD O'Malley Regional Manager, North America Hawker Beechcraft Corporation
	Engine	Number of Engines	1 SME - LCDR John ROTTER	2 T-37B FLIGHT MANUAL T.O. 1T-37B-1	1 JD O'Malley Regional Manager, North America Hawker Beechcraft Corporation
	Ejection Seat	Ejection Seat Star Value	No Ejection Seat SME - LCDR John ROTTER	Ejection Seat w/ a Flight Envelope T-37B FLIGHT MANUAL T.O. 1T-37B-1	Zero/Zero Ejection Seat JD O'Malley Regional Manager, North America Hawker Beechcraft Corporation
	Hook	Hook Speed Limit	N/A SME - LCDR John ROTTER	N/A T-37B FLIGHT MANUAL T.O. 1T-37B-1	N/A JD O'Malley Regional Manager, North America Hawker Beechcraft Corporation
	Drag Chute	Drag Chute Speed limit	N/A SME - LCDR John ROTTER	N/A T-37B FLIGHT MANUAL T.O. 1T-37B-1	N/A JD O'Malley Regional Manager, North America Hawker Beechcraft Corporation
	Collision Avoidance System	Avoidance System Star value	TCAS (degraded) SME - LCDR John ROTTER	No Avoidance System T-37B FLIGHT MANUAL T.O. 1T-37B-1	TCAS JD O'Malley Regional Manager, North America Hawker Beechcraft Corporation
FLYING QUALITY	Recoverability	Stall Warning Before Stall Margin_Knots	5 K SME - LCDR John ROTTER	10 K T-37B FLIGHT MANUAL T.O. 1T-37B-1	5 K JD O'Malley Regional Manager, North America Hawker Beechcraft Corporation
	Stability	Degrees of Stability	Normally (positively) stable SME - LCDR John ROTTER	Normally (positively) stable T-37B FLIGHT MANUAL T.O. 1T-37B-1	Normally (positively) stable SME - LCDR Theodore DIAMOND
	Maneuverability / Roll Rate	Degrees Per Second	180 degrees/sec SME - LCDR John ROTTER	160 degrees/sec http://answers.yahoo.com/question/index?qid=20080114132822AAfqfmS	260 degrees/sec http://www.soaringwear.com/uploadz/02/PDF/Paper3x.PDF
	Maneuverability / G_Capacity	Gs	+ 4.5 / -2.3 SME - LCDR John ROTTER	+ 6.67 / -2.67 T-37B FLIGHT MANUAL T.O. 1T-37B-1	+7 / -3.5 (Jane's 2007-2008 Pg-645)

Table A.12: Data Source for T-34C, T-37B, T-6A (Pg-3/3)

	Handling Quality Rating	Cooper Harper Score	4 SME - LCDR John ROTTER	3 SME - 1st Lieutenant Tufan YELESER	2 SME - LCDR Theodore DIAMOND
	Flight Path Stability	Degrees Per Knot	0.15 (Level-2) http://forums.x-plane.org/lofiversion/index.php?f8.html	0.15 (Level-2) http://www.pprune.org/forums/forumdisplay.php?f=50 http://forums.x-plane.org/lofiversion/index.php?f8.html	0.06 (Level-1) http://www.pprune.org/forums/forumdisplay.php?f=50
TRAINING QUALITY	Instrument Flight	Instrument Flight Quality Level	Radio Instrument Flight Training SME - LCDR John ROTTER	Radio Instrument Flight Training T-37B FLIGHT MANUAL T.O. 1T-37B-1	Radio Instrument Flight Training SME - LCDR Theodore DIAMOND
	Formation Flight	Formation Flight Quality Level	Cruise Formation Flight Training SME - LCDR John ROTTER	Cruise Formation Flight Training T-37B FLIGHT MANUAL T.O. 1T-37B-1	Cruise + IFR Formation Flight Training SME - LCDR Theodore DIAMOND
	Low Level Flight	Low Level Quality Level	AGL-500' / 300K SME - LCDR John ROTTER	AGL-500' / 300K SME - 1st Lieutenant Tufan YELESER	AGL-500' / 300K SME - LCDR Theodore DIAMOND
	Aerobatics	Aerobatics Quality Level	Chndll+Hmmrhd+Loop+Immlmn+Cbn8+Spin SME - LCDR John ROTTER	Chndll+Hmmrhd+Loop+Immlmn+Cbn8+Spin SME - 1st Lieutenant Tufan YELESER	Chndll+Hmmrhd+Loop+Immlmn+Cbn8+Spin http://www.aviationweek.com/aw/generic/ story_generic.jsp?channel=awst&id=news/04283top.xml
	Ground Handling	Ground Handling Quality Level	Castering Nosewheel Steering Capacity SME - LCDR John ROTTER	Steering w/ Press-Hold Button (Jane's 1977-1978 Pg-276)	Steering With ON/OFF Button http://www.accessibleaviation.com/SUPT_Gouge/T6_Gouge
TECHNOLOGY	Consistency With Current	Currency Scale	Basic Flight Instruments + Basic Navigation Systems SME - LCDR John ROTTER	Basic Flight Instruments + Advanced Navigation Systems T-37B FLIGHT MANUAL T.O. 1T-37B-1	Adv Inst Panel + Adv Nav Sys (Jane's 2007-2008 Pg-645)
	NAVAIDS	NAVAIDS Scale	NDB+ TACAN+ VOR/DME (Jane's 1989-1990 Pg-349)	TACAN + ILS T-37B FLIGHT MANUAL T.O. 1T-37B-1	GPS+TACAN+ILS+INS (Jane's 2007-2008 Pg-645)
	Comm System	Comm System Quality Level	VHF only Tom Calhoun Manager, T-34/T-44/C-12 Programs Hawker Beechcraft Corporation	UHF only T-37B FLIGHT MANUAL T.O. 1T-37B-1	UHF+VHF (Jane's 2007-2008 Pg-645)
	Radar	Radar Capability Level	No Radar Capability SME - LCDR John ROTTER	No Radar Capability T-37B FLIGHT MANUAL T.O. 1T-37B-1	No Radar Capability JD O'Malley Regional Manager, North America Hawker Beechcraft Corporation
COST	Maintenance Cost	Hundred Dollars	$ 48 (0.5MMH/FH) http://www.globalsecurity.org/military/library/policy/navy/ntsp/CXP-IFF-I.htm	$ 106 (1.10 MMH/FH) Improving Aircraft Accident Forecasting Michael T. McNerney and Tracy A. Turen Center for Transportation Research	$ 198 (2.06 MMH/FH) JD O'Malley Regional Manager, North America Hawker Beechcraft Corporation
	Aircraft Price	Million Dollars	$ 1 M http://www.navy.mil/navydata/fact_display.asp?cid=1100&tid=1800&ct=1	$ 1.24 M ($180K in 1960) Tony Evans USAF AETC AETC/A4MAP http://www.dollartimes.com/calculators/inflation.htm The Changing Value of Dollar-Inflation Calculator	$ 4.27 M JD O'Malley Regional Manager, North America Hawker Beechcraft Corporation
SUPPORTING SYSTEMS	Synthetic Training System	Synthetic Trainer Star Value	Flight & Navigation Procedures Trainer SME - LCDR John ROTTER	Flight & Navigation Procedures Trainer SME - 1st Lieutenant Tufan YELESER	Full Simulator JD O'Malley Regional Manager, North America Hawker Beechcraft Corporation
	Debriefing System	Debriefing System Star Value	No Debriefing System SME - LCDR John ROTTER	No Debriefing System SME - 1st Lieutenant Tufan YELESER	Digital Video Debriefing System (DVDS) http://www.navair.navy.mil/publications/ar_1998.pdf
	Life Support Materials / G-Suit	G-Suit Quality Level	No Anti-G Suit SME - LCDR John ROTTER	No Anti-G Suit SME - 1st Lieutenant Tufan YELESER	Standart Anti-G Suit JD O'Malley Regional Manager, North America Hawker Beechcraft Corporation

*** Pounds are converted to gallons with the following conversion ratio: 1 gallons of gas = 3.785 pounds of gas
*** Refrigerant Type (ECS): The mechanism used by the chiller, which performs heat transfer by converting from liquid to gas and gas to liquid at various pressures and temperatures. Common refrigerants used in commercial HVAC are R-11, R-12, R-22, R-113,
*** A training aircraft is assumed to fly an average of 500 hours a year.
*** According to Dr. King's conversion formula, the thrust measures have been coverted from SHP to Lbs. accord'ng to the following formula:]F(lbs) * V(ft/s)] / 550 = BHP
*** According to http://forums.jetcareers.com/cfi-corner/43771-horsepower-to-thrust-conversion.html F (Lbs.) = SHP * 375 * Prop efficiency / Speed in MPH
*** According to Cpt. Jason Brown's thesis database relating to the aircraft maintenance cost;
--- E-5 labor rate per hour is rounded to $ 65 / hour
--- Depot Maintenance Activity Group (DMAG) (aka…contractor) is $ 127 / hour
*** According to those two value, the average value of $ 96 / hour has been used in this study for Preventive Maintenance MMH/FH cost.

Table A.13: Data Source for EMB.312, KT-1C, T-35 (Pg-1/3)

VALUE		MEASURE	EMB.312	KT-1C	T-35
DESIGN	User Friendly / Throttle	Throttle Star Value	Mechanical Single SLPC Julian Jaime Cervantes EMBRAER Sales Engineering	Combined (Mechanical+ Digital) SLPC (Jane's 2007-2008 Pg-408)	Mechanical Single SLPC Ricardo Klima W. ENAER Gerente Comercial
	User Friendly / Avionics	Avionics Scale	Integrated Avionics System Julian Jaime Cervantes EMBRAER Sales Engineering	Integrated Avionics System (Jane's 2007-2008 Pg-407)	Navigation System With Auto Alignment Ricardo Klima W. ENAER Gerente Comercial
	Simplicity / Standardized Cockpit	Standardization Level	Advanced Cockpit Layout Julian Jaime Cervantes EMBRAER Sales Engineering	Advanced Cockpit Layout (Jane's 2007-2008 Pg-407)	Integrated Cockpit (Pri Inst + Essen Nav + Essen Comm) Ricardo Klima W. ENAER Gerente Comercial
	Simplicity / Emergency Procedures	Average Number of Steps in Boldfaces	6 Julian Jaime Cervantes EMBRAER Sales Engineering	5 Jung Seung-Lip http://avitop.com/cs/forums/25/showforum.aspx	6 Ricardo Klima W. ENAER Gerente Comercial
	Robustness / Landing Gears	Failure Rate Per 100K F/H	5 Julian Jaime Cervantes EMBRAER Sales Engineering	4 Jung Seung-Lip http://avitop.com/cs/forums/25/showforum.aspx	3 Ricardo Klima W. ENAER Gerente Comercial
	Robustness / Airframe Lifetime	Years	32 Years (16000 Flight Hours) Julian Jaime Cervantes EMBRAER Sales Engineering	30 Years (15000 Flight Hours) Jung Seung-Lip http://avitop.com/cs/forums/25/showforum.aspx	30 Years Ricardo Klima W. ENAER Gerente Comercial
	Ergonomics / Cockpit	Cockpit Star Value	Stepped Tandem Julian Jaime Cervantes EMBRAER Sales Engineering	Stepped Tandem (Jane's 2007-2008 Pg-407)	Tandem Ricardo Klima W. ENAER Gerente Comercial
	Ergonomics / Visibility	Visibility Star Value	Clam-shell Type Canopy Julian Jaime Cervantes EMBRAER Sales Engineering	Clam-Shell Type Canopy (Jane's 2007-2008 Pg-408)	Clam-Shell Type Canopy Ricardo Klima W. ENAER Gerente Comercial
	Ergonomics / Noise Level	dB	94 dB Julian Jaime Cervantes EMBRAER Sales Engineering	90 dB A noise survey conducted on the KT-1C at KAI M Hancock, A Hazell, M Aitchison	100 dB Ricardo Klima W. ENAER Gerente Comercial
	Ergonomics / ECS	ECS Star Value	Full Ground + In-Flight ECS System Julian Jaime Cervantes EMBRAER Sales Engineering	Full Ground + In-Flight ECS System (Jane's 2007-2008 Pg-407)	50% Ground Efficient+ In-Flight Operated ECS System Ricardo Klima W. ENAER Gerente Comercial
	Systems Complexity	Complexity Level	Moderate Julian Jaime Cervantes EMBRAER Sales Engineering	Moderate Kim Chang-Sun http://forum.dtmonline.com/leo/cgi-bin/printpage.cgi?forum=4&topic=475	Low/Moderate Ricardo Klima W. ENAER Gerente Comercial
	Systems Dependency / Engine Start	Engine Start Dependency Level	Battery Power Start Julian Jaime Cervantes EMBRAER Sales Engineering	Battery Power Start (Jane's 2007-2008 Pg-408)	Battery Power Start Ricardo Klima W. ENAER Gerente Comercial
	Upgradeability	Upgradeability Level	Modular design improved upgradeability Julian Jaime Cervantes EMBRAER Sales Engineering	Built-in Upgradeability http://www.cmcelectronics.ca/	Modular design improved upgradeability Ricardo Klima W. ENAER Gerente Comercial
	Styling	Styling Star Value	Round Shape Fuselage with Straight Low Wing Julian Jaime Cervantes EMBRAER Sales Engineering	Round Shape Fuselage with Straight Low Wing http://www.flugrevue.de/index.php?id=228&f=1283&a=td	Round Shape Fuselage with Straight Low Wing Ricardo Klima W. ENAER Gerente Comercial
	Deactivation Capability	Deactivation Feature Star Value	NAVAIDS (Flight Instruments) Deactivation Capability Julian Jaime Cervantes EMBRAER Sales Engineering	MFD Modes Deactivation Capability http://www.cmcelectronics.ca/	NAVAIDS (Flight Instruments) Deactivation Capability Ricardo Klima W. ENAER Gerente Comercial
PERFORMANCE	Endurance	Minutes	300 min. Julian Jaime Cervantes EMBRAER Sales Engineering	360 min. (Jane's 2007-2008 Pg-409)	340 min. Ricardo Klima W. ENAER Gerente Comercial
	Thrust	Lbs.	970 lbs. (750 shp) Julian Jaime Cervantes EMBRAER Sales Engineering	1017 lbs. (950 shp) (Jane's 2007-2008 Pg-408)	543 lbs. (300 bhp) Ricardo Klima W. ENAER Gerente Comercial
	Fuel Efficiency	Gallons Per F/H	61 gallons/FH (445 lbs/FH) (~0.595 lb/SHP/h) Julian Jaime Cervantes EMBRAER Sales Engineering	52 gallons/FH (380 lbs/FH) http://www.armada.ch/06-4/article-full.cfm	22 gallons/FH (85 lt/FH) Ricardo Klima W. ENAER Gerente Comercial
	Speed	Knots	290 K Julian Jaime Cervantes EMBRAER Sales Engineering	350K (Jane's 2007-2008 Pg-408)	180K Ricardo Klima W. ENAER Gerente Comercial
	Range	Miles	995 NM Julian Jaime Cervantes EMBRAER Sales Engineering	720 NM (Jane's 2007-2008 Pg-408)	680 NM Ricardo Klima W. ENAER Gerente Comercial
	Ceiling	Feet	25050 ft Julian Jaime Cervantes EMBRAER Sales Engineering	38000 ft (Jane's 2007-2008 Pg-408)	19160 Ricardo Klima W. ENAER Gerente Comercial
	Max Take-off Runway Length	Feet	2086 ft (636m) Julian Jaime Cervantes EMBRAER Sales Engineering	1620 ft. (Jane's 2007-2008 Pg-409)	940 ft Ricardo Klima W. ENAER Gerente Comercial
	Power Loading	Power/Weight Ratio	0.243 (970 lbs / 3990 pounds) 0.294 SHP/kg Julian Jaime Cervantes EMBRAER Sales Engineering	0.241 (1017 lbs / 4210pounds) 3.59 kg/kW (5.89 lb/shp) (Jane's 2007-2008 Pg-408)	0.261 (543 lbs / 2080 pounds) 300 bhp / 2950 lb Ricardo Klima W. ENAER Gerente Comercial

Table A.14: Data Source for EMB.312, KT-1C, T-35 (Pg-2/3)

RELIABILITY	Mean Time Between Failures (MTBF)	Hours	16.7 FH Julian Jaime Cervantes EMBRAER Sales Engineering	28 FH Chol Jung-Keun http://jets.dk/cs/forums/25/ShowForum.aspx	34 FH Ricardo Klima W. ENAER Gerente Comercial
MAINTAINABILITY	Mean Time Between Maintenance (MTBM)	Hours	13.9 FH Julian Jaime Cervantes EMBRAER Sales Engineering	10 FH Chol Jung-Keun http://jets.dk/cs/forums/25/ShowForum.aspx	100 FH Ricardo Klima W. ENAER Gerente Comercial
	Time Between Overhaul (TBO)	Hours	3000 Flight Hours TBO for Engine Julian Jaime Cervantes EMBRAER Sales Engineering	4000 Flight Hours TBO for Engine Chol Jung-Keun http://jets.dk/cs/forums/25/ShowForum.aspx	1400 Flight Hours TBO for Engine Ricardo Klima W. ENAER Gerente Comercial
	Recording Capacity	Recording Capacity Level	No Recording Capability Julian Jaime Cervantes EMBRAER Sales Engineering	FDR (Jane's 2007-2008 Pg-408)	No Recording Capability Ricardo Klima W. ENAER Gerente Comercial
	Maintenance Specialty Requirement	Specialty Certificate Requirement Level	All Specialty-Certificate Maintenance Requirement Julian Jaime Cervantes EMBRAER Sales Engineering	All Specialty-Certificate Maintenance Requirement http://www.flugrevue.de/index.php?id=228&f=1283&a=td	All Specialty-Certificate Maintenance Requirement Ricardo Klima W. ENAER Gerente Comercial
	Civilian Airports Cross Service	Cross Service Support Level	No Cross-Serviceable Julian Jaime Cervantes EMBRAER Sales Engineering	No Cross-Serviceable http://www.flugrevue.de/index.php?id=228&f=1283&a=td	No Cross-Serviceable Ricardo Klima W. ENAER Gerente Comercial
SAFETY	Total Safety Incidents (Class A,B,C)	Total Number Per 100K F/H	41 http://www.whq-forum.de/invisionboard/lofiversion/index.php/t19777-1450.html	14 Kim Chang-Sun http://forum.dtmonline.com/leo/cgi-bin/printpage.cgi?forum=4&topic=475	36 Ricardo Klima W. ENAER Gerente Comercial
	Engine	Number of Engines	1 Julian Jaime Cervantes EMBRAER Sales Engineering	1 (Jane's 2007-2008 Pg-408)	1 Ricardo Klima W. ENAER Gerente Comercial
	Ejection Seat	Ejection Seat Star Value	Ejection Seat with a Flight Envelope (MBBR8LC) Julian Jaime Cervantes EMBRAER Sales Engineering	Zero/Zero Ejection Seat (Jane's 2007-2008 Pg-408)	No Ejection Seat Ricardo Klima W. ENAER Gerente Comercial
	Hook	Hook Speed Limit	N/A Julian Jaime Cervantes EMBRAER Sales Engineering	N/A (Jane's 2007-2008 Pg-408)	N/A Ricardo Klima W. ENAER Gerente Comercial
	Drag Chute	Drag Chute Speed limit	N/A Julian Jaime Cervantes EMBRAER Sales Engineering	N/A (Jane's 2007-2008 Pg-408)	N/A Ricardo Klima W. ENAER Gerente Comercial
	Collision Avoidance System	Avoidance System Star value	No Avoidance System Julian Jaime Cervantes EMBRAER Sales Engineering	TCAS http://acilr-cdril.com/CD_No1/CMC_capability_brochure_en.pdf	No Avoidance System Ricardo Klima W. ENAER Gerente Comercial
FLYING QUALITY	Recoverability	Stall Warning Before Stall Margin_Knots	5 K Julian Jaime Cervantes EMBRAER Sales Engineering	5 K Kwang Weon-Kee http://avitop.com/cs/forums/thread/5195.aspx	5 K Ricardo Klima W. ENAER Gerente Comercial
	Stability	Degrees of Stability	Normally (positively) stable Julian Jaime Cervantes EMBRAER Sales Engineering	Normally (positively) stable http://www.flugrevue.de/index.php?id=228&f=1283&a=td	Normally (positively) stable Ricardo Klima W. ENAER Gerente Comercial
	Maneuverability / Roll Rate	Degrees Per Second	230 degrees/sec http://www.milavia.net/news/archive.php?2005-12	250 degrees/sec Kwang Weon-Kee http://avitop.com/cs/forums/thread/5195.aspx	111 degrees/sec Ricardo Klima W. ENAER Gerente Comercial
	Maneuverability / G_Capacity	Gs	+ 6 / -3 Julian Jaime Cervantes EMBRAER Sales Engineering	+7 / -3.5 (Jane's 2007-2008 Pg-409)	+6 / -3 Ricardo Klima W. ENAER Gerente Comercial
	Handling Quality Rating	Cooper Harper Score	3 Julian Jaime Cervantes EMBRAER Sales Engineering	2 Moon Bong-Choi http://www.usaviation.com/forums/index.php?showtopic=40069&pid=572116&start=0&#entry572116	3 Ricardo Klima W. ENAER Gerente Comercial
	Flight Path Stability	Degrees Per Knot	0.06 (Level-1) http://www.pprune.org/forums/forumdisplay.php?f=50	0.06 (Level-1) http://www.pprune.org/forums/forumdisplay.php?f=50	0.15 (Level-2) Ricardo Klima W. ENAER Gerente Comercial
TRAINING QUALITY	Instrument Flight	Instrument Flight Quality Level	Radio Instrument Flight Training Julian Jaime Cervantes EMBRAER Sales Engineering	Radio Instrument Flight Training Jeon Eunkyhung http://boardreader.com/fp/US_Aviation_Aviation_Forums_Ai_21840/Flight_Training_Forum_186922.html	Radio Instrument Flight Training Ricardo Klima W. ENAER Gerente Comercial
	Formation Flight	Formation Flight Quality Level	Cruise Formation Flight Training Julian Jaime Cervantes EMBRAER Sales Engineering	Cruise + IFR Formation Flight Training Jeon Eunkyhung http://boardreader.com/fp/US_Aviation_Aviation_Forums_Ai_21840/Flight_Training_Forum_186922.html	Cruise Formation Flight Training Ricardo Klima W. ENAER Gerente Comercial
	Low Level Flight	Low Level Quality Level	AGL-500' / 300K Julian Jaime Cervantes EMBRAER Sales Engineering	AGL-500' / 300K Jeon Eunkyhung http://boardreader.com/fp/US_Aviation_Aviation_Forums_Ai_21840/Flight_Training_Forum_186922.html	AGL-500' / 300K Ricardo Klima W. ENAER Gerente Comercial
	Aerobatics	Aerobatics Quality Level	Chndll+Hmmrhd+Loop+Immlmn+Cbn8+Spin Julian Jaime Cervantes EMBRAER Sales Engineering	Chndll+Hmmrhd+Loop+Immlmn+Cbn8+Spin (Jane's 2007-2008 Pg-408)	Chndll+Hmmrhd+Loop+Immlmn+Cbn8+Spin Ricardo Klima W. ENAER Gerente Comercial
	Ground Handling	Ground Handling Quality Level	Steering With ON/OFF Button Julian Jaime Cervantes EMBRAER Sales Engineering	Steering With ON/OFF Button (Jane's 2007-2008 Pg-408)	Differential Braking Ricardo Klima W. ENAER Gerente Comercial
TECHNOLOGY	Consistency With Current	Currency Scale	Adv Inst Panel + Adv Nav Sys Julian Jaime Cervantes EMBRAER Sales Engineering	Adv Inst Panel + Adv Nav Sys (Jane's 2007-2008 Pg-408)	Basic Flight Instruments + Basic Navigation Systems Ricardo Klima W. ENAER Gerente Comercial

Table A.15: Data Source for EMB.312, KT-1C, T-35 (Pg-3/3)

	NAVAIDS	NAVAIDS Scale	TACAN+ILS (ILS,VOR,DME) Julian Jaime Cervantes EMBRAER Sales Engineering	GPS+ TACAN+ ILS+ INS (Jane's 2007-2008 Pg-407)	NDB + VOR/DME Ricardo Klima W. ENAER Gerente Comercial
	Comm System	Comm System Quality Level	UHF + VHF Julian Jaime Cervantes EMBRAER Sales Engineering	VHF only (Jane's 2007-2008 Pg-408)	VHF only Ricardo Klima W. ENAER Gerente Comercial
	Radar	Radar Capability Level	No Radar Capability Julian Jaime Cervantes EMBRAER Sales Engineering	No Radar capability http://www.thefreelibrary.com/A+clash+of+generations:+the+key+question+in+primary+tr ainers	No Radar Capability Ricardo Klima W. ENAER Gerente Comercial
COST	Maintenance Cost	Hundred Dollars	$120 (1.25 MH/FH) Julian Jaime Cervantes EMBRAER Sales Engineering	$ 140 (1.46 MMH/FH) Jeung Eui-Tae http://aviationforum.org/forums/showthread.php?threadid=3299	$ 67 (0.7 MMH/FH) Ricardo Klima W. ENAER Gerente Comercial
	Aircraft Price	Million Dollars	$ 2 M Julian Jaime Cervantes EMBRAER Sales Engineering	$ 5M (Jane's 2007-2008 Pg-407)	$ 685K Ricardo Klima W. ENAER Gerente Comercial
SUPPORTING SYSTEMS	Synthetic Training System	Synthetic Trainer Star Value	No Synthetic Trainer system Julian Jaime Cervantes EMBRAER Sales Engineering	Full Simulator http://www.flugrevue.de/index.php?id=228&f=1283&a=td	No Synthetic Trainer System Ricardo Klima W. ENAER Gerente Comercial
	Debriefing System	Debriefing System Star Value	No Debriefing System Julian Jaime Cervantes EMBRAER Sales Engineering	Digital Video Debriefing System (DVDS) http://www.flugrevue.de/index.php?id=228&f=1283&a=td	No Debrifing System Ricardo Klima W. ENAER Gerente Comercial
	Life Support Materials / G-Suit	G-Suit Quality Level	No Anti-G Suit Julian Jaime Cervantes EMBRAER Sales Engineering	Standard Anti-G Suit System http://www.aving.net/kr/news/default.asp?mode=read&c_num=62549&C_Code=07&SP_ Num=116	No Anti-G Suit System Ricardo Klima W. ENAER Gerente Comercial

*** Pounds are converted to gallons with the following conversion ratio: 1 gallons of gas = 3.785 pounds of gas
*** Refrigerant Type (ECS): The mechanism used by the chiller, which performs heat transfer by converting from liquid to gas and gas to liquid at various pressures and temperatures. Common refrigerants used in commercial HVAC are R-11, R-12, R-22, R-113,
*** A training aircraft is assumed to fly an average of 500 hours a year.
*** According to Dr. King's conversion formula, the thrust measures have been coverted from SHP to Lbs. accord'ng to the following formula:]F(lbs) * V(ft/s)] / 550 = BHP
*** According to http://forums.jetcareers.com/cfi-corner/43771-horsepower-to-thrust-conversion.html F (Lbs.) = SHP * 375 * Prop efficiency / Speed in MPH
*** According to Cpt. Jason Brown's thesis database relating to the aircraft maintenance cost;
--- E-5 labor rate per hour is rounded to $ 65 / hour
--- Depot Maintenance Activity Group (DMAG) (aka…contractor) is $ 127 / hour
*** According to those two value, the average value of $ 96 / hour has been used in this study for Preventive Maintenance MMH/FH cost.

Table A.16: DM-1 Alternatives Scoring Complete List

VALUE		MEASURE	Global Weight	ALTERNATIVE SCORES T-34C	T-37B	T-6A	EMB.312	KT-1C	T-35	WEIGHTED SCORES T-34C	T-37B	T-6A	EMB.312	KT-1C	T-35
DESIGN	User Friendly / Throttle	Throttle Star Value													
	User Friendly / Avionics	Avionics Scale													
	Simplicity / Standardized Cockpit	Standardization Level													
	Simplicity / Emergency Procedures	Average Number of Steps in Boldfaces													
	Robustness / Landing Gears	Failure Rate Per 100K F/H	0,03	0	0	0,67	0	0,33	0,42	0	0	0,0201	0	0,0099	0,0126
	Robustness / Airframe Lifetime	Years													
	Ergonomics / Cockpit	Cockpit Star Value	0,045	0,25	1	0,25	0,5	0,25	0,25	0,01125	0,045	0,01125	0,0225	0,01125	0,01125
	Ergonomics / Visibility	Visibility Star Value													
	Ergonomics / Noise Level	dB													
	Ergonomics / ECS	ECS Star Value													
	Systems Complexity	Complexity Level	0,076	0,47	0,47	0,68	0,68	0,68	0,47	0,03572	0,03572	0,05168	0,05168	0,05168	0,03572
	Systems Dependency / Engine Start	Engine Start Dependency Level													
	Upgradeability	Upgradeability Level	0,015	0,38	0,38	1	0,38	1	0,38	0,0057	0,0057	0,015	0,0057	0,015	0,0057
	Styling	Styling Star Value													
	Deactivation Capability	Deactivation Feature Star Value													
PERFORMANCE	Endurance	Minutes													
	Thrust	Lbs.													
	Fuel Efficiency	Gallons Per F/H	0,083	0,5	0	0	0	0	0,88	0,0415	0	0	0	0	0,07304
	Speed	Knots													
	Range	Miles													
	Ceiling	Feet													
	Max Take-off Runway Length	Feet													
	Power Loading	Power/Weight Ratio													
RELIABILITY	Mean Time Between Failures (MTBF)	Hours													
MAINTAINABILITY	Mean Time Between Maintenance (MTBM)	Hours	0,083	0	0	0	0	0	1	0	0	0	0	0	0,083
	Time Between Overhaul (TBO)	Hours	0,042	1	1	1	1	1	1	0,042	0,042	0,042	0,042	0,042	0,042
	Recording Capacity	Recording Capacity Level													
	Maintenance Specialty Requirement	Specialty Certificate Requirement Level													
	Civilian Airports Cross Service	Cross Service Support Level													
SAFETY	Total Safety Incidents (Class A,B,C)	Total Number Per 100K F/H	0,333	0	0	0	0	0	0	0	0	0	0	0	0
	Engine	Number of Engines													
	Ejection Seat	Ejection Seat Star Value													
	Hook	Hook Speed Limit													
	Drag Chute	Drag Chute Speed limit													
	Collision Avoidance System	Avoidance System Star value													
FLYING QUALITY	Recoverability	Stall Warning Before Stall Margin_Knots	0,168	0,47	0,82	0,47	0,47	0,47	0,47	0,07896	0,13776	0,07896	0,07896	0,07896	0,07896
	Stability	Degrees of Stability													
	Maneuverability / Roll Rate	Degrees Per Second													
	Maneuverability / G_Capacity	Gs													
	Handling Quality Rating	Cooper Harper Score													
	Flight Path Stability	Degrees Per Knot													
TRAINING QUALITY	Instrument Flight	Instrument Flight Quality Level													
	Formation Flight	Formation Flight Quality Level													
	Low Level Flight	Low Level Quality Level													
	Aerobatics	Aerobatics Quality Level													
	Ground Handling	Ground Handling Quality Level													
TECHNOLOGY	Consistency With Current	Currency Scale													
	NAVAIDS	NAVAIDS Scale	0,083	0,28	0,45	1	0,45	1	0,1	0,02324	0,03735	0,083	0,03735	0,083	0,0083
	Comm System	Comm System Quality Level													
	Radar	Radar Capability Level													
COST	Maintenance Cost	Hundred Dollars													
	Aircraft Price	Million Dollars	0,042	1	1	1	1	1	1	0,042	0,042	0,042	0,042	0,042	0,042
SUPPORTING SYSTEMS	Synthetic Training System	Synthetic Trainer Star Value													
	Debriefing System	Debriefing System Star Value													
	Life Support Materials / G-Suit	G-Suit Quality Level													
		GLOBAL WEIGHT TOTAL →	1,000	RESULTING SCORES →						0,2804	0,34553	0,34399	0,28019	0,33379	0,3926
															T-35

1-	T-35 PILLAN	0,3926
2-	T-37B TWEET	0,34553
3-	T-6A TEXAN II	0,34399
4-	KT-1C	0,33379
5-	T-34C	0,2804
6-	EMB.312	0,28019

Table A.17: DM-1 Alternatives Scoring Summary List

VALUE		MEASURE	Global Weight	ALTERNATIVE SCORES T-34C	T-37B	T-6A	EMB.312	KT-1C	T-35	WEIGHTED SCORES T-34C	T-37B	T-6A	EMB.312	KT-1C	T-35
DESIGN	Robustness / Landing Gears	Failure Rate Per 100K F/H	0,03	0	0	0,67	0	0,33	0,42	0	0	0,0201	0	0,0099	0,0126
	Ergonomics / Cockpit	Cockpit Star Value	0,045	0,25	1	0,25	0,5	0,25	0,25	0,01125	0,045	0,01125	0,0225	0,01125	0,01125
	Systems Complexity	Complexity Level	0,076	0,47	0,47	0,68	0,68	0,68	0,47	0,03572	0,03572	0,05168	0,05168	0,05168	0,03572
	Upgradeability	Upgradeability Level	0,015	0,38	0,38	1	0,38	1	0,38	0,0057	0,0057	0,015	0,0057	0,015	0,0057
PERFORMANCE	Fuel Efficiency	Gallons Per F/H	0,083	0,5	0	0	0	0	0,88	0,0415	0	0	0	0	0,07304
MAINTAINABILITY	Mean Time Between Maintenance (MTBM)	Hours	0,083	0	0	0	0	0	1	0	0	0	0	0	0,083
	Time Between Overhaul (TBO)	Hours	0,042	1	1	1	1	1	1	0,042	0,042	0,042	0,042	0,042	0,042
SAFETY	Total Safety Incidents (Class A,B,C)	Total Number Per 100K F/H	0,333	0	0	0	0	0	0	0	0	0	0	0	0
FLYING QUALITY	Recoverability	Stall Warning Before Stall Margin_Knots	0,168	0,47	0,82	0,47	0,47	0,47	0,47	0,07896	0,13776	0,07896	0,07896	0,07896	0,07896
TECHNOLOGY	NAVAIDS	NAVAIDS Scale	0,083	0,28	0,45	1	0,45	1	0,1	0,02324	0,03735	0,083	0,03735	0,083	0,0083
COST	Aircraft Price	Million Dollars	0,042	1	1	1	1	1	1	0,042	0,042	0,042	0,042	0,042	0,042
		GLOBAL WEIGHT TOTAL →	1,000	RESULTING SCORES →						0,2804	0,34553	0,34399	0,28019	0,33379	0,3926
															T-35

1-	T-35 PILLAN	0,3926
2-	T-37B TWEET	0,34553
3-	T-6A TEXAN II	0,34399
4-	KT-1C	0,33379
5-	T-34C	0,2804
6-	EMB.312	0,28019

Table A.18: DM-2 Alternatives Scoring Complete List

VALUE		MEASURE		ALTERNATIVE SCORES						WEIGHTED SCORES					
			Global Weight	T-34C	T-37B	T-6A	EMB.312	KT-1C	T-35	T-34C	T-37B	T-6A	EMB.312	KT-1C	T-35
DESIGN	User Friendly / Throttle	Throttle Star Value													
	User Friendly / Avionics	Avionics Scale													
	Simplicity / Standardized Cockpit	Standardization Level													
	Simplicity / Emergency Procedures	Average Number of Steps in Boldfaces	0,0714	0,54	1	1	0,54	0,6	0,54	0,0386	0,0714	0,0714	0,0386	0,0428	0,0386
	Robustness / Landing Gears	Failure Rate Per 100K F/H													
	Robustness / Airframe Lifetime	Years													
	Ergonomics / Cockpit	Cockpit Star Value	0,0714	0,17	1	0,17	0,5	0,5	0,17	0,0121	0,0714	0,0121	0,0357	0,0357	0,0121
	Ergonomics / Visibility	Visibility Star Value													
	Ergonomics / Noise Level	dB													
	Ergonomics / ECS	ECS Star Value													
	Systems Complexity	Complexity Level													
	Systems Dependency / Engine Start	Engine Start Dependency Level													
	Upgradeability	Upgradeability Level													
	Styling	Styling Star Value													
	Deactivation Capability	Deactivation Feature Star Value													
PERFORMANCE	Endurance	Minutes													
	Thrust	Lbs.													
	Fuel Efficiency	Gallons Per F/H													
	Speed	Knots													
	Range	Miles													
	Ceiling	Feet													
	Max Take-off Runway Length	Feet													
	Power Loading	Power/Weight Ratio													
RELIABILITY	Mean Time Between Failures (MTBF)	Hours	0,2142	0	0	0	0	0	0	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000
MAINTAINABILITY	Mean Time Between Maintenance (MTBM)	Hours													
	Time Between Overhaul (TBO)	Hours													
	Recording Capacity	Recording Capacity Level													
	Maintenance Specialty Requirement	Specialty Certificate Requirement Level													
	Civilian Airports Cross Service	Cross Service Support Level													
SAFETY	Total Safety Incidents (Class A,B,C)	Total Number Per 100K F/H													
	Engine	Number of Engines													
	Ejection Seat	Ejection Seat Star Value	0,2865	0	0,8	1	0,8	1	0	0,0000	0,2292	0,2865	0,2292	0,2865	0,0000
	Hook	Hook Speed Limit													
	Drag Chute	Drag Chute Speed limit													
	Collision Avoidance System	Avoidance System Star value													
FLYING QUALITY	Recoverability	Stall Warning Before Stall Margin_Knots	0,1710	0,57	0,88	0,57	0,57	0,57	0,57	0,0975	0,1505	0,0975	0,0975	0,0975	0,0975
	Stability	Degrees of Stability	0,1140	1	1	1	1	1	1	0,1140	0,1140	0,1140	0,1140	0,1140	0,1140
	Maneuverability / Roll Rate	Degrees Per Second													
	Maneuverability / G_Capacity	Gs													
	Handling Quality Rating	Cooper Harper Score													
	Flight Path Stability	Degrees Per Knot													
TRAINING QUALITY	Instrument Flight	Instrument Flight Quality Level													
	Formation Flight	Formation Flight Quality Level													
	Low Level Flight	Low Level Quality Level													
	Aerobatics	Aerobatics Quality Level													
	Ground Handling	Ground Handling Quality Level													
TECHNOLOGY	Consistency With Current	Currency Scale	0,0710	0,6	1	0	0	0	0,6	0,0426	0,0710	0,0000	0,0000	0,0000	0,0426
	NAVAIDS	NAVAIDS Scale													
	Comm System	Comm System Quality Level													
	Radar	Radar Capability Level													
COST	Maintenance Cost	Hundred Dollars													
	Aircraft Price	Million Dollars													
SUPPORTING SYSTEMS	Synthetic Training System	Synthetic Trainer Star Value													
	Debriefing System	Debriefing System Star Value													
	Life Support Materials / G-Suit	G-Suit Quality Level													
		GLOBAL WEIGHT TOTAL →	1,000	RESULTING SCORES →						0,3048	0,70748	0,581508	0,51493	0,57651	0,3048
											T-37B				

1-	T-37B TWEET	0,70748
2-	T-6A TEXAN II	0,581508
3-	KT-1C	0,57651
4-	EMB.312	0,51493
5-6-	T-35	0,3048
5-6-	T-34C	0,3048

Table A.19: DM-2 Alternatives Scoring Summary List

VALUE		MEASURE		ALTERNATIVE SCORES						WEIGHTED SCORES					
			Global Weight	T-34C	T-37B	T-6A	EMB.312	KT-1C	T-35	T-34C	T-37B	T-6A	EMB.312	KT-1C	T-35
DESIGN	Simplicity / Emergency Procedures	Average Number of Steps in Boldfaces	0,0714	0,54	1	1	0,54	0,6	0,54	0,0386	0,0714	0,0714	0,0386	0,0428	0,0386
	Ergonomics / Cockpit	Cockpit Star Value	0,0714	0,17	1	0,17	0,5	0,5	0,17	0,0121	0,0714	0,0121	0,0357	0,0357	0,0121
RELIABILITY	Mean Time Between Failures (MTBF)	Hours	0,2142	0	0	0	0	0	0	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000
SAFETY	Ejection Seat	Ejection Seat Star Value	0,2865	0	0,8	1	0,8	1	0	0,0000	0,2292	0,2865	0,2292	0,2865	0,0000
FLYING QUALITY	Recoverability	Stall Warning Before Stall Margin_Knots	0,1710	0,57	0,88	0,57	0,57	0,57	0,57	0,0975	0,1505	0,0975	0,0975	0,0975	0,0975
	Stability	Degrees of Stability	0,1140	1	1	1	1	1	1	0,1140	0,1140	0,1140	0,1140	0,1140	0,1140
TECHNOLOGY	Consistency With Current	Currency Scale	0,0710	0,6	1	0	0	0	0,6	0,0426	0,0710	0,0000	0,0000	0,0000	0,0426
		GLOBAL WEIGHT TOTAL →	1,000	RESULTING SCORES →						0,3048	0,70748	0,581508	0,51493	0,57651	0,3048
											T-37B				

1-	T-37B TWEET	0,70748
2-	T-6A TEXAN II	0,581508
3-	KT-1C	0,57651
4-	EMB.312	0,51493
5-6-	T-35	0,3048
5-6-	T-34C	0,3048

Table A.20: DM-4 Alternatives Scoring Complete List

VALUE		MEASURE		ALTERNATIVE SCORES						WEIGHTED SCORES					
			Global Weight	T-34C	T-37B	T-6A	EMB.312	KT-1C	T-35	T-34C	T-37B	T-6A	EMB.312	KT-1C	T-35
DESIGN	User Friendly / Throttle	Throttle Star Value													
	User Friendly / Avionics	Avionics Scale													
	Simplicity / Standardized Cockpit	Standardization Level													
	Simplicity / Emergency Procedures	Average Number of Steps in Boldfaces													
	Robustness / Landing Gears	Failure Rate Per 100K F/H	0,1200	0	0	0	0	0	0	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000
	Robustness / Airframe Lifetime	Years													
	Ergonomics / Cockpit	Cockpit Star Value													
	Ergonomics / Visibility	Visibility Star Value	0,0800	0,7	0,7	0,7	0,7	0,7	0,7	0,0560	0,0560	0,0560	0,0560	0,0560	0,0560
	Ergonomics / Noise Level	dB													
	Ergonomics / ECS	ECS Star Value													
	Systems Complexity	Complexity Level													
	Systems Dependency / Engine Start	Engine Start Dependency Level													
	Upgradeability	Upgradeability Level													
	Styling	Styling Star Value													
	Deactivation Capability	Deactivation Feature Star Value													
PERFORMANCE	Endurance	Minutes													
	Thrust	Lbs.													
	Fuel Efficiency	Gallons Per F/H													
	Speed	Knots													
	Range	Miles													
	Ceiling	Feet													
	Max Take-off Runway Length	Feet													
	Power Loading	Power/Weight Ratio	0,2000	0	0	0	0	0	0	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000
RELIABILITY	Mean Time Between Failures (MTBF)	Hours													
MAINTAINABILITY	Mean Time Between Maintenance (MTBM)	Hours													
	Time Between Overhaul (TBO)	Hours													
	Recording Capacity	Recording Capacity Level													
	Maintenance Specialty Requirement	Specialty Certificate Requirement Level													
	Civilian Airports Cross Service	Cross Service Support Level													
SAFETY	Total Safety Incidents (Class A,B,C)	Total Number Per 100K F/H													
	Engine	Number of Engines													
	Ejection Seat	Ejection Seat Star Value	0,3000	0	0,8	1	0,8	1	0	0,0000	0,2400	0,3000	0,2400	0,3000	0,0000
	Hook	Hook Speed Limit													
	Drag Chute	Drag Chute Speed limit													
	Collision Avoidance System	Avoidance System Star value													
FLYING QUALITY	Recoverability	Stall Warning Before Stall Margin_Knots													
	Stability	Degrees of Stability	0,1200	1	1	1	1	1	1	0,1200	0,1200	0,1200	0,1200	0,1200	0,1200
	Maneuverability / Roll Rate	Degrees Per Second													
	Maneuverability / G_Capacity	Gs													
	Handling Quality Rating	Cooper Harper Score	0,0800	0,33	0,56	0,67	0,56	0,56	0,56	0,0264	0,0448	0,0536	0,0448	0,0448	0,0448
	Flight Path Stability	Degrees Per Knot													
TRAINING QUALITY	Instrument Flight	Instrument Flight Quality Level													
	Formation Flight	Formation Flight Quality Level													
	Low Level Flight	Low Level Quality Level													
	Aerobatics	Aerobatics Quality Level													
	Ground Handling	Ground Handling Quality Level													
TECHNOLOGY	Consistency With Current	Currency Scale	0,1000	1	0,33	0	0	0	1	0,1000	0,0330	0,0000	0,0000	0,0000	0,1000
	NAVAIDS	NAVAIDS Scale													
	Comm System	Comm System Quality Level													
	Radar	Radar Capability Level													
COST	Maintenance Cost	Hundred Dollars													
	Aircraft Price	Million Dollars													
SUPPORTING SYSTEMS	Synthetic Training System	Synthetic Trainer Star Value													
	Debriefing System	Debriefing System Star Value													
	Life Support Materials / G-Suit	G-Suit Quality Level													
		GLOBAL WEIGHT TOTAL ⟶	1,000	RESULTING SCORES ⟶						0,3024	0,4938	0,5296	0,4608	0,5208	0,3208
												T-6A TEXAN II			

1-2-	T-6A TEXAN II	0,5296
1-2-	KT-1C	0,5296
3-	T-37B TWEET	0,4938
4-	EMB.312	0,4608
5-	T-35	0,3208
6-	T-34C	0,3024

Table A.21: DM-4 Alternatives Scoring Summary List

VALUE		MEASURE		ALTERNATIVE SCORES						WEIGHTED SCORES					
			Global Weight	T-34C	T-37B	T-6A	EMB.312	KT-1C	T-35	T-34C	T-37B	T-6A	EMB.312	KT-1C	T-35
DESIGN	Robustness / Landing Gears	Failure Rate Per 100K F/H	0,1200	0	0	0	0	0	0	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000
	Ergonomics / Visibility	Visibility Star Value	0,0800	0,7	0,7	0,7	0,7	0,7	0,7	0,0560	0,0560	0,0560	0,0560	0,0560	0,0560
PERFORMANCE	Power Loading	Power/Weight Ratio	0,2000	0	0	0	0	0	0	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000
SAFETY	Ejection Seat	Ejection Seat Star Value	0,3000	0	0,8	1	0,8	1	0	0,0000	0,2400	0,3000	0,2400	0,3000	0,0000
FLYING QUALITY	Stability	Degrees of Stability	0,1200	1	1	1	1	1	1	0,1200	0,1200	0,1200	0,1200	0,1200	0,1200
	Handling Quality Rating	Cooper Harper Score	0,0800	0,33	0,56	0,67	0,56	0,56	0,56	0,0264	0,0448	0,0536	0,0448	0,0448	0,0448
TECHNOLOGY	Consistency With Current	Currency Scale	0,1000	1	0,33	0	0	0	1	0,1000	0,0330	0,0000	0,0000	0,0000	0,1000
		GLOBAL WEIGHT TOTAL ⟶	1,000	RESULTING SCORES ⟶						0,3024	0,4938	0,5296	0,4608	0,5208	0,3208
												T-6A TEXAN II			

1-2-	T-6A TEXAN II	0,5296
1-2-	KT-1C	0,5296
3-	T-37B TWEET	0,4938
4-	EMB.312	0,4608
5-	T-35	0,3208
6-	T-34C	0,3024

Table A.22: DM-5 Alternatives Scoring Complete List

VALUE		MEASURE	Global Weight	ALTERNATIVE SCORES T-34C	T-37B	T-6A	EMB.312	KT-1C	T-35	WEIGHTED SCORES T-34C	T-37B	T-6A	EMB.312	KT-1C	T-35
DESIGN	User Friendly / Throttle	Throttle Star Value													
	User Friendly / Avionics	Avionics Scale													
	Simplicity / Standardized Cockpit	Standardization Level													
	Simplicity / Emergency Procedures	Average Number of Steps in Boldfaces													
	Robustness / Landing Gears	Failure Rate Per 100K F/H	0,0850	0	0	0	0	0	0	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000
	Robustness / Airframe Lifetime	Years													
	Ergonomics / Cockpit	Cockpit Star Value													
	Ergonomics / Visibility	Visibility Star Value													
	Ergonomics / Noise Level	dB													
	Ergonomics / ECS	ECS Star Value													
	Systems Complexity	Complexity Level	0,1290	0,53	0,53	0,74	0,74	0,74	0,53	0,0684	0,0684	0,0955	0,0955	0,0955	0,0684
	Systems Dependency / Engine Start	Engine Start Dependency Level													
	Upgradeability	Upgradeability Level													
	Styling	Styling Star Value													
	Deactivation Capability	Deactivation Feature Star Value													
PERFORMANCE	Endurance	Minutes													
	Thrust	Lbs.	0,0710	0	0,2085	0,4214	0	0,0037	0	0,0000	0,0148	0,0299	0,0000	0,0003	0,0000
	Fuel Efficiency	Gallons Per F/H													
	Speed	Knots													
	Range	Miles													
	Ceiling	Feet													
	Max Take-off Runway Length	Feet													
	Power Loading	Power/Weight Ratio													
RELIABILITY	Mean Time Between Failures (MTBF)	Hours	0,1420	0	0	0	0	0	0	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000
MAINTAINABILITY	Mean Time Between Maintenance (MTBM)	Hours	0,1610	0	0	0	0	0	0,2057	0,0000	0,0000	0,0000	0,0000	0,0000	0,0331
	Time Between Overhaul (TBO)	Hours	0,0540	0	0	0	0	0	0	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000
	Recording Capacity	Recording Capacity Level													
	Maintenance Specialty Requirement	Specialty Certificate Requirement Level													
	Civilian Airports Cross Service	Cross Service Support Level													
SAFETY	Total Safety Incidents (Class A,B,C)	Total Number Per 100K F/H													
	Engine	Number of Engines													
	Ejection Seat	Ejection Seat Star Value													
	Hook	Hook Speed Limit													
	Drag Chute	Drag Chute Speed limit													
	Collision Avoidance System	Avoidance System Star value													
FLYING QUALITY	Recoverability	Stall Warning Before Stall Margin_Knots	0,0400	0,8	1	0,8	0,8	0,8	0,8	0,0320	0,0400	0,0320	0,0320	0,0320	0,0320
	Stability	Degrees of Stability	0,0790	0,86	0,86	0,86	0,86	0,86	0,86	0,0679	0,0679	0,0679	0,0679	0,0679	0,0679
	Maneuverability / Roll Rate	Degrees Per Second	0,0400	1	1	1	1	1	1	0,0400	0,0400	0,0400	0,0400	0,0400	0,0400
	Maneuverability / G_Capacity	Gs	0,0400	0,135	0,4175	0,575	0,35	0,575	0,35	0,0054	0,0167	0,0230	0,0140	0,0230	0,0140
	Handling Quality Rating	Cooper Harper Score	0,1590	0	0,38	0,5	0,38	0,5	0,38	0,0000	0,0604	0,0795	0,0604	0,0795	0,0604
	Flight Path Stability	Degrees Per Knot													
TRAINING QUALITY	Instrument Flight	Instrument Flight Quality Level													
	Formation Flight	Formation Flight Quality Level													
	Low Level Flight	Low Level Quality Level													
	Aerobatics	Aerobatics Quality Level													
	Ground Handling	Ground Handling Quality Level													
TECHNOLOGY	Consistency With Current	Currency Scale													
	NAVAIDS	NAVAIDS Scale													
	Comm System	Comm System Quality Level													
	Radar	Radar Capability Level													
COST	Maintenance Cost	Hundred Dollars													
	Aircraft Price	Million Dollars													
SUPPORTING SYSTEMS	Synthetic Training System	Synthetic Trainer Star Value													
	Debriefing System	Debriefing System Star Value													
	Life Support Materials / G-Suit	G-Suit Quality Level													
		GLOBAL WEIGHT TOTAL ——>	1,000	RESULTING SCORES ——>						0,2137	0,3082335	0,3678194	0,30982	0,3381627	0,3158

T-6A TEXAN II

1-	T-6A TEXAN II	0,3678194
2-	KT-1C	0,3381627
3-	T-35	0,3158
4-	EMB.312	0,30982
5-	T-37B TWEET	0,3082335
6-	T-34C	0,2137

Table A.23: DM-5 Alternatives Scoring Summary List

VALUE		MEASURE	Global Weight	ALTERNATIVE SCORES T-34C	T-37B	T-6A	EMB.312	KT-1C	T-35	WEIGHTED SCORES T-34C	T-37B	T-6A	EMB.312	KT-1C	T-35
DESIGN	Robustness / Landing Gears	Failure Rate Per 100K F/H	0,0850	0	0	0	0	0	0	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000
	Systems Complexity	Complexity Level	0,1290	0,53	0,53	0,74	0,74	0,74	0,53	0,0684	0,0684	0,0955	0,0955	0,0955	0,0684
PERFORMANCE	Thrust	Lbs.	0,0710	0	0,2085	0,4214	0	0,0037	0	0,0000	0,0148	0,0299	0,0000	0,0003	0,0000
RELIABILITY	Mean Time Between Failures (MTBF)	Hours	0,1420	0	0	0	0	0	0	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000
MAINTAINABILITY	Mean Time Between Maintenance (MTBM)	Hours	0,1610	0	0	0	0	0	0,2057	0,0000	0,0000	0,0000	0,0000	0,0000	0,0331
	Time Between Overhaul (TBO)	Hours	0,0540	0	0	0	0	0	0	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000
FLYING QUALITY	Recoverability	Stall Warning Before Stall Margin_Knots	0,0400	0,8	1	0,8	0,8	0,8	0,8	0,0320	0,0400	0,0320	0,0320	0,0320	0,0320
	Stability	Degrees of Stability	0,0790	0,86	0,86	0,86	0,86	0,86	0,86	0,0679	0,0679	0,0679	0,0679	0,0679	0,0679
	Maneuverability / Roll Rate	Degrees Per Second	0,0400	1	1	1	1	1	1	0,0400	0,0400	0,0400	0,0400	0,0400	0,0400
	Maneuverability / G_Capacity	Gs	0,0400	0,135	0,4175	0,575	0,35	0,575	0,35	0,0054	0,0167	0,0230	0,0140	0,0230	0,0140
	Handling Quality Rating	Cooper Harper Score	0,1590	0	0,38	0,5	0,38	0,5	0,38	0,0000	0,0604	0,0795	0,0604	0,0795	0,0604
		GLOBAL WEIGHT TOTAL --------->	1,000	RESULTING SCORES ---------->						0,2137	0,3082335	0,3678194	0,30982	0,3381627	0,3158

T-6A TEXAN II

1-	T-6A TEXAN II	0,3678194
2-	KT-1C	0,3381627
3-	T-35	0,3158
4-	EMB.312	0,30982
5-	T-37B TWEET	0,3082335
6-	T-34C	0,2137

Table A.24: DM-6 Alternatives Scoring Complete List

	VALUE	MEASURE		ALTERNATIVE SCORES						WEIGHTED SCORES					
			Global Weight	T-34C	T-37B	T-6A	EMB.312	KT-1C	T-35	T-34C	T-37B	T-6A	EMB.312	KT-1C	T-35
DESIGN	User Friendly / Throttle	Throttle Star Value													
	User Friendly / Avionics	Avionics Scale													
	Simplicity / Standardized Cockpit	Standardization Level													
	Simplicity / Emergency Procedures	Average Number of Steps in Boldfaces													
	Robustness / Landing Gears	Failure Rate Per 100K F/H	0,1430	0,57	0,54	0,82	0,57	0,66	0,75	0,0815	0,0772	0,1173	0,0815	0,0944	0,1073
	Robustness / Airframe Lifetime	Years													
	Ergonomics / Cockpit	Cockpit Star Value													
	Ergonomics / Visibility	Visibility Star Value													
	Ergonomics / Noise Level	dB													
	Ergonomics / ECS	ECS Star Value													
	Systems Complexity	Complexity Level													
	Systems Dependency / Engine Start	Engine Start Dependency Level													
	Upgradeability	Upgradeability Level													
	Styling	Styling Star Value													
	Deactivation Capability	Deactivation Feature Star Value													
PERFORMANCE	Endurance	Minutes													
	Thrust	Lbs.	0,0470	0	0	0	0	0	0	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000
	Fuel Efficiency	Gallons Per F/H													
	Speed	Knots													
	Range	Miles													
	Ceiling	Feet													
	Max Take-off Runway Length	Feet													
	Power Loading	Power/Weight Ratio													
RELIABILITY	Mean Time Between Failures (MTBF)	Hours													
MAINTAINABILITY	Mean Time Between Maintenance (MTBM)	Hours													
	Time Between Overhaul (TBO)	Hours													
	Recording Capacity	Recording Capacity Level													
	Maintenance Specialty Requirement	Specialty Certificate Requirement Level													
	Civilian Airports Cross Service	Cross Service Support Level													
SAFETY	Total Safety Incidents (Class A,B,C)	Total Number Per 100K F/H													
	Engine	Number of Engines													
	Ejection Seat	Ejection Seat Star Value													
	Hook	Hook Speed Limit													
	Drag Chute	Drag Chute Speed limit													
	Collision Avoidance System	Avoidance System Star value													
FLYING QUALITY	Recoverability	Stall Warning Before Stall Margin_Knots													
	Stability	Degrees of Stability	0,2290	0,93	0,93	0,93	0,93	0,93	0,93	0,2130	0,2130	0,2130	0,2130	0,2130	0,2130
	Maneuverability / Roll Rate	Degrees Per Second	0,0570	1	0,75	1	1	1	0,1377	0,0570	0,0428	0,0570	0,0570	0,0570	0,0078
	Maneuverability / G_Capacity	Gs													
	Handling Quality Rating	Cooper Harper Score													
	Flight Path Stability	Degrees Per Knot													
TRAINING QUALITY	Instrument Flight	Instrument Flight Quality Level													
	Formation Flight	Formation Flight Quality Level													
	Low Level Flight	Low Level Quality Level													
	Aerobatics	Aerobatics Quality Level													
	Ground Handling	Ground Handling Quality Level													
TECHNOLOGY	Consistency With Current	Currency Scale													
	NAVAIDS	NAVAIDS Scale	0,1430	0,39	0,57	1	0,57	1	0,17	0,0558	0,0815	0,1430	0,0815	0,1430	0,0243
	Comm System	Comm System Quality Level													
	Radar	Radar Capability Level													
COST	Maintenance Cost	Hundred Dollars	0,3050	0,984	0,965	0,934	0,96	0,953	0,978	0,3001	0,2943	0,2849	0,2928	0,2907	0,2983
	Aircraft Price	Million Dollars	0,0760	0,5	0,381	0	0	0	0,658	0,0380	0,0290	0,0000	0,0000	0,0000	0,0500
SUPPORTING SYSTEMS	Synthetic Training System	Synthetic Trainer Star Value													
	Debriefing System	Debriefing System Star Value													
	Life Support Materials / G-Suit	G-Suit Quality Level													
		GLOBAL WEIGHT TOTAL →	1,000	RESULTING SCORES →						0,7454	0,737731	0,8151	0,72579	0,798015	0,7007

T-6A TEXAN II

1-	T-6A TEXAN II	0,8151
2-	KT-1C	0,798015
3-	T-34C	0,7454
4-	T-37B TWEET	0,737731
5-	EMB.312	0,72579
6-	T-35	0,7007

Table A.25: DM-6 Alternatives Scoring Summary List

	VALUE	MEASURE		ALTERNATIVE SCORES						WEIGHTED SCORES					
			Global Weight	T-34C	T-37B	T-6A	EMB.312	KT-1C	T-35	T-34C	T-37B	T-6A	EMB.312	KT-1C	T-35
DESIGN	Robustness / Landing Gears	Failure Rate Per 100K F/H	0,1430	0,57	0,54	0,82	0,57	0,66	0,75	0,0815	0,0772	0,1173	0,0815	0,0944	0,1073
PERFORMANCE	Thrust	Lbs.	0,0470	0	0	0	0	0	0	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000
FLYING QUALITY	Stability	Degrees of Stability	0,2290	0,93	0,93	0,93	0,93	0,93	0,93	0,2130	0,2130	0,2130	0,2130	0,2130	0,2130
	Maneuverability / Roll Rate	Degrees Per Second	0,0570	1	0,75	1	1	1	0,1377	0,0570	0,0428	0,0570	0,0570	0,0570	0,0078
TECHNOLOGY	NAVAIDS	NAVAIDS Scale	0,1430	0,39	0,57	1	0,57	1	0,17	0,0558	0,0815	0,1430	0,0815	0,1430	0,0243
COST	Maintenance Cost	Hundred Dollars	0,3050	0,984	0,965	0,934	0,96	0,953	0,978	0,3001	0,2943	0,2849	0,2928	0,2907	0,2983
	Aircraft Price	Million Dollars	0,0760	0,5	0,381	0	0	0	0,658	0,0380	0,0290	0,0000	0,0000	0,0000	0,0500
		GLOBAL WEIGHT TOTAL →	1,000	RESULTING SCORES →						0,7454	0,737731	0,8151	0,72579	0,798015	0,7007

T-6A TEXAN II

1-	T-6A TEXAN II	0,8151
2-	KT-1C	0,798015
3-	T-34C	0,7454
4-	T-37B TWEET	0,737731
5-	EMB.312	0,72579
6-	T-35	0,7007

Table A.26: DM-7 Alternatives Scoring Complete List

VALUE		MEASURE	Global Weight	ALTERNATIVE SCORES T-34C	T-37B	T-6A	EMB.312	KT-1C	T-35	WEIGHTED SCORES T-34C	T-37B	T-6A	EMB.312	KT-1C	T-35
DESIGN	User Friendly / Throttle	Throttle Star Value													
	User Friendly / Avionics	Avionics Scale													
	Simplicity / Standardized Cockpit	Standardization Level													
	Simplicity / Emergency Procedures	Average Number of Steps in Boldfaces													
	Robustness / Landing Gears	Failure Rate Per 100K F/H	0,0160	0	0	0	0	0	0	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000
	Robustness / Airframe Lifetime	Years													
	Ergonomics / Cockpit	Cockpit Star Value	0,0040	1	0,07	1	0	0	1	0,0040	0,0003	0,0040	0,0000	0,0000	0,0040
	Ergonomics / Visibility	Visibility Star Value													
	Ergonomics / Noise Level	dB													
	Ergonomics / ECS	ECS Star Value													
	Systems Complexity	Complexity Level	0,0220	0,89	0,89	1	1	1	0,89	0,0196	0,0196	0,0220	0,0220	0,0220	0,0196
	Systems Dependency / Engine Start	Engine Start Dependency Level													
	Upgradeability	Upgradeability Level													
	Styling	Styling Star Value													
	Deactivation Capability	Deactivation Feature Star Value													
PERFORMANCE	Endurance	Minutes	0,0700	1	1	1	1	1	1	0,0700	0,0700	0,0700	0,0700	0,0700	0,0700
	Thrust	Lbs.													
	Fuel Efficiency	Gallons Per F/H													
	Speed	Knots	0,0700	0	0	0	0	0	0	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000
	Range	Miles													
	Ceiling	Feet													
	Max Take-off Runway Length	Feet	0,0350	1	1	1	1	1	1	0,0350	0,0350	0,0350	0,0350	0,0350	0,0350
	Power Loading	Power/Weight Ratio													
RELIABILITY	Mean Time Between Failures (MTBF)	Hours													
MAINTAINABILITY	Mean Time Between Maintenance (MTBM)	Hours	0,0750	0,228	1	1	1	1	1	0,0171	0,0750	0,0750	0,0750	0,0750	0,0750
	Time Between Overhaul (TBO)	Hours	0,0120	1	1	1	1	1	1	0,0120	0,0120	0,0120	0,0120	0,0120	0,0120
	Recording Capacity	Recording Capacity Level													
	Maintenance Specialty Requirement	Specialty Certificate Requirement Level													
	Civilian Airports Cross Service	Cross Service Support Level													
SAFETY	Total Safety Incidents (Class A,B,C)	Total Number Per 100K F/H													
	Engine	Number of Engines													
	Ejection Seat	Ejection Seat Star Value	0,1300	0	0,9	1	0,9	1	0	0,0000	0,1170	0,1300	0,1170	0,1300	0,0000
	Hook	Hook Speed Limit													
	Drag Chute	Drag Chute Speed limit													
	Collision Avoidance System	Avoidance System Star value													
FLYING QUALITY	Recoverability	Stall Warning Before Stall Margin_Knots													
	Stability	Degrees of Stability													
	Maneuverability / Roll Rate	Degrees Per Second	0,1740	1	1	1	1	1	0,5501	0,1740	0,1740	0,1740	0,1740	0,1740	0,0957
	Maneuverability / G_Capacity	Gs													
	Handling Quality Rating	Cooper Harper Score													
	Flight Path Stability	Degrees Per Knot													
TRAINING QUALITY	Instrument Flight	Instrument Flight Quality Level	0,1740	0,88	0,88	0,88	0,88	0,88	0,88	0,1531	0,1531	0,1531	0,1531	0,1531	0,1531
	Formation Flight	Formation Flight Quality Level													
	Low Level Flight	Low Level Quality Level													
	Aerobatics	Aerobatics Quality Level													
	Ground Handling	Ground Handling Quality Level													
TECHNOLOGY	Consistency With Current	Currency Scale													
	NAVAIDS	NAVAIDS Scale	0,0220	0,54	0,73	1	0,73	1	0,32	0,0119	0,0161	0,0220	0,0161	0,0220	0,0070
	Comm System	Comm System Quality Level	0,0650	0,06	0	0,38	0,38	0,06	0,06	0,0039	0,0000	0,0247	0,0161	0,0039	0,0039
	Radar	Radar Capability Level													
COST	Maintenance Cost	Hundred Dollars													
	Aircraft Price	Million Dollars													
SUPPORTING SYSTEMS	Synthetic Training System	Synthetic Trainer Star Value	0,0980	0,67	0,67	1	0	1	0	0,0657	0,0657	0,0980	0,0000	0,0980	0,0000
	Debriefing System	Debriefing System Star Value													
	Life Support Materials / G-Suit	G-Suit Quality Level	0,0330	0	0	0,86	0	0,86	0	0,0000	0,0000	0,0284	0,0000	0,0284	0,0000
		GLOBAL WEIGHT TOTAL ⟶	1,000	RESULTING SCORES ⟶						0,5662	0,7377	0,8482	0,69888	0,8234	0,4754

T-6A TEXAN II

1-	T-6A TEXAN II	0,8482
2-	KT-1C	0,8234
3-	T-37B TWEET	0,7377
4-	EMB.312	0,69888
5-	T-34C	0,5662
6-	T-35	0,4754

Table A.27: DM-7 Alternatives Scoring Summary List

VALUE		MEASURE	Global Weight	ALTERNATIVE SCORES T-34C	T-37B	T-6A	EMB.312	KT-1C	T-35	WEIGHTED SCORES T-34C	T-37B	T-6A	EMB.312	KT-1C	T-35
DESIGN	Robustness / Landing Gears	Failure Rate Per 100K F/H	0,0160	0	0	0	0	0	0	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000
	Ergonomics / Cockpit	Cockpit Star Value	0,0040	1	0,07	1	0	0	1	0,0040	0,0003	0,0040	0,0000	0,0000	0,0040
	Systems Complexity	Complexity Level	0,0220	0,89	0,89	1	1	1	0,89	0,0196	0,0196	0,0220	0,0220	0,0220	0,0196
PERFORMANCE	Endurance	Minutes	0,0700	1	1	1	1	1	1	0,0700	0,0700	0,0700	0,0700	0,0700	0,0700
	Speed	Knots	0,0700	0	0	0	0	0	0	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000
	Max Take-off Runway Length	Feet	0,0350	1	1	1	1	1	1	0,0350	0,0350	0,0350	0,0350	0,0350	0,0350
MAINTAINABILITY	Mean Time Between Maintenance (MTBM)	Hours	0,0750	0,228	1	1	1	1	1	0,0171	0,0750	0,0750	0,0750	0,0750	0,0750
	Time Between Overhaul (TBO)	Hours	0,0120	1	1	1	1	1	1	0,0120	0,0120	0,0120	0,0120	0,0120	0,0120
SAFETY	Ejection Seat	Ejection Seat Star Value	0,1300	0	0,9	1	0,9	1	0	0,0000	0,1170	0,1300	0,1170	0,1300	0,0000
FLYING QUALITY	Maneuverability / Roll Rate	Degrees Per Second	0,1740	1	1	1	1	1	0,5501	0,1740	0,1740	0,1740	0,1740	0,1740	0,0957
TRAINING QUALITY	Instrument Flight	Instrument Flight Quality Level	0,1740	0,88	0,88	0,88	0,88	0,88	0,88	0,1531	0,1531	0,1531	0,1531	0,1531	0,1531
TECHNOLOGY	NAVAIDS	NAVAIDS Scale	0,0220	0,54	0,73	1	0,73	1	0,32	0,0119	0,0161	0,0220	0,0161	0,0220	0,0070
	Comm System	Comm System Quality Level	0,0650	0,06	0	0,38	0,38	0,06	0,06	0,0039	0,0000	0,0247	0,0247	0,0039	0,0039
SUPPORTING SYSTEMS	Synthetic Training System	Synthetic Trainer Star Value	0,0980	0,67	0,67	1	0	1	0	0,0657	0,0657	0,0980	0,0000	0,0980	0,0000
	Life Support Materials / G-Suit	G-Suit Quality Level	0,0330	0	0	0,86	0	0,86	0	0,0000	0,0000	0,0284	0,0000	0,0284	0,0000
		GLOBAL WEIGHT TOTAL ⟶	1,000	RESULTING SCORES ⟶						0,5662	0,7377	0,8482	0,69888	0,8234	0,4754

T-6A TEXAN II

1-	T-6A TEXAN II	0,8482
2-	KT-1C	0,8234
3-	T-37B TWEET	0,7377
4-	EMB.312	0,69888
5-	T-34C	0,5662
6-	T-35	0,4754

Table A.28: DM-8 Alternatives Scoring Complete List

VALUE		MEASURE	Global Weight	ALTERNATIVE SCORES T-34C	T-37B	T-6A	EMB.312	KT-1C	T-35	WEIGHTED SCORES T-34C	T-37B	T-6A	EMB.312	KT-1C	T-35
DESIGN	User Friendly / Throttle	Throttle Star Value													
	User Friendly / Avionics	Avionics Scale													
	Simplicity / Standardized Cockpit	Standardization Level													
	Simplicity / Emergency Procedures	Average Number of Steps in Boldfaces													
	Robustness / Landing Gears	Failure Rate Per 100K F/H													
	Robustness / Airframe Lifetime	Years													
	Ergonomics / Cockpit	Cockpit Star Value	0,0240	0,29	1	0,29	0,43	0,43	0,29	0,0070	0,0240	0,0070	0,0103	0,0103	0,0070
	Ergonomics / Visibility	Visibility Star Value													
	Ergonomics / Noise Level	dB	0,0060	0,389	0,14	0,694	0,62	0,694	0,5	0,0023	0,0008	0,0042	0,0037	0,0042	0,0030
	Ergonomics / ECS	ECS Star Value	0,0120	0,59	0,59	1	0,82	0,82	0,59	0,0071	0,0071	0,0120	0,0098	0,0098	0,0071
	Systems Complexity	Complexity Level													
	Systems Dependency / Engine Start	Engine Start Dependency Level													
	Upgradeability	Upgradeability Level													
	Styling	Styling Star Value	0,0110	0	0	0	0	0	0	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000
	Deactivation Capability	Deactivation Feature Star Value													
PERFORMANCE	Endurance	Minutes													
	Thrust	Lbs.													
	Fuel Efficiency	Gallons Per F/H													
	Speed	Knots	0,1050	0,2738	0,8304	0,8337	0,6339	0,8337	0,2672	0,0287	0,0872	0,0875	0,0666	0,0875	0,0281
	Range	Miles													
	Ceiling	Feet													
	Max Take-off Runway Length	Feet													
	Power Loading	Power/Weight Ratio													
RELIABILITY	Mean Time Between Failures (MTBF)	Hours													
MAINTAINABILITY	Mean Time Between Maintenance (MTBM)	Hours													
	Time Between Overhaul (TBO)	Hours													
	Recording Capacity	Recording Capacity Level													
	Maintenance Specialty Requirement	Specialty Certificate Requirement Level													
	Civilian Airports Cross Service	Cross Service Support Level	0,1580	0,8	0,8	0,8	0	0	0	0,1264	0,1264	0,1264	0,0000	0,0000	0,0000
SAFETY	Total Safety Incidents (Class A,B,C)	Total Number Per 100K F/H													
	Engine	Number of Engines													
	Ejection Seat	Ejection Seat Star Value	0,2110	0	0,8	1	0,8	1	0	0,0000	0,1688	0,2110	0,1688	0,2110	0,0000
	Hook	Hook Speed Limit													
	Drag Chute	Drag Chute Speed limit													
	Collision Avoidance System	Avoidance System Star value													
FLYING QUALITY	Recoverability	Stall Warning Before Stall Margin_Knots													
	Stability	Degrees of Stability	0,0900	0,91	0,91	0,91	0,91	0,91	0,91	0,0819	0,0819	0,0819	0,0819	0,0819	0,0819
	Maneuverability / Roll Rate	Degrees Per Second													
	Maneuverability / G_Capacity	Gs													
	Handling Quality Rating	Cooper Harper Score	0,1800	0,75	1	1	1	1	1	0,1350	0,1800	0,1800	0,1800	0,1800	0,1800
	Flight Path Stability	Degrees Per Knot	0,0450	0,3	0,3	0,684	0,684	0,684	0,3	0,0135	0,0135	0,0308	0,0308	0,0308	0,0135
TRAINING QUALITY	Instrument Flight	Instrument Flight Quality Level													
	Formation Flight	Formation Flight Quality Level													
	Low Level Flight	Low Level Quality Level	0,1580	0,27	0,27	0,27	0,27	0,27	0,27	0,0427	0,0427	0,0427	0,0427	0,0427	0,0427
	Aerobatics	Aerobatics Quality Level													
	Ground Handling	Ground Handling Quality Level													
TECHNOLOGY	Consistency With Current	Currency Scale													
	NAVAIDS	NAVAIDS Scale													
	Comm System	Comm System Quality Level													
	Radar	Radar Capability Level													
COST	Maintenance Cost	Hundred Dollars													
	Aircraft Price	Million Dollars													
SUPPORTING SYSTEMS	Synthetic Training System	Synthetic Trainer Star Value													
	Debriefing System	Debriefing System Star Value													
	Life Support Materials / G-Suit	G-Suit Quality Level													
		GLOBAL WEIGHT TOTAL ⟶	1,000	RESULTING SCORES ⟶						0,4311	0,7189	0,7526	0,5638	0,6274	0,3497

T-6A TEXAN II

1-	T-6A TEXAN II	0,7526225
2-	T-37B TWEET	0,718872
3-	KT-1C	0,6274225
4-	EMB.312	0,5638
5-	T-34C	0,4311
6-	T-35	0,3497

Table A.29: DM-8 Alternatives Scoring Summary List

VALUE		MEASURE	Global Weight	ALTERNATIVE SCORES T-34C	T-37B	T-6A	EMB.312	KT-1C	T-35	WEIGHTED SCORES T-34C	T-37B	T-6A	EMB.312	KT-1C	T-35
DESIGN	Ergonomics / Cockpit	Cockpit Star Value	0,0240	0,29	1	0,29	0,43	0,43	0,29	0,0070	0,0240	0,0070	0,0103	0,0103	0,0070
	Ergonomics / Noise Level	dB	0,0060	0,389	0,14	0,694	0,62	0,694	0,5	0,0023	0,0008	0,0042	0,0037	0,0042	0,0030
	Ergonomics / ECS	ECS Star Value	0,0120	0,59	0,59	1	0,82	0,82	0,59	0,0071	0,0071	0,0120	0,0098	0,0098	0,0071
	Styling	Styling Star Value	0,0110	0	0	0	0	0	0	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000
PERFORMANCE	Speed	Knots	0,1050	0,2738	0,8304	0,8337	0,6339	0,8337	0,2672	0,0287	0,0872	0,0875	0,0666	0,0875	0,0281
MAINTAINABILITY	Civilian Airports Cross Service	Cross Service Support Level	0,1580	0,8	0,8	0,8	0	0	0	0,1264	0,1264	0,1264	0,0000	0,0000	0,0000
SAFETY	Ejection Seat	Ejection Seat Star Value	0,2110	0	0,8	1	0,8	1	0	0,0000	0,1688	0,2110	0,1688	0,2110	0,0000
FLYING QUALITY	Stability	Degrees of Stability	0,0900	0,91	0,91	0,91	0,91	0,91	0,91	0,0819	0,0819	0,0819	0,0819	0,0819	0,0819
	Handling Quality Rating	Cooper Harper Score	0,1800	0,75	1	1	1	1	1	0,1350	0,1800	0,1800	0,1800	0,1800	0,1800
	Flight Path Stability	Degrees Per Knot	0,0450												
TRAINING QUALITY	Low Level Flight	Low Level Quality Level	0,1580	0,27	0,27	0,27	0,27	0,27	0,27	0,0427	0,0427	0,0427	0,0427	0,0427	0,0427
		GLOBAL WEIGHT TOTAL --------->	1,000	RESULTING SCORES ---------->						0,4311	0,718872	0,7526225	0,5638	0,6274225	0,3497

T-6A TEXAN II

1-	T-6A TEXAN II	0,7526225
2-	T-37B TWEET	0,718872
3-	KT-1C	0,6274225
4-	EMB.312	0,5638
5-	T-34C	0,4311
6-	T-35	0,3497

Table A.30: DM-9 Alternatives Scoring Complete List

VALUE		MEASURE		ALTERNATIVE SCORES						WEIGHTED SCORES					
			Global Weight	T-34C	T-37B	T-6A	EMB.312	KT-1C	T-35	T-34C	T-37B	T-6A	EMB.312	KT-1C	T-35
DESIGN	User Friendly / Throttle	Throttle Star Value													
	User Friendly / Avionics	Avionics Scale													
	Simplicity / Standardized Cockpit	Standardization Level													
	Simplicity / Emergency Procedures	Average Number of Steps in Boldfaces													
	Robustness / Landing Gears	Failure Rate Per 100K F/H													
	Robustness / Airframe Lifetime	Years													
	Ergonomics / Cockpit	Cockpit Star Value	0,1570	0	0,45	0	0,33	0,33	0	0,0000	0,0707	0,0000	0,0518	0,0518	0,0000
	Ergonomics / Visibility	Visibility Star Value													
	Ergonomics / Noise Level	dB													
	Ergonomics / ECS	ECS Star Value													
	Systems Complexity	Complexity Level	0,0260	0,56	0,56	1	1	1	0,56	0,0146	0,0146	0,0260	0,0260	0,0260	0,0146
	Systems Dependency / Engine Start	Engine Start Dependency Level													
	Upgradeability	Upgradeability Level													
	Styling	Styling Star Value													
	Deactivation Capability	Deactivation Feature Star Value	0,0780	1	0,29	0,35	1	0,35	1	0,0780	0,0226	0,0273	0,0780	0,0273	0,0780
PERFORMANCE	Endurance	Minutes	0,1740	1	1	1	1	1	1	0,1740	0,1740	0,1740	0,1740	0,1740	0,1740
	Thrust	Lbs.													
	Fuel Efficiency	Gallons Per F/H													
	Speed	Knots													
	Range	Miles													
	Ceiling	Feet													
	Max Take-off Runway Length	Feet													
	Power Loading	Power/Weight Ratio													
RELIABILITY	Mean Time Between Failures (MTBF)	Hours													
MAINTAINABILITY	Mean Time Between Maintenance (MTBM)	Hours													
	Time Between Overhaul (TBO)	Hours													
	Recording Capacity	Recording Capacity Level													
	Maintenance Specialty Requirement	Specialty Certificate Requirement Level													
	Civilian Airports Cross Service	Cross Service Support Level													
SAFETY	Total Safety Incidents (Class A,B,C)	Total Number Per 100K F/H													
	Engine	Number of Engines													
	Ejection Seat	Ejection Seat Star Value													
	Hook	Hook Speed Limit													
	Drag Chute	Drag Chute Speed limit													
	Collision Avoidance System	Avoidance System Star value													
FLYING QUALITY	Recoverability	Stall Warning Before Stall Margin_Knots													
	Stability	Degrees of Stability													
	Maneuverability / Roll Rate	Degrees Per Second	0,0430	0,8	0,6	1	1	1	0,11	0,0344	0,0258	0,0430	0,0430	0,0430	0,0047
	Maneuverability / G_Capacity	Gs													
	Handling Quality Rating	Cooper Harper Score													
	Flight Path Stability	Degrees Per Knot													
TRAINING QUALITY	Instrument Flight	Instrument Flight Quality Level	0,0820	0,88	0,88	0,88	0,88	0,88	0,88	0,0722	0,0722	0,0722	0,0722	0,0722	0,0722
	Formation Flight	Formation Flight Quality Level	0,0310	0,44	0,44	1	0,44	1	0,44	0,0136	0,0136	0,0310	0,0136	0,0310	0,0136
	Low Level Flight	Low Level Quality Level	0,0100	0,77	0,77	0,77	0,77	0,77	0,77	0,0077	0,0077	0,0077	0,0077	0,0077	0,0077
	Aerobatics	Aerobatics Quality Level	0,0510	1	1	1	1	1	1	0,0510	0,0510	0,0510	0,0510	0,0510	0,0510
	Ground Handling	Ground Handling Quality Level													
TECHNOLOGY	Consistency With Current	Currency Scale													
	NAVAIDS	NAVAIDS Scale													
	Comm System	Comm System Quality Level													
	Radar	Radar Capability Level													
COST	Maintenance Cost	Hundred Dollars													
	Aircraft Price	Million Dollars													
SUPPORTING SYSTEMS	Synthetic Training System	Synthetic Trainer Star Value	0,1740	0,56	0,56	1	0	1	0	0,0974	0,0974	0,1740	0,0000	0,1740	0,0000
	Debriefing System	Debriefing System Star Value	0,1740	0	0	0,29	0	0,29	0	0,0000	0,0000	0,0505	0,0000	0,0505	0,0000
	Life Support Materials / G-Suit	G-Suit Quality Level													
		GLOBAL WEIGHT TOTAL ⟶	1,000	RESULTING SCORES ⟶						0,5429	0,54957	0,65662	0,51731	0,70843	0,4158
														KT-1C	

1-	KT-1C	0,70843
2-	T-6A TEXAN II	0,65662
3-	T-37B TWEET	0,54957
4-	T-34C	0,5429
5-	EMB.312	0,51731
6-	T-35	0,4158

Table A.31: DM-9 Alternatives Scoring Summary List

VALUE		MEASURE		ALTERNATIVE SCORES						WEIGHTED SCORES					
			Global Weight	T-34C	T-37B	T-6A	EMB.312	KT-1C	T-35	T-34C	T-37B	T-6A	EMB.312	KT-1C	T-35
DESIGN	Ergonomics / Cockpit	Cockpit Star Value	0,1570	0	0,45	0	0,33	0,33	0	0,0000	0,0707	0,0000	0,0518	0,0518	0,0000
	Systems Complexity	Complexity Level	0,0260	0,56	0,56	1	1	1	0,56	0,0146	0,0146	0,0260	0,0260	0,0260	0,0146
	Deactivation Capability	Deactivation Feature Star Value	0,0780	1	0,29	0,35	1	0,35	1	0,0780	0,0226	0,0273	0,0780	0,0273	0,0780
PERFORMANCE	Endurance	Minutes	0,1740	1	1	1	1	1	1	0,1740	0,1740	0,1740	0,1740	0,1740	0,1740
FLYING QUALITY	Maneuverability / Roll Rate	Degrees Per Second	0,0430	0,8	0,6	1	1	1	0,11	0,0344	0,0258	0,0430	0,0430	0,0430	0,0047
TRAINING QUALITY	Instrument Flight	Instrument Flight Quality Level	0,0820	0,88	0,88	0,88	0,88	0,88	0,88	0,0722	0,0722	0,0722	0,0722	0,0722	0,0722
	Formation Flight	Formation Flight Quality Level	0,0310	0,44	0,44	1	0,44	1	0,44	0,0136	0,0136	0,0310	0,0136	0,0310	0,0136
	Low Level Flight	Low Level Quality Level	0,0100	0,77	0,77	0,77	0,77	0,77	0,77	0,0077	0,0077	0,0077	0,0077	0,0077	0,0077
	Aerobatics	Aerobatics Quality Level	0,0510	1	1	1	1	1	1	0,0510	0,0510	0,0510	0,0510	0,0510	0,0510
SUPPORTING SYSTEMS	Synthetic Training System	Synthetic Trainer Star Value	0,1740	0,56	0,56	1	0	1	0	0,0974	0,0974	0,1740	0,0000	0,1740	0,0000
	Debriefing System	Debriefing System Star Value	0,1740	0	0	0,29	0	0,29	0	0,0000	0,0000	0,0505	0,0000	0,0505	0,0000
		GLOBAL WEIGHT TOTAL ⟶	1,000	RESULTING SCORES ⟶						0,5429	0,54957	0,65662	0,51731	0,70843	0,4158
														KT-1C	

1-	KT-1C	0,70843
2-	T-6A TEXAN II	0,65662
3-	T-37B TWEET	0,54957
4-	T-34C	0,5429
5-	EMB.312	0,51731
6-	T-35	0,4158

Table A.32: DM-10 Alternatives Scoring Complete List

VALUE		MEASURE	Global Weight	ALTERNATIVE SCORES T-34C	T-37B	T-6A	EMB.312	KT-1C	T-35	WEIGHTED SCORES T-34C	T-37B	T-6A	EMB.312	KT-1C	T-35
DESIGN	User Friendly / Throttle	Throttle Star Value													
	User Friendly / Avionics	Avionics Scale													
	Simplicity / Standardized Cockpit	Standardization Level	0,0389	0,88	0,88	1	1	1	0,88	0,0343	0,0343	0,0389	0,0389	0,0389	0,0343
	Simplicity / Emergency Procedures	Average Number of Steps in Boldfaces													
	Robustness / Landing Gears	Failure Rate Per 100K F/H	0,0196	0	0	0,77	0	0	0	0,0000	0,0000	0,0151	0,0000	0,0000	0,0000
	Robustness / Airframe Lifetime	Years													
	Ergonomics / Cockpit	Cockpit Star Value	0,0388	1	0,13	1	0,75	0,75	1	0,0388	0,0051	0,0388	0,0291	0,0291	0,0388
	Ergonomics / Visibility	Visibility Star Value													
	Ergonomics / Noise Level	dB													
	Ergonomics / ECS	ECS Star Value													
	Systems Complexity	Complexity Level													
	Systems Dependency / Engine Start	Engine Start Dependency Level													
	Upgradeability	Upgradeability Level													
	Styling	Styling Star Value													
	Deactivation Capability	Deactivation Feature Star Value													
PERFORMANCE	Endurance	Minutes	0,0879	1	1	1	1	1	1	0,0879	0,0879	0,0879	0,0879	0,0879	0,0879
	Thrust	Lbs.													
	Fuel Efficiency	Gallons Per F/H													
	Speed	Knots	0,0176	0	0,492	0,4998	0	0,4998	0	0,0000	0,0087	0,0088	0,0000	0,0088	0,0000
	Range	Miles	0,0528	0,7697	1	1	1	0,7997	0,6996	0,0406	0,0528	0,0528	0,0528	0,0422	0,0369
	Ceiling	Feet	0,0357	0	0,4818	0,7152	0,0023	1	0	0,0000	0,0172	0,0255	0,0001	0,0357	0,0000
	Max Take-off Runway Length	Feet													
	Power Loading	Power/Weight Ratio													
RELIABILITY	Mean Time Between Failures (MTBF)	Hours	0,0953	0	0	0	0	0	0	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000
MAINTAINABILITY	Mean Time Between Maintenance (MTBM)	Hours	0,0537	0,1169	0,2781	0,2781	0,7883	0,2781	1	0,0063	0,0149	0,0149	0,0423	0,0149	0,0537
	Time Between Overhaul (TBO)	Hours	0,0263	1	0,8242	1	1	1	1	0,0263	0,0217	0,0263	0,0263	0,0263	0,0263
	Recording Capacity	Recording Capacity Level	0,0059	0	0	0,67	0	0,67	0	0,0000	0,0000	0,0040	0,0000	0,0040	0,0000
	Maintenance Specialty Requirement	Specialty Certificate Requirement Level	0,0117	0,17	0,17	1	0	0	0	0,0020	0,0020	0,0117	0,0000	0,0000	0,0000
	Civilian Airports Cross Service	Cross Service Support Level													
SAFETY	Total Safety Incidents (Class A,B,C)	Total Number Per 100K F/H													
	Engine	Number of Engines	0,0955	0	0,83	0	0	0	0	0,0000	0,0792	0,0000	0,0000	0,0000	0,0000
	Ejection Seat	Ejection Seat Star Value													
	Hook	Hook Speed Limit													
	Drag Chute	Drag Chute Speed limit													
	Collision Avoidance System	Avoidance System Star value													
FLYING QUALITY	Recoverability	Stall Warning Before Stall Margin_Knots	0,0960	0,07	0,14	0,07	0,07	0,07	0,07	0,0067	0,0134	0,0067	0,0067	0,0067	0,0067
	Stability	Degrees of Stability													
	Maneuverability / Roll Rate	Degrees Per Second													
	Maneuverability / G_Capacity	Gs													
	Handling Quality Rating	Cooper Harper Score													
	Flight Path Stability	Degrees Per Knot													
TRAINING QUALITY	Instrument Flight	Instrument Flight Quality Level													
	Formation Flight	Formation Flight Quality Level	0,0349	0,93	0,93	1	0,93	1	0,93	0,0325	0,0325	0,0349	0,0325	0,0349	0,0325
	Low Level Flight	Low Level Quality Level	0,0349	0	0	0	0	0	0	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000
	Aerobatics	Aerobatics Quality Level	0,1799	1	1	1	1	1	1	0,1799	0,1799	0,1799	0,1799	0,1799	0,1799
	Ground Handling	Ground Handling Quality Level													
TECHNOLOGY	Consistency With Current	Currency Scale	0,0170	0,68	0,91	1	1	1	0,68	0,0116	0,0155	0,0170	0,0170	0,0170	0,0116
	NAVAIDS	NAVAIDS Scale	0,0327	0,24	0,82	1	0,82	1	0,12	0,0078	0,0268	0,0327	0,0268	0,0327	0,0039
	Comm System	Comm System Quality Level													
	Radar	Radar Capability Level													
COST	Maintenance Cost	Hundred Dollars													
	Aircraft Price	Million Dollars	0,0246	1	1	0,683	1	0,5	1	0,0246	0,0246	0,0168	0,0246	0,0123	0,0246
SUPPORTING SYSTEMS	Synthetic Training System	Synthetic Trainer Star Value													
	Debriefing System	Debriefing System Star Value													
	Life Support Materials / G-Suit	G-Suit Quality Level													
		GLOBAL WEIGHT TOTAL →	1,000	RESULTING SCORES →						0,4993	0,6164	0,6129463	0,56499	0,57145	0,5371
											T-37B				

1-	T-37B TWEET	0,6164
2-	T-6A TEXAN II	0,6129463
3-	KT-1C	0,57145
4-	EMB.312	0,56499
5-	T-35	0,5371
6-	T-34C	0,4993

Table A.33: DM-10 Alternatives Scoring Summary List

VALUE		MEASURE	Global Weight	ALTERNATIVE SCORES T-34C	T-37B	T-6A	EMB.312	KT-1C	T-35	WEIGHTED SCORES T-34C	T-37B	T-6A	EMB.312	KT-1C	T-35
DESIGN	Simplicity / Standardized Cockpit	Standardization Level	0,0389	0,88	0,88	1	1	1	0,88	0,0343	0,0343	0,0389	0,0389	0,0389	0,0343
	Robustness / Landing Gears	Failure Rate Per 100K F/H	0,0196	0	0	0,77	0	0	0	0,0000	0,0000	0,0151	0,0000	0,0000	0,0000
	Ergonomics / Cockpit	Cockpit Star Value	0,0388	1	0,13	1	0,75	0,75	1	0,0388	0,0051	0,0388	0,0291	0,0291	0,0388
PERFORMANCE	Endurance	Minutes	0,0879	1	1	1	1	1	1	0,0879	0,0879	0,0879	0,0879	0,0879	0,0879
	Speed	Knots	0,0176	0	0,492	0,4998	0	0,4998	0	0,0000	0,0087	0,0088	0,0000	0,0088	0,0000
	Range	Miles	0,0528	0,7697	1	1	1	0,7997	0,6996	0,0406	0,0528	0,0528	0,0528	0,0422	0,0369
	Ceiling	Feet	0,0357	0	0,4818	0,7152	0,0023	1	0	0,0000	0,0172	0,0255	0,0001	0,0357	0,0000
RELIABILITY	Mean Time Between Failures (MTBF)	Hours	0,0953	0	0	0	0	0	0	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000
MAINTAINABILITY	Mean Time Between Maintenance (MTBM)	Hours	0,0537	0,1169	0,2781	0,2781	0,7883	0,2781	1	0,0063	0,0149	0,0149	0,0423	0,0149	0,0537
	Time Between Overhaul (TBO)	Hours	0,0263	1	0,8242	1	1	1	1	0,0263	0,0217	0,0263	0,0263	0,0263	0,0263
	Recording Capacity	Recording Capacity Level	0,0059	0	0	0,67	0	0,67	0	0,0000	0,0000	0,0040	0,0000	0,0040	0,0000
	Maintenance Specialty Requirement	Specialty Certificate Requirement Level	0,0117	0,17	0,17	1	0	0	0	0,0020	0,0020	0,0117	0,0000	0,0000	0,0000
SAFETY	Engine	Number of Engines	0,0955	0	0,83	0	0	0	0	0,0000	0,0792	0,0000	0,0000	0,0000	0,0000
FLYING QUALITY	Recoverability	Stall Warning Before Stall Margin_Knots	0,0960	0,07	0,14	0,07	0,07	0,07	0,07	0,0067	0,0134	0,0067	0,0067	0,0067	0,0067
TRAINING QUALITY	Formation Flight	Formation Flight Quality Level	0,0349	0,93	0,93	1	0,93	1	0,93	0,0325	0,0325	0,0349	0,0325	0,0349	0,0325
	Low Level Flight	Low Level Quality Level	0,0349	0	0	0	0	0	0	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000
	Aerobatics	Aerobatics Quality Level	0,1799	1	1	1	1	1	1	0,1799	0,1799	0,1799	0,1799	0,1799	0,1799
TECHNOLOGY	Consistency With Current	Currency Scale	0,0170	0,68	0,91	1	1	1	0,68	0,0116	0,0155	0,0170	0,0170	0,0170	0,0116
	NAVAIDS	NAVAIDS Scale	0,0327	0,24	0,82	1	0,82	1	0,12	0,0078	0,0268	0,0327	0,0268	0,0327	0,0039
COST	Aircraft Price	Million Dollars	0,0246	1	1	0,683	1	0,5	1	0,0246	0,0246	0,0168	0,0246	0,0123	0,0246
		GLOBAL WEIGHT TOTAL →	1,000	RESULTING SCORES →						0,4993	0,6164	0,6129463	0,56499	0,57145	0,5371
											T-37B				

1-	T-37B TWEET	0,6164
2-	T-6A TEXAN II	0,6129463
3-	KT-1C	0,57145
4-	EMB.312	0,56499
5-	T-35	0,5371
6-	T-34C	0,4993

Table A.34: DM-11 Alternatives Scoring Complete List

VALUE		MEASURE		ALTERNATIVE SCORES						WEIGHTED SCORES					
			Global Weight	T-34C	T-37B	T-6A	EMB.312	KT-1C	T-35	T-34C	T-37B	T-6A	EMB.312	KT-1C	T-35
DESIGN	User Friendly / Throttle	Throttle Star Value													
	User Friendly / Avionics	Avionics Scale													
	Simplicity / Standardized Cockpit	Standardization Level													
	Simplicity / Emergency Procedures	Average Number of Steps in Boldfaces													
	Robustness / Landing Gears	Failure Rate Per 100K F/H													
	Robustness / Airframe Lifetime	Years													
	Ergonomics / Cockpit	Cockpit Star Value	0,1570	0	0,45	0	0,33	0,33	0	0,0000	0,0707	0,0000	0,0518	0,0518	0,0000
	Ergonomics / Visibility	Visibility Star Value													
	Ergonomics / Noise Level	dB													
	Ergonomics / ECS	ECS Star Value													
	Systems Complexity	Complexity Level	0,0260	0,56	0,56	1	1	1	0,56	0,0146	0,0146	0,0260	0,0260	0,0260	0,0146
	Systems Dependency / Engine Start	Engine Start Dependency Level													
	Upgradeability	Upgradeability Level													
	Styling	Styling Star Value													
	Deactivation Capability	Deactivation Feature Star Value	0,0780	1	0,29	0,35	1	0,35	1	0,0780	0,0226	0,0273	0,0780	0,0273	0,0780
PERFORMANCE	Endurance	Minutes	0,1740	1	1	1	1	1	1	0,1740	0,1740	0,1740	0,1740	0,1740	0,1740
	Thrust	Lbs.													
	Fuel Efficiency	Gallons Per F/H													
	Speed	Knots													
	Range	Miles													
	Ceiling	Feet													
	Max Take-off Runway Length	Feet													
	Power Loading	Power/Weight Ratio													
RELIABILITY	Mean Time Between Failures (MTBF)	Hours													
MAINTAINABILITY	Mean Time Between Maintenance (MTBM)	Hours													
	Time Between Overhaul (TBO)	Hours													
	Recording Capacity	Recording Capacity Level													
	Maintenance Specialty Requirement	Specialty Certificate Requirement Level													
	Civilian Airports Cross Service	Cross Service Support Level													
SAFETY	Total Safety Incidents (Class A,B,C)	Total Number Per 100K F/H													
	Engine	Number of Engines													
	Ejection Seat	Ejection Seat Star Value													
	Hook	Hook Speed Limit													
	Drag Chute	Drag Chute Speed limit													
	Collision Avoidance System	Avoidance System Star value													
FLYING QUALITY	Recoverability	Stall Warning Before Stall Margin_Knots													
	Stability	Degrees of Stability													
	Maneuverability / Roll Rate	Degrees Per Second	0,0430	0,8	0,6	1	1	1	0,11	0,0344	0,0258	0,0430	0,0430	0,0430	0,0047
	Maneuverability / G_Capacity	Gs													
	Handling Quality Rating	Cooper Harper Score													
	Flight Path Stability	Degrees Per Knot													
TRAINING QUALITY	Instrument Flight	Instrument Flight Quality Level	0,0820	0,88	0,88	0,88	0,88	0,88	0,88	0,0722	0,0722	0,0722	0,0722	0,0722	0,0722
	Formation Flight	Formation Flight Quality Level	0,0310	0,44	0,44	1	0,44	1	0,44	0,0136	0,0136	0,0310	0,0136	0,0310	0,0136
	Low Level Flight	Low Level Quality Level	0,0100	0,77	0,77	0,77	0,77	0,77	0,77	0,0077	0,0077	0,0077	0,0077	0,0077	0,0077
	Aerobatics	Aerobatics Quality Level	0,0510	1	1	1	1	1	1	0,0510	0,0510	0,0510	0,0510	0,0510	0,0510
	Ground Handling	Ground Handling Quality Level													
TECHNOLOGY	Consistency With Current	Currency Scale													
	NAVAIDS	NAVAIDS Scale													
	Comm System	Comm System Quality Level													
	Radar	Radar Capability Level													
COST	Maintenance Cost	Hundred Dollars													
	Aircraft Price	Million Dollars													
SUPPORTING SYSTEMS	Synthetic Training System	Synthetic Trainer Star Value	0,1740	0,56	0,56	1	0	1	0	0,0974	0,0974	0,1740	0,0000	0,1740	0,0000
	Debriefing System	Debriefing System Star Value	0,1740	0	0	0,29	0	0,29	0	0,0000	0,0000	0,0505	0,0000	0,0505	0,0000
	Life Support Materials / G-Suit	G-Suit Quality Level													
		GLOBAL WEIGHT TOTAL →	1,000	RESULTING SCORES →						0,5429	0,54957	0,65662	0,51731	0,70843	0,4158
														KT-1C	

1-	KT-1C	0,70843
2-	T-6A TEXAN II	0,65662
3-	T-37B TWEET	0,54957
4-	T-34C	0,5429
5-	EMB.312	0,51731
6-	T-35	0,4158

Table A.35: DM-11 Alternatives Scoring Summary List

VALUE		MEASURE		ALTERNATIVE SCORES						WEIGHTED SCORES					
			Global Weight	T-34C	T-37B	T-6A	EMB.312	KT-1C	T-35	T-34C	T-37B	T-6A	EMB.312	KT-1C	T-35
DESIGN	Ergonomics / Cockpit	Cockpit Star Value	0,5000	0,93	0,6	0,93	1	1	0,93	0,4650	0,3000	0,4650	0,5000	0,5000	0,4650
FLYING QUALITY	Stability	Degrees of Stability	0,1950	1	1	1	1	1	1	0,1950	0,1950	0,1950	0,1950	0,1950	0,1950
	Handling Quality Rating	Cooper Harper Score	0,1050	0	0,33	0,5	0,33	0,5	0,33	0,0000	0,0347	0,0525	0,0347	0,0525	0,0347
TECHNOLOGY	Consistency With Current	Currency Scale	0,2000	0,44	0,75	1	1	1	0,44	0,0880	0,1500	0,2000	0,2000	0,2000	0,0880
		GLOBAL WEIGHT TOTAL →	1,000	RESULTING SCORES →						0,748	0,67965	0,9125	0,92965	0,9475	0,7827
														KT-1C	

1-	KT-1C	0,9475
2-	EMB.312	0,92965
3-	T-6A TEXAN II	0,9125
4-	T-35	0,7827
5-	T-34C	0,748
6-	T-37B TWEET	0,67965

Table A.36: DM-12 Alternatives Scoring Complete List

VALUE		MEASURE	Global Weight	ALTERNATIVE SCORES T-34C	T-37B	T-6A	EMB.312	KT-1C	T-35	WEIGHTED SCORES T-34C	T-37B	T-6A	EMB.312	KT-1C	T-35
DESIGN	User Friendly / Throttle	Throttle Star Value													
	User Friendly / Avionics	Avionics Scale													
	Simplicity / Standardized Cockpit	Standardization Level													
	Simplicity / Emergency Procedures	Average Number of Steps in Boldfaces													
	Robustness / Landing Gears	Failure Rate Per 100K F/H	0,0250	1	1	1	1	1	1	0,0250	0,0250	0,0250	0,0250	0,0250	0,0250
	Robustness / Airframe Lifetime	Years													
	Ergonomics / Cockpit	Cockpit Star Value	0,0100	0,75	1	0,75	0,5	0,5	0,75	0,0075	0,0100	0,0075	0,0050	0,0050	0,0075
	Ergonomics / Visibility	Visibility Star Value	0,0150	0,86	0,86	0,86	0,86	0,86	0,86	0,0129	0,0129	0,0129	0,0129	0,0129	0,0129
	Ergonomics / Noise Level	dB													
	Ergonomics / ECS	ECS Star Value													
	Systems Complexity	Complexity Level													
	Systems Dependency / Engine Start	Engine Start Dependency Level													
	Upgradeability	Upgradeability Level													
	Styling	Styling Star Value	0,0130	0,29	0,29	0,29	0,29	0,29	0,29	0,0038	0,0038	0,0038	0,0038	0,0038	0,0038
	Deactivation Capability	Deactivation Feature Star Value													
PERFORMANCE	Endurance	Minutes	0,0470	1	0,5	0	1	1	1	0,0470	0,0235	0,0000	0,0470	0,0470	0,0470
	Thrust	Lbs.	0,0930	0	0	0	0	0	0	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000
	Fuel Efficiency	Gallons Per F/H	0,0470	1	0	0,834	0,634	0,933	1	0,0470	0,0000	0,0392	0,0298	0,0439	0,0470
	Speed	Knots													
	Range	Miles													
	Ceiling	Feet													
	Max Take-off Runway Length	Feet													
	Power Loading	Power/Weight Ratio													
RELIABILITY	Mean Time Between Failures (MTBF)	Hours	0,2500	1	1	0,5	0	0,8	1	0,2500	0,2500	0,1250	0,0000	0,2000	0,2500
MAINTAINABILITY	Mean Time Between Maintenance (MTBM)	Hours													
	Time Between Overhaul (TBO)	Hours													
	Recording Capacity	Recording Capacity Level													
	Maintenance Specialty Requirement	Specialty Certificate Requirement Level													
	Civilian Airports Cross Service	Cross Service Support Level													
SAFETY	Total Safety Incidents (Class A,B,C)	Total Number Per 100K F/H	0,2500	0	0	0	0	0	0	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000
	Engine	Number of Engines													
	Ejection Seat	Ejection Seat Star Value													
	Hook	Hook Speed Limit													
	Drag Chute	Drag Chute Speed limit													
	Collision Avoidance System	Avoidance System Star value													
FLYING QUALITY	Recoverability	Stall Warning Before Stall Margin_Knots													
	Stability	Degrees of Stability													
	Maneuverability / Roll Rate	Degrees Per Second	0,0300	0	0	0,8656	0,5	0,7377	0	0,0000	0,0000	0,0260	0,0150	0,0221	0,0000
	Maneuverability / G_Capacity	Gs	0,0200	0,43925	0,72563	0,89125	0,7825	0,89125	0,7825	0,0088	0,0145	0,0178	0,0157	0,0178	0,0157
	Handling Quality Rating	Cooper Harper Score	0,0750	1	1	1	1	1	1	0,0750	0,0750	0,0750	0,0750	0,0750	0,0750
	Flight Path Stability	Degrees Per Knot													
TRAINING QUALITY	Instrument Flight	Instrument Flight Quality Level													
	Formation Flight	Formation Flight Quality Level													
	Low Level Flight	Low Level Quality Level													
	Aerobatics	Aerobatics Quality Level													
	Ground Handling	Ground Handling Quality Level													
TECHNOLOGY	Consistency With Current	Currency Scale													
	NAVAIDS	NAVAIDS Scale													
	Comm System	Comm System Quality Level													
	Radar	Radar Capability Level													
COST	Maintenance Cost	Hundred Dollars													
	Aircraft Price	Million Dollars													
SUPPORTING SYSTEMS	Synthetic Training System	Synthetic Trainer Star Value	0,1250	0,63	0,63	1	0	1	0	0,0788	0,0788	0,1250	0,0000	0,1250	0,0000
	Debriefing System	Debriefing System Star Value													
	Life Support Materials / G-Suit	G-Suit Quality Level													
		GLOBAL WEIGHT TOTAL →	1,000	RESULTING SCORES →						0,5557	0,49343	0,457161	0,22912	0,577477	0,4838
														KT-1C	

1-	KT-1C	0,577477
2-	T-34C	0,5557
3-	T-37B TWEET	0,49343
4-	T-35	0,4838
5-	T-6A TEXAN II	0,457161
6-	EMB.312	0,22912

Table A.37: DM-12 Alternatives Scoring Summary List

VALUE		MEASURE	Global Weight	ALTERNATIVE SCORES T-34C	T-37B	T-6A	EMB.312	KT-1C	T-35	WEIGHTED SCORES T-34C	T-37B	T-6A	EMB.312	KT-1C	T-35
DESIGN	Robustness / Landing Gears	Failure Rate Per 100K F/H	0,0250	1	1	1	1	1	1	0,0250	0,0250	0,0250	0,0250	0,0250	0,0250
	Ergonomics / Cockpit	Cockpit Star Value	0,0100	0,75	1	0,75	0,5	0,5	0,75	0,0075	0,0100	0,0075	0,0050	0,0050	0,0075
	Ergonomics / Visibility	Visibility Star Value	0,0150	0,86	0,86	0,86	0,86	0,86	0,86	0,0129	0,0129	0,0129	0,0129	0,0129	0,0129
	Styling	Styling Star Value	0,0130	0,29	0,29	0,29	0,29	0,29	0,29	0,0038	0,0038	0,0038	0,0038	0,0038	0,0038
PERFORMANCE	Endurance	Minutes	0,0470	1	0,5	0	1	1	1	0,0470	0,0235	0,0000	0,0470	0,0470	0,0470
	Thrust	Lbs.	0,0930	0	0	0	0	0	0	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000
	Fuel Efficiency	Gallons Per F/H	0,0470	1	0	0,834	0,634	0,933	1	0,0470	0,0000	0,0392	0,0298	0,0439	0,0470
RELIABILITY	Mean Time Between Failures (MTBF)	Hours	0,2500	1	1	0,5	0	0,8	1	0,2500	0,2500	0,1250	0,0000	0,2000	0,2500
SAFETY	Total Safety Incidents (Class A,B,C)	Total Number Per 100K F/H	0,2500	0	0	0	0	0	0	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000
FLYING QUALITY	Maneuverability / Roll Rate	Degrees Per Second	0,0300	0	0	0,8656	0,5	0,7377	0	0,0000	0,0000	0,0260	0,0150	0,0221	0,0000
	Maneuverability / G_Capacity	Gs	0,0200	0,43925	0,72563	0,89125	0,7825	0,89125	0,7825	0,0088	0,0145	0,0178	0,0157	0,0178	0,0157
	Handling Quality Rating	Cooper Harper Score	0,0750	1	1	1	1	1	1	0,0750	0,0750	0,0750	0,0750	0,0750	0,0750
SUPPORTING SYSTEMS	Synthetic Training System	Synthetic Trainer Star Value	0,1250	0,63	0,63	1	0	1	0	0,0788	0,0788	0,1250	0,0000	0,1250	0,0000
		GLOBAL WEIGHT TOTAL →	1,000	RESULTING SCORES →						0,5557	0,49343	0,457161	0,22912	0,577477	0,4838
														KT-1C	

1-	KT-1C	0,577477
2-	T-34C	0,5557
3-	T-37B TWEET	0,49343
4-	T-35	0,4838
5-	T-6A TEXAN II	0,457161
6-	EMB.312	0,22912

Table A.38: DM-13 Alternatives Scoring Complete List

VALUE		MEASURE	Global Weight	ALTERNATIVE SCORES T-34C	T-37B	T-6A	EMB.312	KT-1C	T-35	WEIGHTED SCORES T-34C	T-37B	T-6A	EMB.312	KT-1C	T-35
DESIGN	User Friendly / Throttle	Throttle Star Value													
	User Friendly / Avionics	Avionics Scale													
	Simplicity / Standardized Cockpit	Standardization Level	0,0370	0,66	0,66	1	1	1	0,66	0,0244	0,0244	0,0370	0,0370	0,0370	0,0244
	Simplicity / Emergency Procedures	Average Number of Steps in Boldfaces													
	Robustness / Landing Gears	Failure Rate Per 100K F/H	0,0450	0	0	0,5	0	0,3	0,4	0,0000	0,0000	0,0225	0,0000	0,0135	0,0180
	Robustness / Airframe Lifetime	Years													
	Ergonomics / Cockpit	Cockpit Star Value	0,0150	0,5	0,25	0,5	1	1	0,5	0,0075	0,0038	0,0075	0,0150	0,0150	0,0075
	Ergonomics / Visibility	Visibility Star Value	0,0070	0	0	0	0	0	0	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000
	Ergonomics / Noise Level	dB													
	Ergonomics / ECS	ECS Star Value	0,0150	0,75	0,75	1	0,95	0,95	0,75	0,0113	0,0113	0,0150	0,0143	0,0143	0,0113
	Systems Complexity	Complexity Level													
	Systems Dependency / Engine Start	Engine Start Dependency Level	0,0070	1	1	1	1	1	1	0,0070	0,0070	0,0070	0,0070	0,0070	0,0070
	Upgradeability	Upgradeability Level													
	Styling	Styling Star Value													
	Deactivation Capability	Deactivation Feature Star Value													
PERFORMANCE	Endurance	Minutes	0,0550	0,9754	0,7843	0,6616	1	1	1	0,0536	0,0431	0,0364	0,0550	0,0550	0,0550
	Thrust	Lbs.													
	Fuel Efficiency	Gallons Per F/H													
	Speed	Knots													
	Range	Miles													
	Ceiling	Feet													
	Max Take-off Runway Length	Feet													
	Power Loading	Power/Weight Ratio													
RELIABILITY	Mean Time Between Failures (MTBF)	Hours	0,1100	0	0	0	0	0	0	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000
MAINTAINABILITY	Mean Time Between Maintenance (MTBM)	Hours	0,0730	0,066	0,0857	0,0857	0,1284	0,0857	1	0,0048	0,0063	0,0063	0,0094	0,0063	0,0730
	Time Between Overhaul (TBO)	Hours	0,0300	0	0	0	0	0	0	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000
	Recording Capacity	Recording Capacity Level													
	Maintenance Specialty Requirement	Specialty Certificate Requirement Level													
	Civilian Airports Cross Service	Cross Service Support Level													
SAFETY	Total Safety Incidents (Class A,B,C)	Total Number Per 100K F/H													
	Engine	Number of Engines													
	Ejection Seat	Ejection Seat Star Value													
	Hook	Hook Speed Limit													
	Drag Chute	Drag Chute Speed limit													
	Collision Avoidance System	Avoidance System Star value	0,1090	0,92	0	0,92	0	0,92	0	0,1003	0,0000	0,1003	0,0000	0,1003	0,0000
FLYING QUALITY	Recoverability	Stall Warning Before Stall Margin_Knots													
	Stability	Degrees of Stability	0,1230	1	1	1	1	1	1	0,1230	0,1230	0,1230	0,1230	0,1230	0,1230
	Maneuverability / Roll Rate	Degrees Per Second													
	Maneuverability / G_Capacity	Gs													
	Handling Quality Rating	Cooper Harper Score	0,0410	0,38	0,88	1	0,88	1	0,88	0,0156	0,0361	0,0410	0,0361	0,0410	0,0361
	Flight Path Stability	Degrees Per Knot													
TRAINING QUALITY	Instrument Flight	Instrument Flight Quality Level	0,0980	0,91	0,91	0,91	0,91	0,91	0,91	0,0892	0,0892	0,0892	0,0892	0,0892	0,0892
	Formation Flight	Formation Flight Quality Level													
	Low Level Flight	Low Level Flight Quality Level													
	Aerobatics	Aerobatics Quality Level	0,0490	1	1	1	1	1	1	0,0490	0,0490	0,0490	0,0490	0,0490	0,0490
	Ground Handling	Ground Handling Quality Level	0,0150	0,66	0,33	0,2	0,2	0,2	0,07	0,0099	0,0050	0,0030	0,0030	0,0030	0,0011
TECHNOLOGY	Consistency With Current	Currency Scale	0,0980	0,36	0,73	1	1	1	0,36	0,0353	0,0715	0,0980	0,0980	0,0980	0,0353
	NAVAIDS	NAVAIDS Scale													
	Comm System	Comm System Quality Level													
	Radar	Radar Capability Level													
COST	Maintenance Cost	Hundred Dollars													
	Aircraft Price	Million Dollars													
SUPPORTING SYSTEMS	Synthetic Training System	Synthetic Trainer Star Value	0,0730	0,5	0,5	1	0	1	0	0,0365	0,0365	0,0730	0,0000	0,0730	0,0000
	Debriefing System	Debriefing System Star Value													
	Life Support Materials / G-Suit	G-Suit Quality Level													
		GLOBAL WEIGHT TOTAL →	1,000	RESULTING SCORES →						0,5674	0,50606	0,7081041	0,53588	0,72447	0,5298
														KT-1C	

1-	KT-1C	0,72447
2-	T-6A TEXAN II	0,7081041
3-	T-34C	0,5674
4-	EMB.312	0,53588
5-	T-35	0,5298
6-	T-37B TWEET	0,50606

Table A.39: DM-13 Alternatives Scoring Summary List

VALUE		MEASURE	Global Weight	ALTERNATIVE SCORES T-34C	T-37B	T-6A	EMB.312	KT-1C	T-35	WEIGHTED SCORES T-34C	T-37B	T-6A	EMB.312	KT-1C	T-35
DESIGN	Simplicity / Standardized Cockpit	Standardization Level	0,0370	0,66	0,66	1	1	1	0,66	0,0244	0,0244	0,0370	0,0370	0,0370	0,0244
	Robustness / Landing Gears	Failure Rate Per 100K F/H	0,0450	0	0	0,5	0	0,3	0,4	0,0000	0,0000	0,0225	0,0000	0,0135	0,0180
	Ergonomics / Cockpit	Cockpit Star Value	0,0150	0,5	0,25	0,5	1	1	0,5	0,0075	0,0038	0,0075	0,0150	0,0150	0,0075
	Ergonomics / Visibility	Visibility Star Value	0,0070	0	0	0	0	0	0	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000
	Ergonomics / ECS	ECS Star Value	0,0150	0,75	0,75	1	0,95	0,95	0,75	0,0113	0,0113	0,0150	0,0143	0,0143	0,0113
	Systems Dependency / Engine Start	Engine Start Dependency Level	0,0070	1	1	1	1	1	1	0,0070	0,0070	0,0070	0,0070	0,0070	0,0070
PERFORMANCE	Endurance	Minutes	0,0550	0,9754	0,7843	0,6616	1	1	1	0,0536	0,0431	0,0364	0,0550	0,0550	0,0550
RELIABILITY	Mean Time Between Failures (MTBF)	Hours	0,1100	0	0	0	0	0	0	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000
MAINTAINABILITY	Mean Time Between Maintenance (MTBM)	Hours	0,0730	0,066	0,0857	0,0857	0,1284	0,0857	1	0,0048	0,0063	0,0063	0,0094	0,0063	0,0730
	Time Between Overhaul (TBO)	Hours	0,0300	0	0	0	0	0	0	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000
SAFETY	Collision Avoidance System	Avoidance System Star value	0,1090	0,92	0	0,92	0	0,92	0	0,1003	0,0000	0,1003	0,0000	0,1003	0,0000
FLYING QUALITY	Stability	Degrees of Stability	0,1230	1	1	1	1	1	1	0,1230	0,1230	0,1230	0,1230	0,1230	0,1230
	Handling Quality Rating	Cooper Harper Score	0,0410	0,38	0,88	1	0,88	1	0,88	0,0156	0,0361	0,0410	0,0361	0,0410	0,0361
TRAINING QUALITY	Instrument Flight	Instrument Flight Quality Level	0,0980	0,91	0,91	0,91	0,91	0,91	0,91	0,0892	0,0892	0,0892	0,0892	0,0892	0,0892
	Aerobatics	Aerobatics Quality Level	0,0490	1	1	1	1	1	1	0,0490	0,0490	0,0490	0,0490	0,0490	0,0490
	Ground Handling	Ground Handling Quality Level	0,0150	0,66	0,33	0,2	0,2	0,2	0,07	0,0099	0,0050	0,0030	0,0030	0,0030	0,0011
TECHNOLOGY	Consistency With Current	Currency Scale	0,0980	0,36	0,73	1	1	1	0,36	0,0353	0,0715	0,0980	0,0980	0,0980	0,0353
SUPPORTING SYSTEMS	Synthetic Training System	Synthetic Trainer Star Value	0,0730	0,5	0,5	1	0	1	0	0,0365	0,0365	0,0730	0,0000	0,0730	0,0000
		GLOBAL WEIGHT TOTAL →	1,000	RESULTING SCORES →						0,5674	0,50606	0,7081041	0,53588	0,72447	0,5298
														KT-1C	

1-	KT-1C	0,72447
2-	T-6A TEXAN II	0,7081041
3-	T-34C	0,5674
4-	EMB.312	0,53588
5-	T-35	0,5298
6-	T-37B TWEET	0,50606

Table A.40: DM-14 Alternatives Scoring Complete List

VALUE		MEASURE	Global Weight	ALTERNATIVE SCORES T-34C	T-37B	T-6A	EMB.312	KT-1C	T-35	WEIGHTED SCORES T-34C	T-37B	T-6A	EMB.312	KT-1C	T-35
DESIGN	User Friendly / Throttle	Throttle Star Value													
	User Friendly / Avionics	Avionics Scale													
	Simplicity / Standardized Cockpit	Standardization Level													
	Simplicity / Emergency Procedures	Average Number of Steps in Boldfaces													
	Robustness / Landing Gears	Failure Rate Per 100K F/H													
	Robustness / Airframe Lifetime	Years	0,0290	0	0	0	0	0	0	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000
	Ergonomics / Cockpit	Cockpit Star Value	0,0300	0,09	0,36	0,09	1	1	0,09	0,0027	0,0108	0,0027	0,0300	0,0300	0,0027
	Ergonomics / Visibility	Visibility Star Value													
	Ergonomics / Noise Level	dB													
	Ergonomics / ECS	ECS Star Value													
	Systems Complexity	Complexity Level													
	Systems Dependency / Engine Start	Engine Start Dependency Level	0,0900	1	1	1	1	1	1	0,0900	0,0900	0,0900	0,0900	0,0900	0,0900
	Upgradeability	Upgradeability Level													
	Styling	Styling Star Value													
	Deactivation Capability	Deactivation Feature Star Value													
PERFORMANCE	Endurance	Minutes	0,1880	1	1	1	1	1	1	0,1880	0,1880	0,1880	0,1880	0,1880	0,1880
	Thrust	Lbs.	0,0750	0	0	0,4	0	0	0	0,0000	0,0000	0,0300	0,0000	0,0000	0,0000
	Fuel Efficiency	Gallons Per F/H	0,0380	1	1	1	1	1	1	0,0380	0,0380	0,0380	0,0380	0,0380	0,0380
	Speed	Knots													
	Range	Miles													
	Ceiling	Feet													
	Max Take-off Runway Length	Feet													
	Power Loading	Power/Weight Ratio													
RELIABILITY	Mean Time Between Failures (MTBF)	Hours													
MAINTAINABILITY	Mean Time Between Maintenance (MTBM)	Hours	0,0830	0	0	0	0,4621	0	1	0,0000	0,0000	0,0000	0,0384	0,0000	0,0830
	Time Between Overhaul (TBO)	Hours	0,0170	0,5	0	1	0,5	1	0	0,0085	0,0000	0,0170	0,0085	0,0170	0,0000
	Recording Capacity	Recording Capacity Level													
	Maintenance Specialty Requirement	Specialty Certificate Requirement Level													
	Civilian Airports Cross Service	Cross Service Support Level													
SAFETY	Total Safety Incidents (Class A,B,C)	Total Number Per 100K F/H													
	Engine	Number of Engines													
	Ejection Seat	Ejection Seat Star Value													
	Hook	Hook Speed Limit													
	Drag Chute	Drag Chute Speed limit													
	Collision Avoidance System	Avoidance System Star value													
FLYING QUALITY	Recoverability	Stall Warning Before Stall Margin_Knots	0,0500	0,71	1	0,71	0,71	0,71	0,71	0,0355	0,0500	0,0355	0,0355	0,0355	0,0355
	Stability	Degrees of Stability													
	Maneuverability / Roll Rate	Degrees Per Second													
	Maneuverability / G_Capacity	Gs													
	Handling Quality Rating	Cooper Harper Score													
	Flight Path Stability	Degrees Per Knot													
TRAINING QUALITY	Instrument Flight	Instrument Flight Quality Level													
	Formation Flight	Formation Flight Quality Level													
	Low Level Flight	Low Level Quality Level													
	Aerobatics	Aerobatics Quality Level													
	Ground Handling	Ground Handling Quality Level													
TECHNOLOGY	Consistency With Current	Currency Scale													
	NAVAIDS	NAVAIDS Scale	0,1500	0,36	0,64	1	0,64	1	0,09	0,0540	0,0960	0,1500	0,0960	0,1500	0,0135
	Comm System	Comm System Quality Level													
	Radar	Radar Capability Level													
COST	Maintenance Cost	Hundred Dollars													
	Aircraft Price	Million Dollars													
SUPPORTING SYSTEMS	Synthetic Training System	Synthetic Trainer Star Value	0,2500	0,59	0,59	1	0	1	0	0,1475	0,1475	0,2500	0,0000	0,2500	0,0000
	Debriefing System	Debriefing System Star Value													
	Life Support Materials / G-Suit	G-Suit Quality Level													
		GLOBAL WEIGHT TOTAL →	1,000	RESULTING SCORES →						0,5642	0,6203	0,8012	0,52435	0,7985	0,4507
												T-6A TEXAN II			

1-	T-6A TEXAN II	0,8012
2-	KT-1C	0,7985
3-	T-37B TWEET	0,6203
4-	T-34C	0,5642
5-	EMB.312	0,52435
6-	T-35	0,4507

Table A.41: DM-14 Alternatives Scoring Summary List

VALUE		MEASURE	Global Weight	ALTERNATIVE SCORES T-34C	T-37B	T-6A	EMB.312	KT-1C	T-35	WEIGHTED SCORES T-34C	T-37B	T-6A	EMB.312	KT-1C	T-35
DESIGN	Robustness / Airframe Lifetime	Years	0,0290	0	0	0	0	0	0	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000
	Ergonomics / Cockpit	Cockpit Star Value	0,0300	0,09	0,36	0,09	1	1	0,09	0,0027	0,0108	0,0027	0,0300	0,0300	0,0027
	Systems Dependency / Engine Start	Engine Start Dependency Level	0,0900	1	1	1	1	1	1	0,0900	0,0900	0,0900	0,0900	0,0900	0,0900
PERFORMANCE	Endurance	Minutes	0,1880	1	1	1	1	1	1	0,1880	0,1880	0,1880	0,1880	0,1880	0,1880
	Thrust	Lbs.	0,0750	0	0	0,4	0	0	0	0,0000	0,0000	0,0300	0,0000	0,0000	0,0000
	Fuel Efficiency	Gallons Per F/H	0,0380	1	1	1	1	1	1	0,0380	0,0380	0,0380	0,0380	0,0380	0,0380
MAINTAINABILITY	Mean Time Between Maintenance (MTBM)	Hours	0,0830	0	0	0	0,4621	0	1	0,0000	0,0000	0,0000	0,0384	0,0000	0,0830
	Time Between Overhaul (TBO)	Hours	0,0170	0,5	0	1	0,5	1	0	0,0085	0,0000	0,0170	0,0085	0,0170	0,0000
FLYING QUALITY	Recoverability	Stall Warning Before Stall Margin_Knots	0,0500	0,71	1	0,71	0,71	0,71	0,71	0,0355	0,0500	0,0355	0,0355	0,0355	0,0355
TECHNOLOGY	NAVAIDS	NAVAIDS Scale	0,1500	0,36	0,64	1	0,64	1	0,09	0,0540	0,0960	0,1500	0,0960	0,1500	0,0135
SUPPORTING SYSTEMS	Synthetic Training System	Synthetic Trainer Star Value	0,2500	0,59	0,59	1	0	1	0	0,1475	0,1475	0,2500	0,0000	0,2500	0,0000
		GLOBAL WEIGHT TOTAL →	1,000	RESULTING SCORES →						0,5642	0,6203	0,8012	0,52435	0,7985	0,4507
												T-6A TEXAN II			

1-	T-6A TEXAN II	0,8012
2-	KT-1C	0,7985
3-	T-37B TWEET	0,6203
4-	T-34C	0,5642
5-	EMB.312	0,52435
6-	T-35	0,4507

Table A.42: DM-15 Alternatives Scoring Complete List

VALUE		MEASURE	Global Weight	ALTERNATIVE SCORES T-34C	ALTERNATIVE SCORES T-37B	ALTERNATIVE SCORES T-6A	ALTERNATIVE SCORES EMB.312	ALTERNATIVE SCORES KT-1C	ALTERNATIVE SCORES T-35	WEIGHTED SCORES T-34C	WEIGHTED SCORES T-37B	WEIGHTED SCORES T-6A	WEIGHTED SCORES EMB.312	WEIGHTED SCORES KT-1C	WEIGHTED SCORES T-35
DESIGN	User Friendly / Throttle	Throttle Star Value													
	User Friendly / Avionics	Avionics Scale													
	Simplicity / Standardized Cockpit	Standardization Level													
	Simplicity / Emergency Procedures	Average Number of Steps in Boldfaces													
	Robustness / Landing Gears	Failure Rate Per 100K F/H													
	Robustness / Airframe Lifetime	Years													
	Ergonomics / Cockpit	Cockpit Star Value	0,0290	1	0,11	1	0,78	0,78	1	0,0290	0,0032	0,0290	0,0226	0,0226	0,0290
	Ergonomics / Visibility	Visibility Star Value	0,1140	0,08	0,08	0,08	0,08	0,08	0,08	0,0023	0,0023	0,0023	0,0023	0,0023	0,0023
	Ergonomics / Noise Level	dB													
	Ergonomics / ECS	ECS Star Value													
	Systems Complexity	Complexity Level													
	Systems Dependency / Engine Start	Engine Start Dependency Level													
	Upgradeability	Upgradeability Level													
	Styling	Styling Star Value													
	Deactivation Capability	Deactivation Feature Star Value													
PERFORMANCE	Endurance	Minutes													
	Thrust	Lbs.													
	Fuel Efficiency	Gallons Per F/H	0,1430	1	0	0	0	0,042	1	0,1430	0,0000	0,0000	0,0000	0,0060	0,1430
	Speed	Knots													
	Range	Miles													
	Ceiling	Feet													
	Max Take-off Runway Length	Feet													
	Power Loading	Power/Weight Ratio													
RELIABILITY	Mean Time Between Failures (MTBF)	Hours													
MAINTAINABILITY	Mean Time Between Maintenance (MTBM)	Hours	0,0480	0,2623	0,5	0,5	0,9003	0,5	1	0,0126	0,0240	0,0240	0,0432	0,0240	0,0480
	Time Between Overhaul (TBO)	Hours	0,0240	0	0	0,5	0	0,3337	0	0,0000	0,0000	0,0120	0,0000	0,0080	0,0000
	Recording Capacity	Recording Capacity Level													
	Maintenance Specialty Requirement	Specialty Certificate Requirement Level													
	Civilian Airports Cross Service	Cross Service Support Level													
SAFETY	Total Safety Incidents (Class A,B,C)	Total Number Per 100K F/H													
	Engine	Number of Engines	0,1290	0	0,89	0	0	0	0	0,0000	0,1148	0,0000	0,0000	0,0000	0,0000
	Ejection Seat	Ejection Seat Star Value	0,1140	0	0,7	1	0,7	1	0	0,0000	0,0798	0,1140	0,0798	0,1140	0,0000
	Hook	Hook Speed Limit	0,0290	0	0	0	0	0	0	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000
	Drag Chute	Drag Chute Speed limit	0,0120	0	0	0	0	0	0	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000
	Collision Avoidance System	Avoidance System Star value													
FLYING QUALITY	Recoverability	Stall Warning Before Stall Margin_Knots	0,1070	0,2	0,4	0,2	0,2	0,2	0,2	0,0214	0,0428	0,0214	0,0214	0,0214	0,0214
	Stability	Degrees of Stability	0,0360	1	1	1	1	1	1	0,0360	0,0360	0,0360	0,0360	0,0360	0,0360
	Maneuverability / Roll Rate	Degrees Per Second													
	Maneuverability / G_Capacity	Gs													
	Handling Quality Rating	Cooper Harper Score													
	Flight Path Stability	Degrees Per Knot													
TRAINING QUALITY	Instrument Flight	Instrument Flight Quality Level													
	Formation Flight	Formation Flight Quality Level													
	Low Level Flight	Low Level Quality Level													
	Aerobatics	Aerobatics Quality Level													
	Ground Handling	Ground Handling Quality Level													
TECHNOLOGY	Consistency With Current	Currency Scale													
	NAVAIDS	NAVAIDS Scale	0,0860	0,41	0,59	1	0,59	1	0,07	0,0353	0,0507	0,0860	0,0507	0,0860	0,0060
	Comm System	Comm System Quality Level	0,0480	0,04	0	0,32	0,32	0,04	0,04	0,0019	0,0000	0,0154	0,0154	0,0019	0,0019
	Radar	Radar Capability Level	0,0100	0	0	0	0	0	0	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000
COST	Maintenance Cost	Hundred Dollars	0,0710	1	0,97	0,511	0,9	0,8	0	0,0710	0,0689	0,0363	0,0639	0,0568	0,0000
	Aircraft Price	Million Dollars													
SUPPORTING SYSTEMS	Synthetic Training System	Synthetic Trainer Star Value													
	Debriefing System	Debriefing System Star Value													
	Life Support Materials / G-Suit	G-Suit Quality Level													
		GLOBAL WEIGHT TOTAL →	1,000	RESULTING SCORES →						0,3525	0,42253	0,376361	0,33535	0,3790748	0,2877

T-37B TWEET

1-	T-37B TWEET	0,42253
2-	KT-1C	0,3790748
3-	T-6A TEXAN II	0,376361
4-	T-34C	0,3525
5-	EMB.312	0,33535
6-	T-35	0,2877

Table A.43: DM-15 Alternatives Scoring Summary List

VALUE		MEASURE	Global Weight	ALTERNATIVE SCORES T-34C	ALTERNATIVE SCORES T-37B	ALTERNATIVE SCORES T-6A	ALTERNATIVE SCORES EMB.312	ALTERNATIVE SCORES KT-1C	ALTERNATIVE SCORES T-35	WEIGHTED SCORES T-34C	WEIGHTED SCORES T-37B	WEIGHTED SCORES T-6A	WEIGHTED SCORES EMB.312	WEIGHTED SCORES KT-1C	WEIGHTED SCORES T-35
DESIGN	Ergonomics / Cockpit	Cockpit Star Value	0,0290	1	0,11	1	0,78	0,78	1	0,0290	0,0032	0,0290	0,0226	0,0226	0,0290
	Ergonomics / Visibility	Visibility Star Value	0,1140	0,08	0,08	0,08	0,08	0,08	0,08	0,0023	0,0023	0,0023	0,0023	0,0023	0,0023
PERFORMANCE	Fuel Efficiency	Gallons Per F/H	0,1430	1	0	0	0	0,042	1	0,1430	0,0000	0,0000	0,0000	0,0060	0,1430
MAINTAINABILITY	Mean Time Between Maintenance (MTBM)	Hours	0,0480	0,2623	0,5	0,5	0,9003	0,5	1	0,0126	0,0240	0,0240	0,0432	0,0240	0,0480
	Time Between Overhaul (TBO)	Hours	0,0240	0	0	0,5	0	0,3337	0	0,0000	0,0000	0,0120	0,0000	0,0080	0,0000
SAFETY	Engine	Number of Engines	0,1290	0	0,89	0	0	0	0	0,0000	0,1148	0,0000	0,0000	0,0000	0,0000
	Ejection Seat	Ejection Seat Star Value	0,1140	0	0,7	1	0,7	1	0	0,0000	0,0798	0,1140	0,0798	0,1140	0,0000
	Hook	Hook Speed Limit	0,0290	0	0	0	0	0	0	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000
	Drag Chute	Drag Chute Speed limit	0,0120	0	0	0	0	0	0	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000
FLYING QUALITY	Recoverability	Stall Warning Before Stall Margin_Knots	0,1070	0,2	0,4	0,2	0,2	0,2	0,2	0,0214	0,0428	0,0214	0,0214	0,0214	0,0214
	Stability	Degrees of Stability	0,0360	1	1	1	1	1	1	0,0360	0,0360	0,0360	0,0360	0,0360	0,0360
TECHNOLOGY	NAVAIDS	NAVAIDS Scale	0,0860	0,41	0,59	1	0,59	1	0,07	0,0353	0,0507	0,0860	0,0507	0,0860	0,0060
	Comm System	Comm System Quality Level	0,0480	0,04	0	0,32	0,32	0,04	0,04	0,0019	0,0000	0,0154	0,0154	0,0019	0,0019
	Radar	Radar Capability Level	0,0100	0	0	0	0	0	0	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000
COST	Maintenance Cost	Hundred Dollars	0,0710	1	0,97	0,511	0,9	0,8	0	0,0710	0,0689	0,0363	0,0639	0,0568	0,0000
		GLOBAL WEIGHT TOTAL →	1,000	RESULTING SCORES →						0,3525	0,42253	0,376361	0,33535	0,3790748	0,2877

T-37B TWEET

1-	T-37B TWEET	0,42253
2-	KT-1C	0,3790748
3-	T-6A TEXAN II	0,376361
4-	T-34C	0,3525
5-	EMB.312	0,33535
6-	T-35	0,2877

Table A.44: Table of Critical Values of S in the Kendall Coefficient of Concordance

k	***N***					**Additional values for *N*=3**	
	3	**4**	**5**	**6**	**7**	***k***	***s***
Values at the .05 level of significance							
3			64.4	103.9	157.3	9	54.0
4		49.5	88.4	143.3	217.0	12	71.9
5		62.6	112.3	182.4	276.2	14	83.8
6		75.7	136.1	221.4	335.2	16	95.8
8	48.1	101.7	183.7	299.0	453.1	18	107.7
10	60.0	127.8	231.2	376.7	571.0		
15	89.8	192.9	349.8	570.5	864.9		
20	119.7	258.0	468.5	764.4	1,158.7		
Values at the .01 level of significance							
3			75.6	122.8	185.6	9	75.9
4		61.4	109.3	176.2	265.0	12	103.5
5		80.5	1428	229.4	343.8	14	121.9
6		99.5	176.1	282.4	422.6	16	140.2
8	66.8	137.4	242.7	388.3	579.9	18	158.6
10	85.1	175.3	309.1	494.0	737.0		
15	131.0	269.8	475.2	758.2	1,129.5		
20	177.0	364.2	641.2	1,022.2	1,521.9		

Table A.45: Table of Critical Values of Chi Square

Level of Significance					
dof	0.05	0.025	0.01	0.005	0.001
1	3.84	5.02	6.63	7.88	10.83
2	5.99	7.38	9.21	10.60	13.82
3	7.81	9.35	11.34	12.84	16.27
4	9.49	11.14	13.28	14.86	18.47
5	11.07	12.83	15.09	16.75	20.51
6	12.59	14.45	16.81	18.55	22.46
7	14.07	16.01	18.48	20.28	24.32
8	15.51	17.53	20.09	21.95	26.12
9	16.92	19.02	21.67	23.59	27.88
10	18.31	20.48	23.21	25.19	29.59
11	19.68	21.92	24.73	26.76	31.26
12	21.03	23.34	26.22	28.30	32.91
13	22.36	24.74	27.69	29.82	34.53
14	23.68	26.12	29.14	31.32	36.12
15	25.00	27.49	30.58	32.80	37.70
16	26.30	28.85	32.00	34.27	39.25
17	27.59	30.19	33.41	35.72	40.79
18	28.87	31.53	34.81	37.16	42.31
19	30.14	32.85	36.19	38.58	43.82
20	31.41	34.17	37.57	40.00	45.31
21	32.67	35.48	38.93	41.40	46.80
22	33.92	36.78	40.29	42.80	48.27
23	35.17	38.08	41.64	44.18	49.73
24	36.42	39.36	42.98	45.56	51.18
25	37.65	40.65	44.31	46.93	52.62

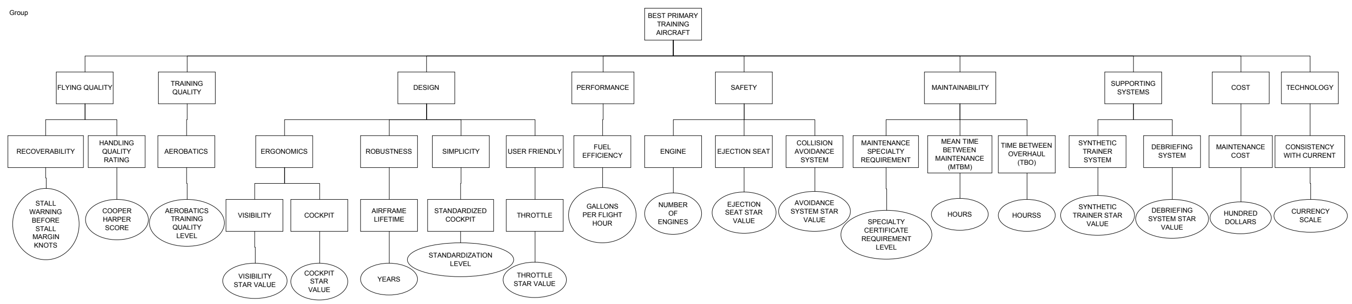

Figure A.1: Group Value Hierarchy

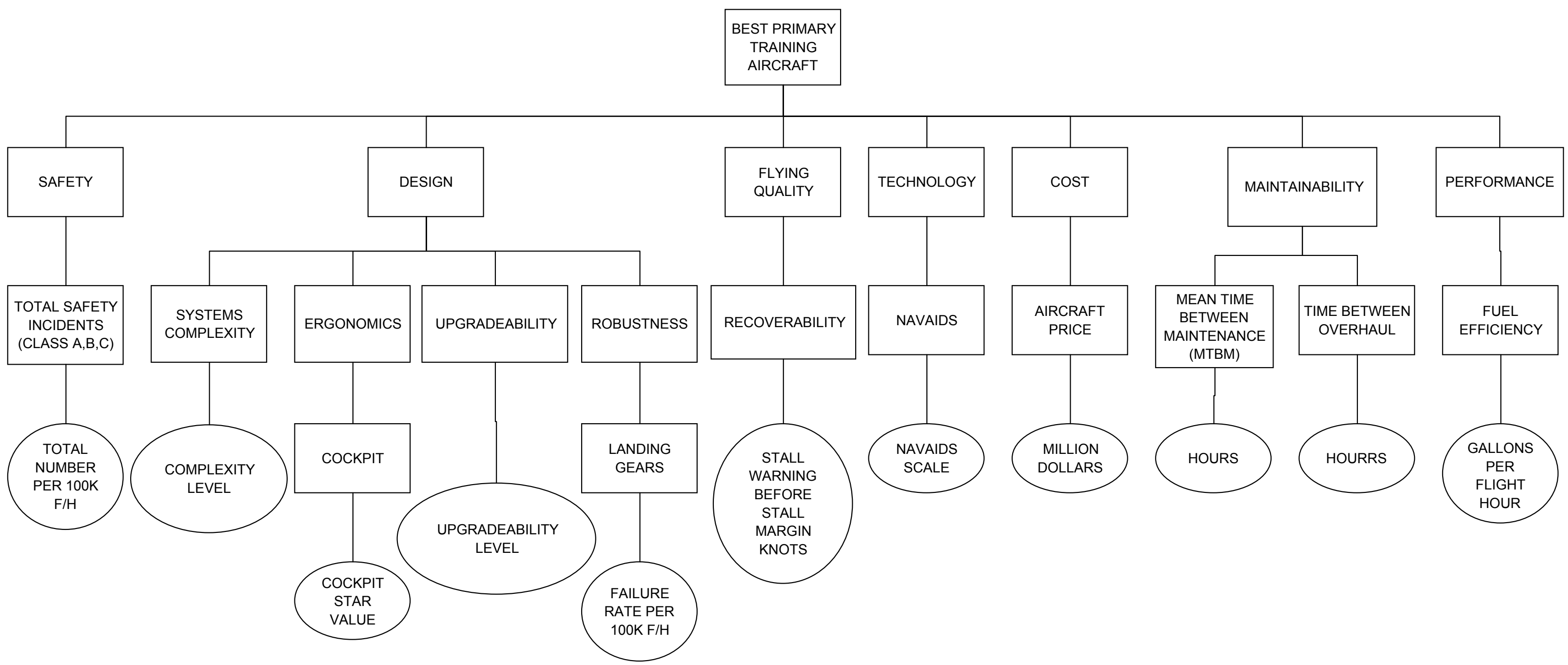

Figure A.2: DM-1 Value Hierarcy

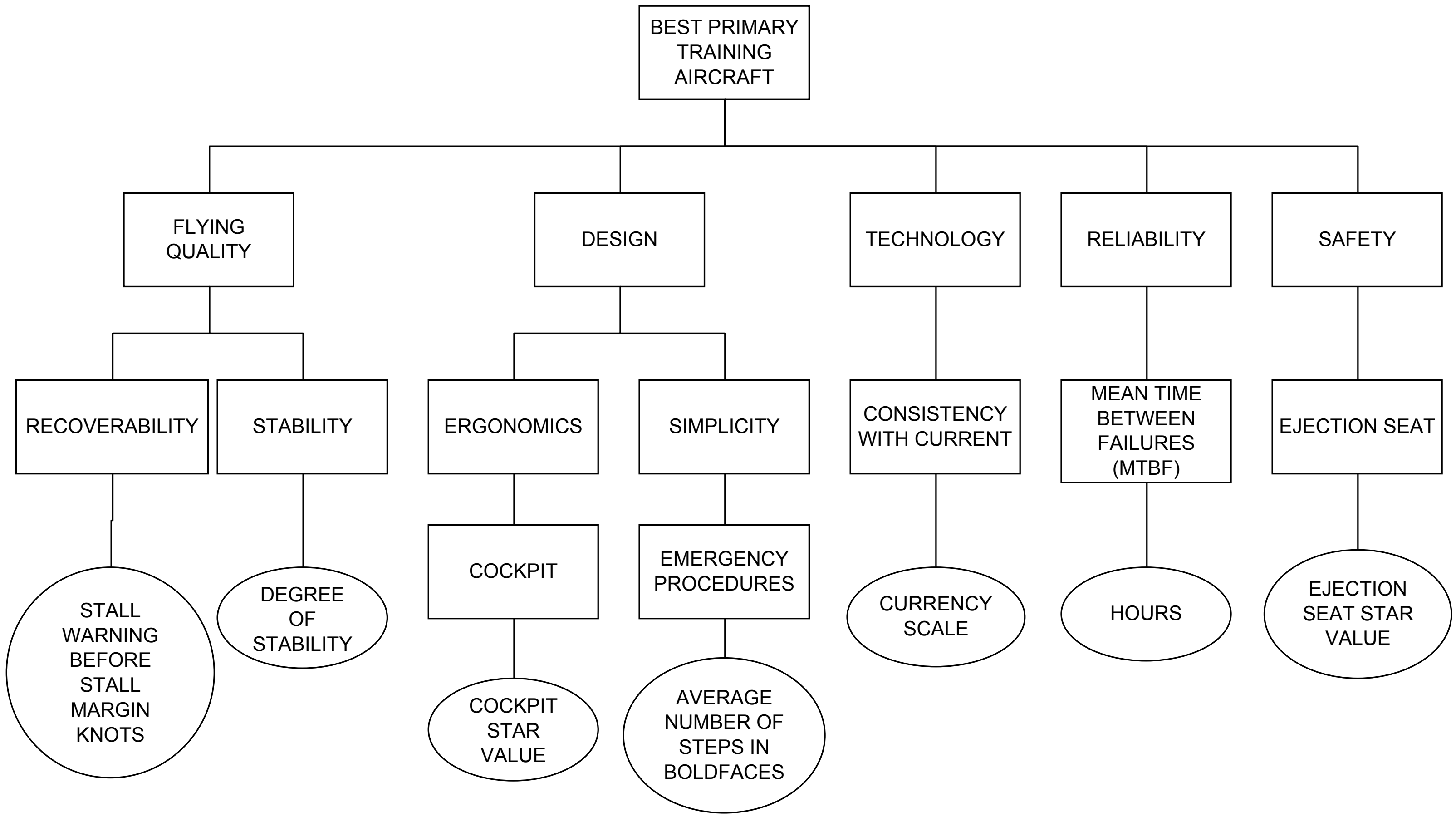

Figure A.3: DM-2 Value Hierarchy

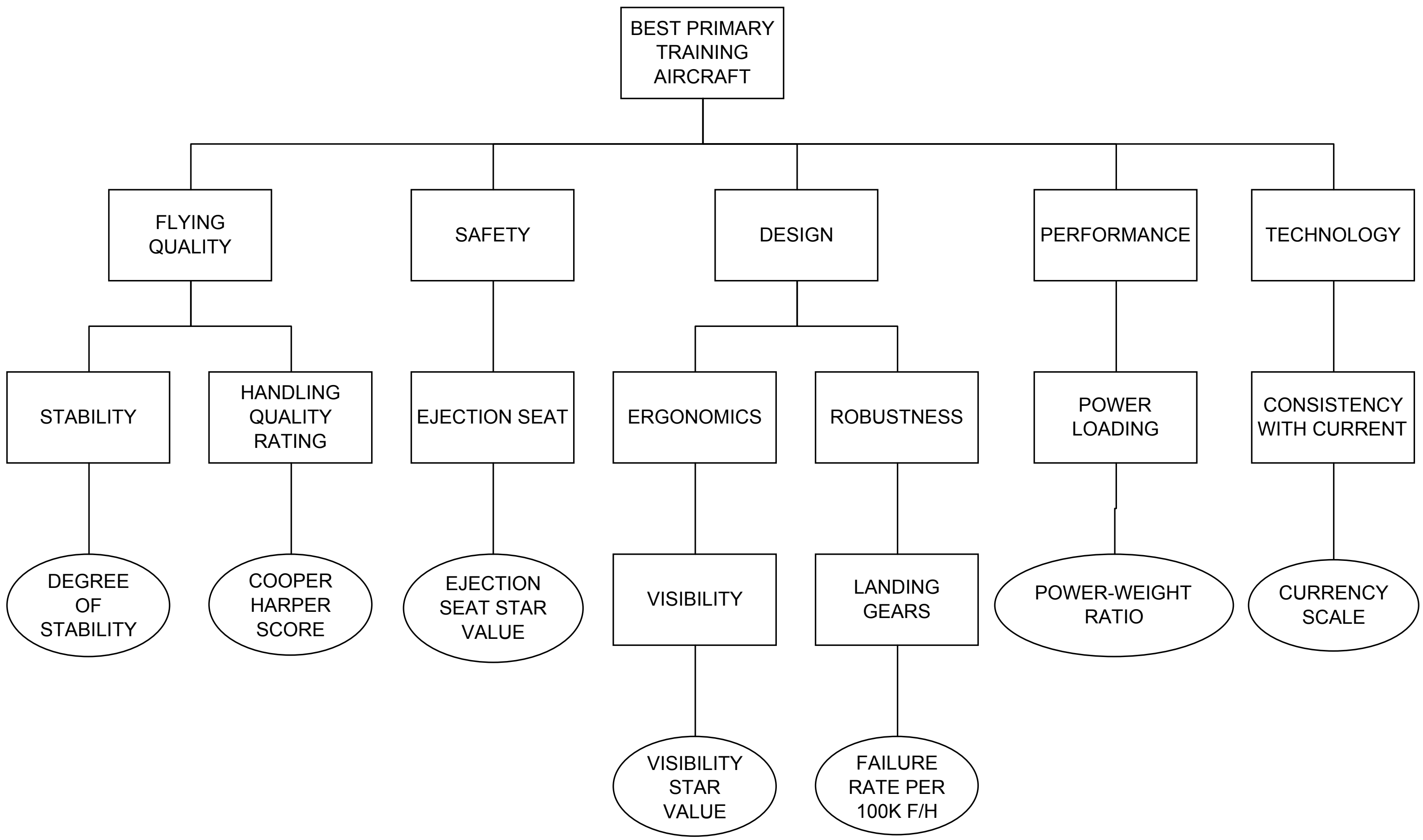

Figure A.4: DM-4 Value Hierarchy

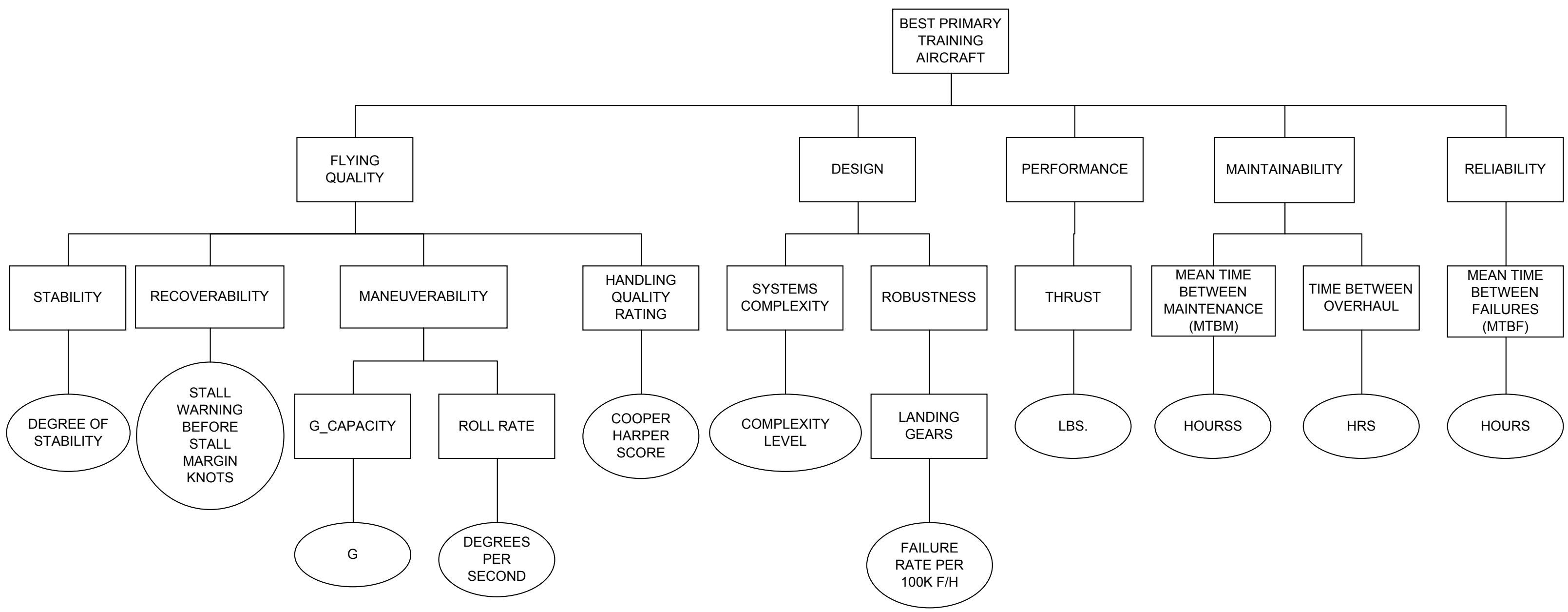

Figure A.5: DM-5 Value Hierarchy

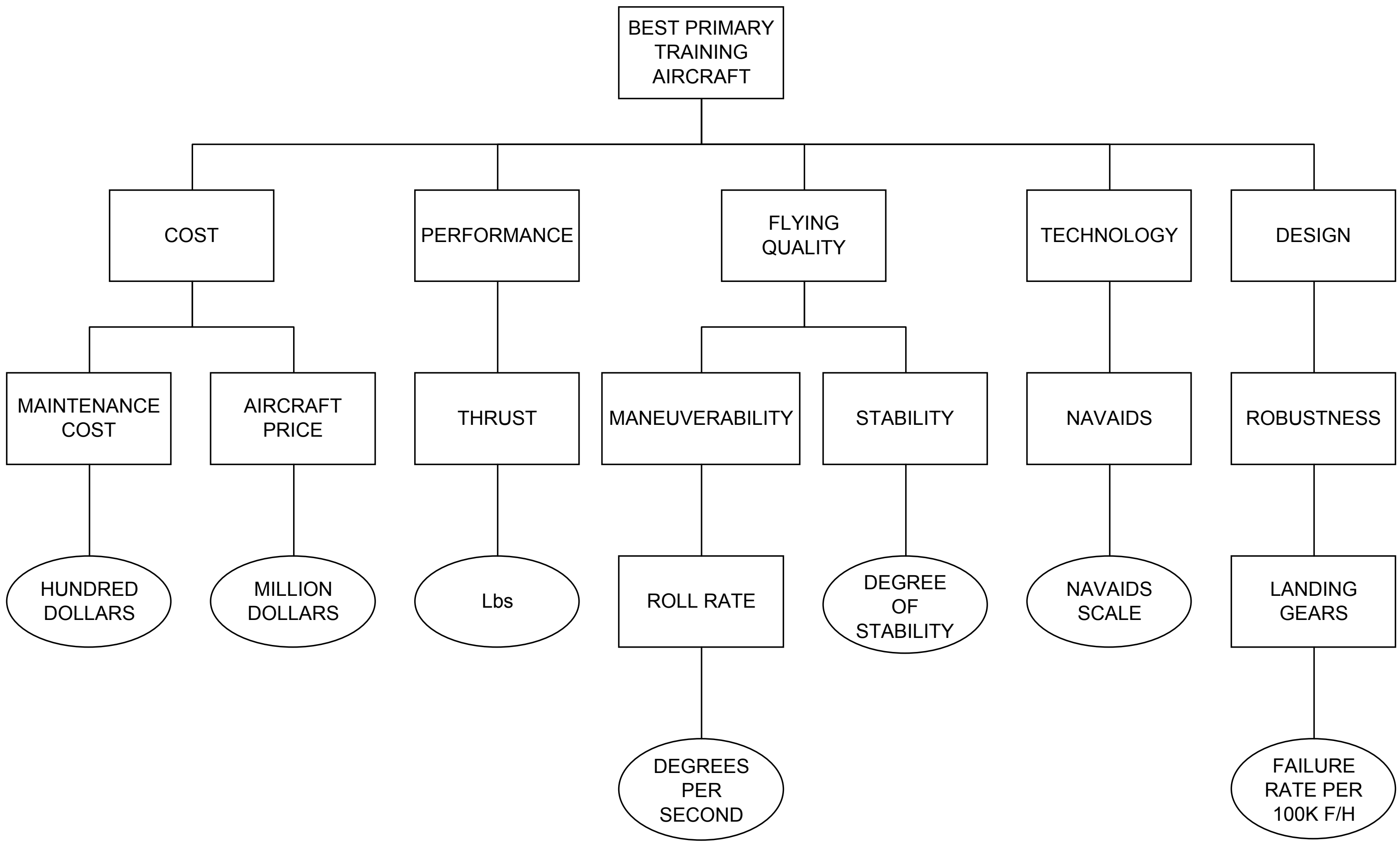

Figure A.6: DM-6 Value Hierarchy

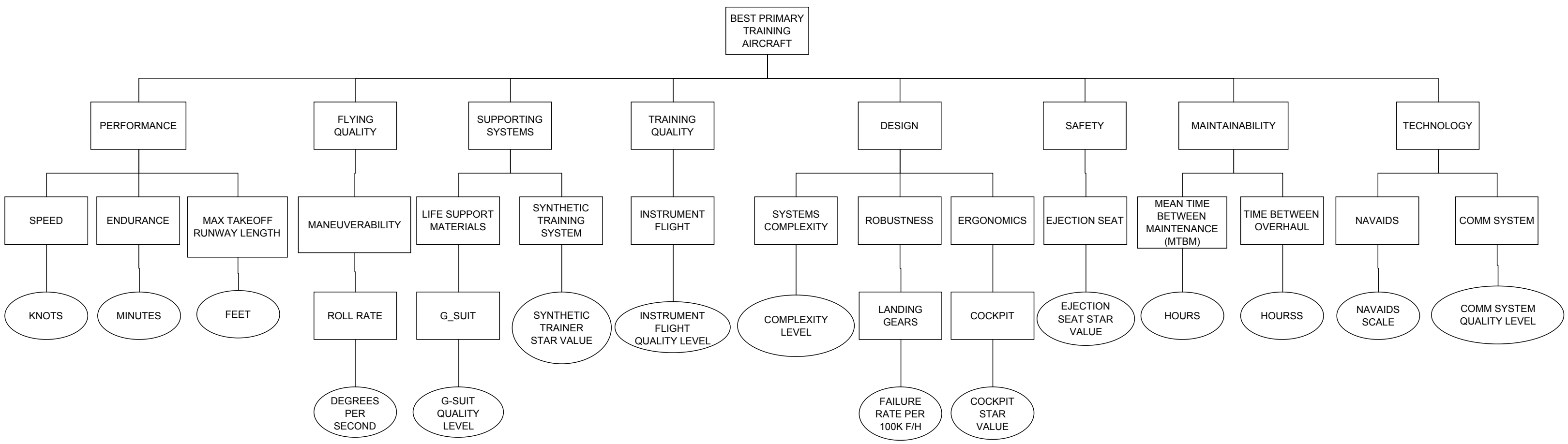

Figure A.7: DM-7 Value Hierarcy

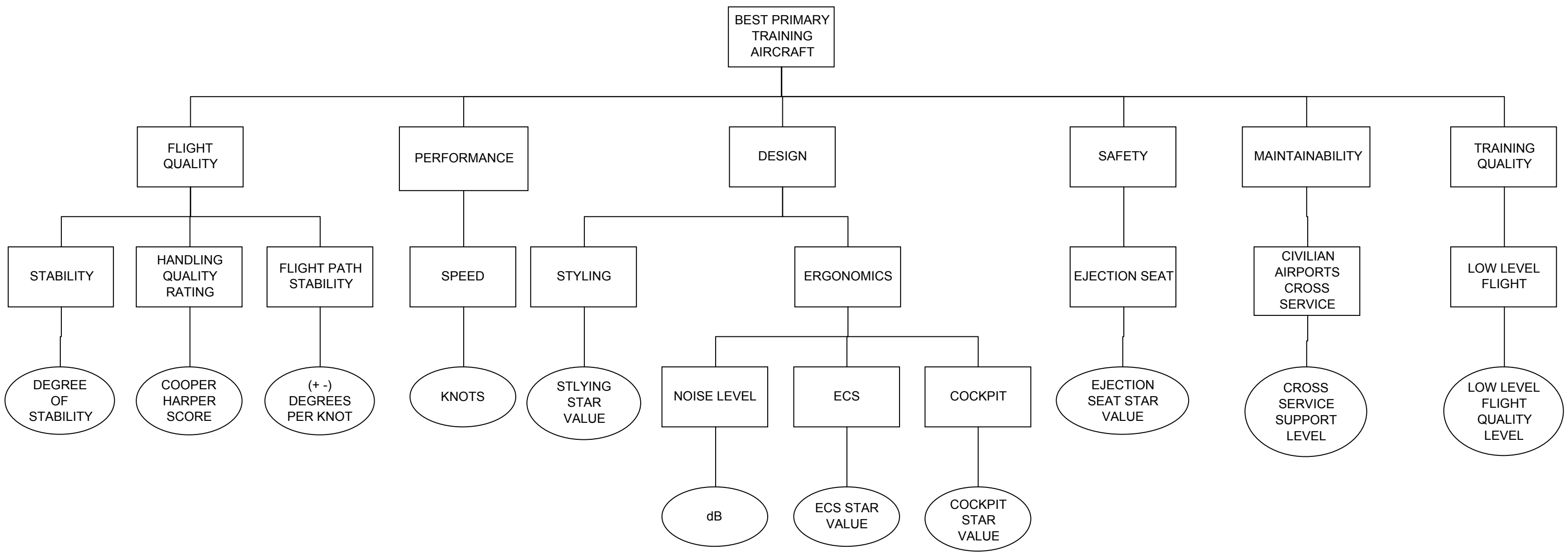

Figure A.8: DM-8 Value Hierarcy

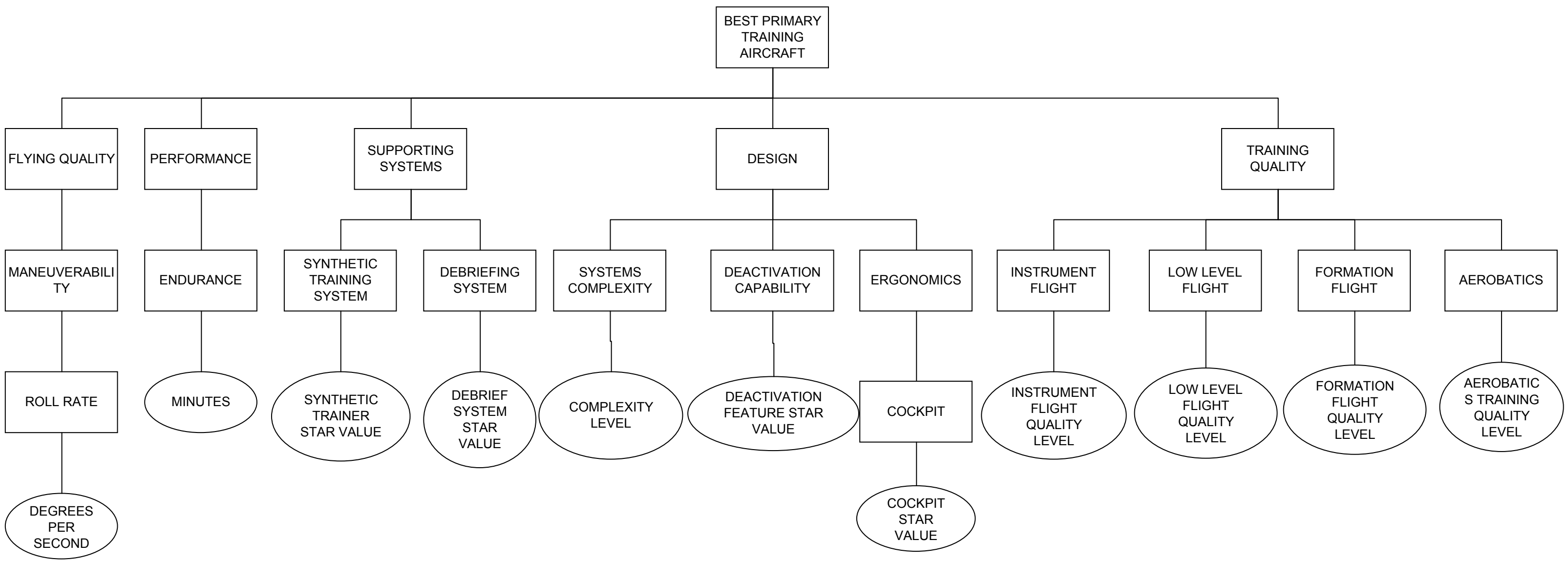

Figure A.9: DM-9 Value Hierarcy

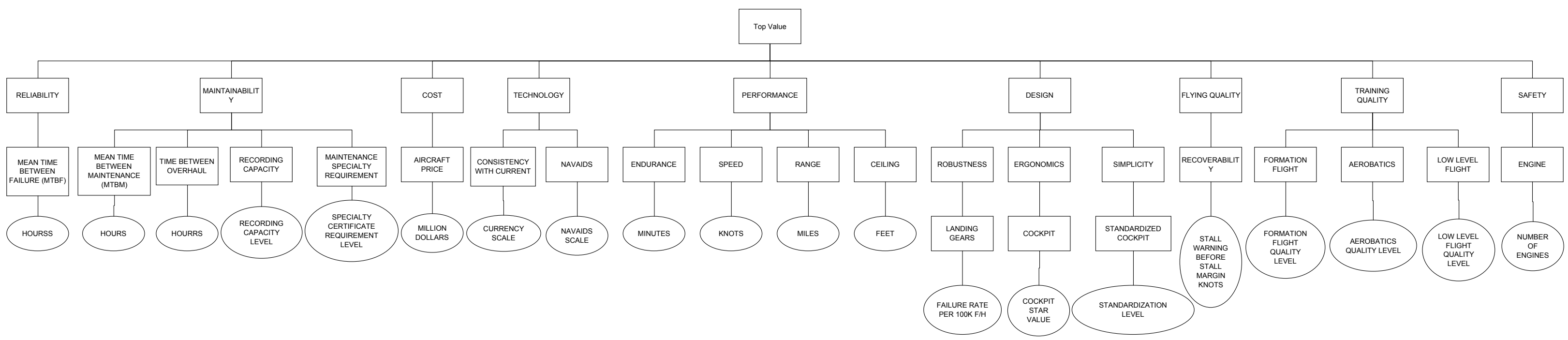

Figure A.10: DM-10 Value Hierarcy

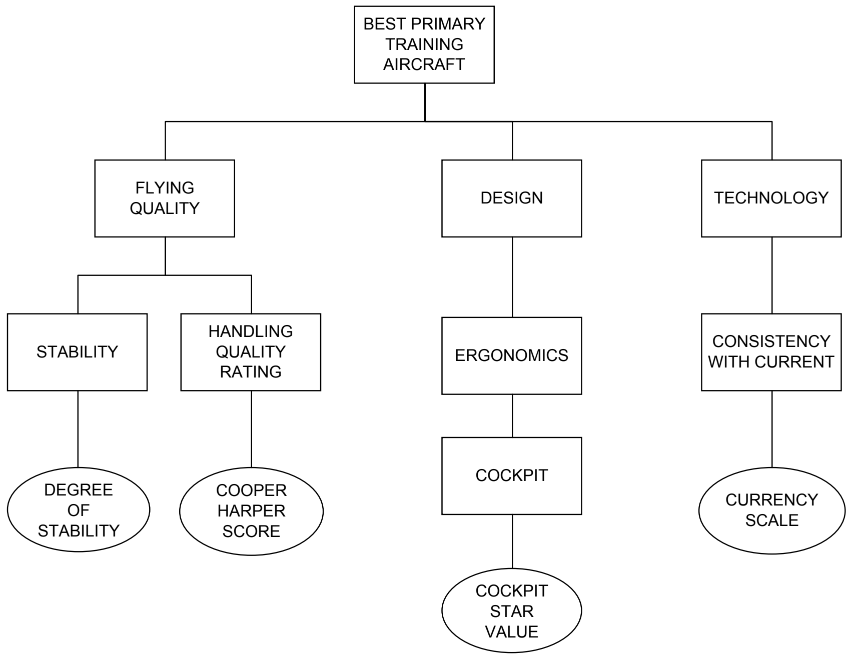

Figure A.11: DM-11 Value Hierarcy

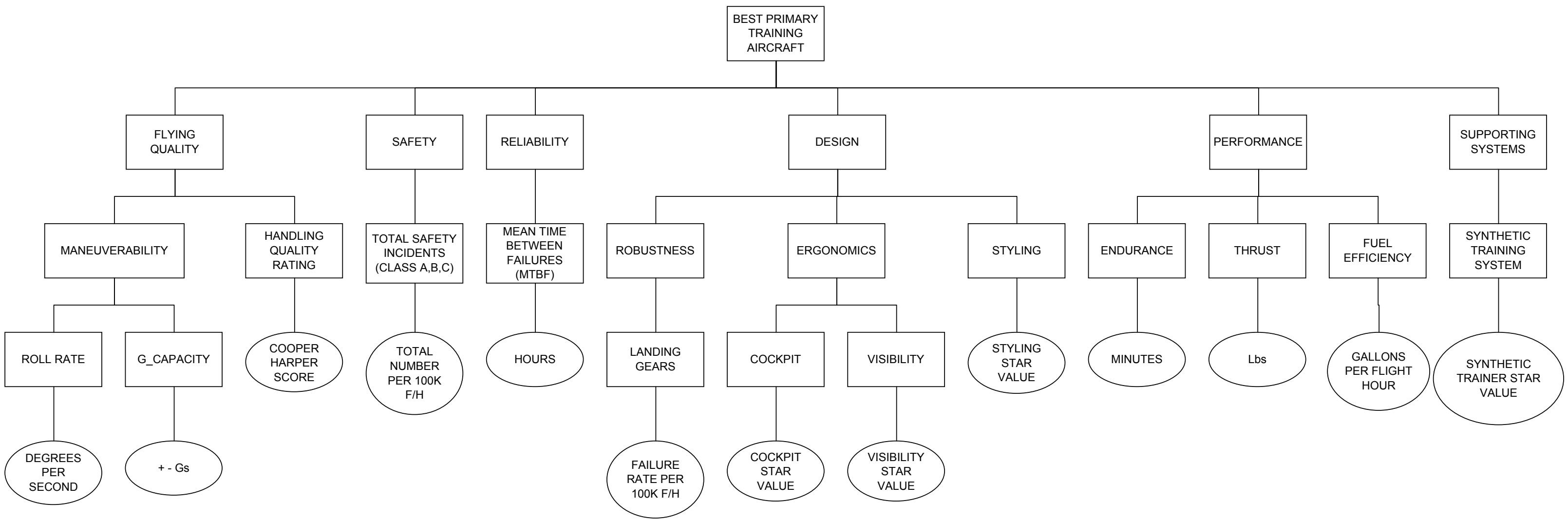

Figure A.12: DM-12 Value Hierarcy

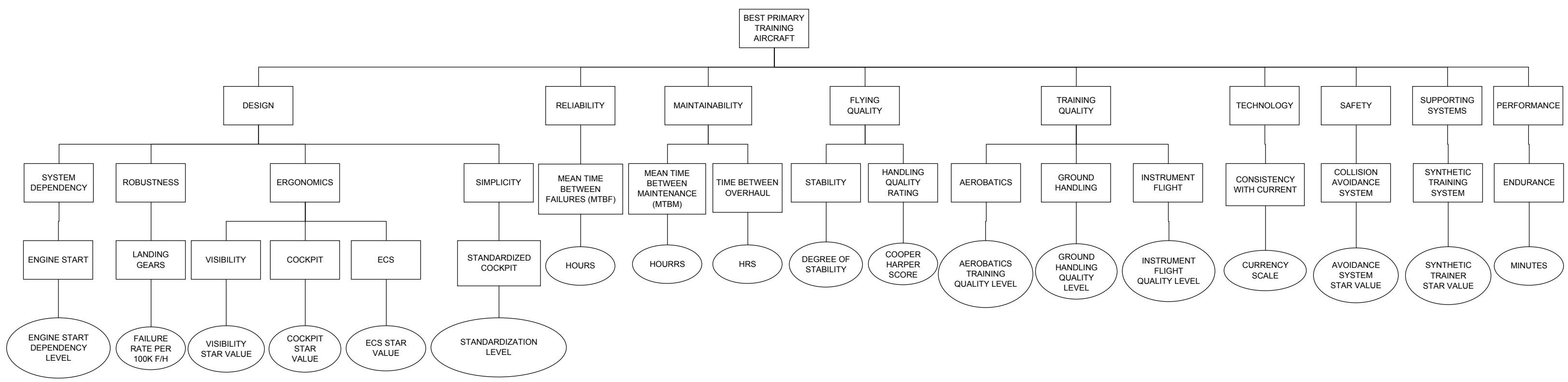

Figure A.13: DM-13 Value Hierarcy

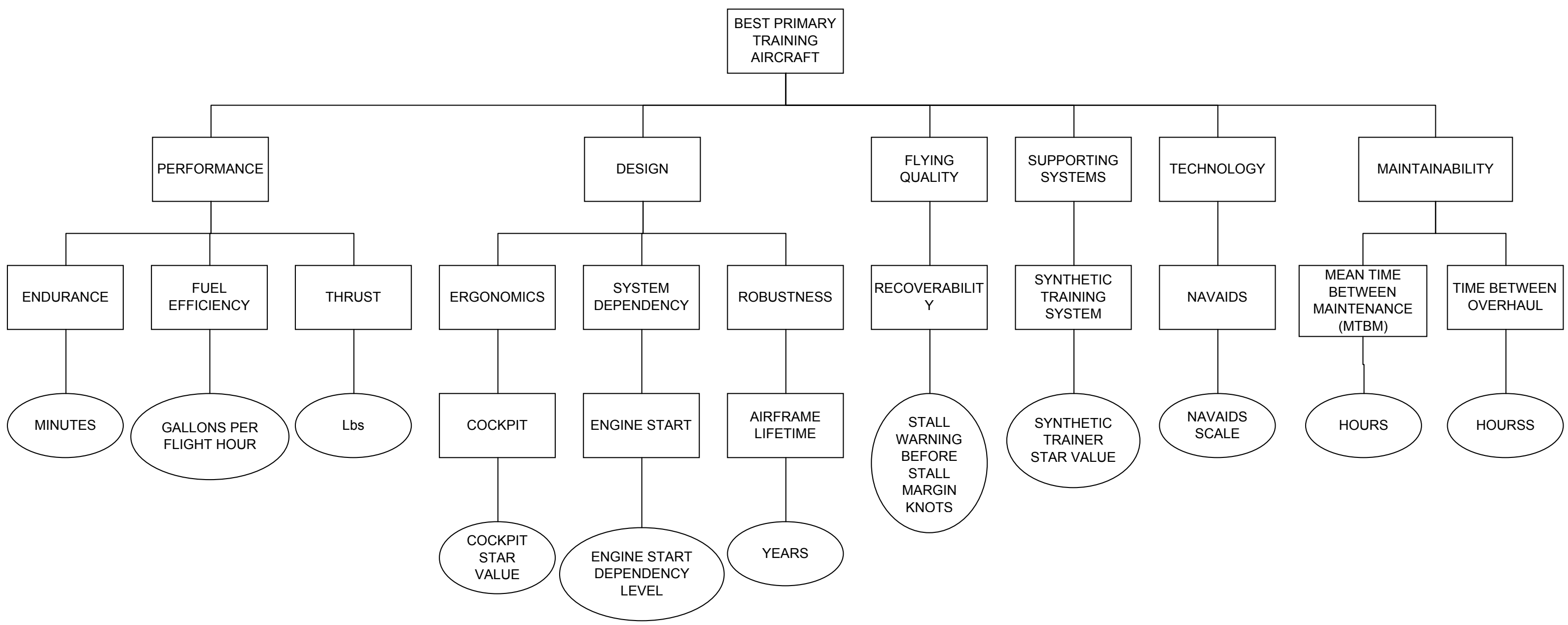

Figure A.14: DM-14 Value Hierarcy

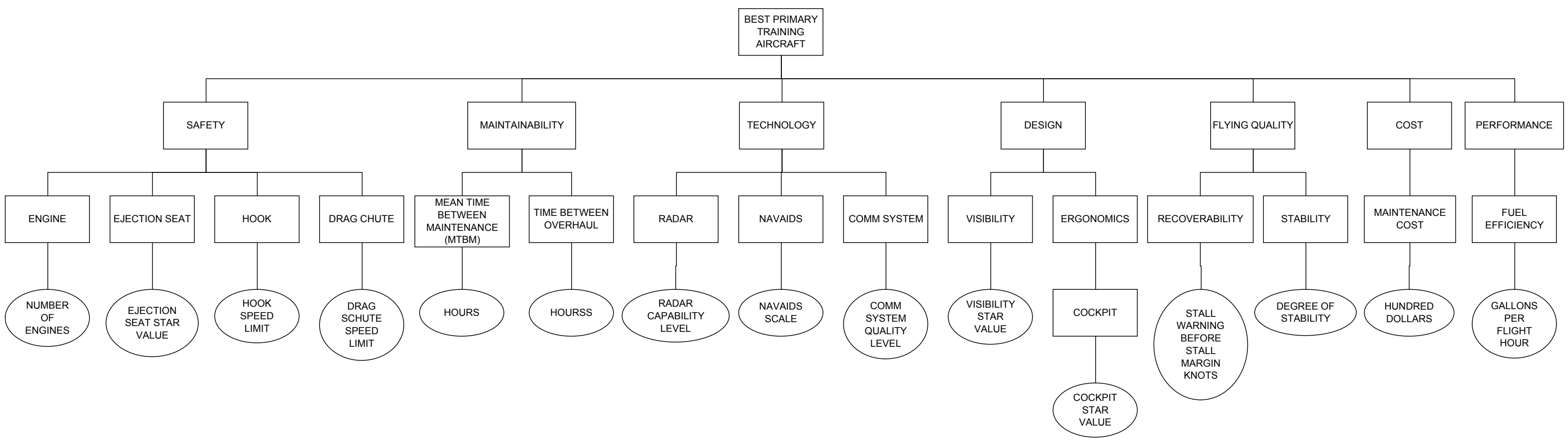

Figure A.15: DM-15 Value Hierarcy

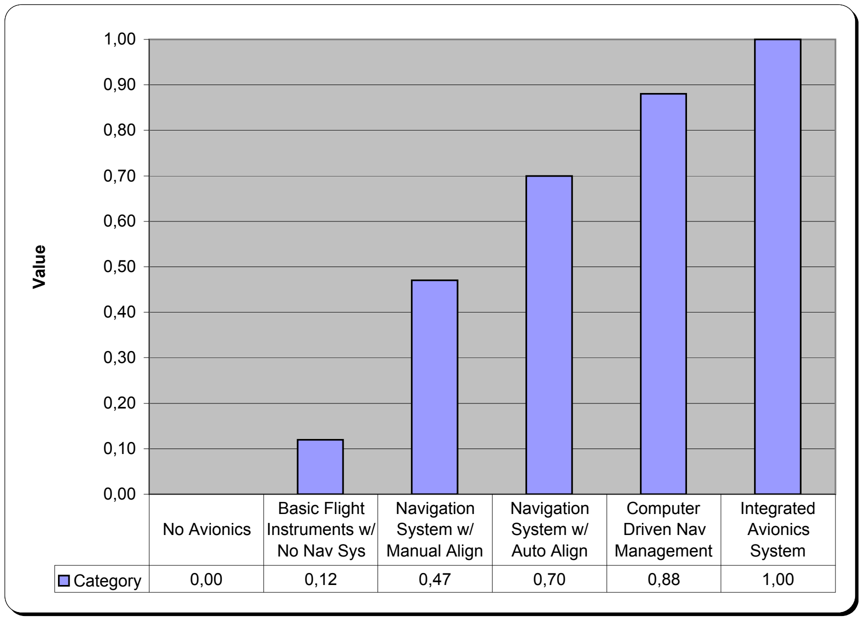

Figure A.16: DM-3 SDVF for Avionics Scale

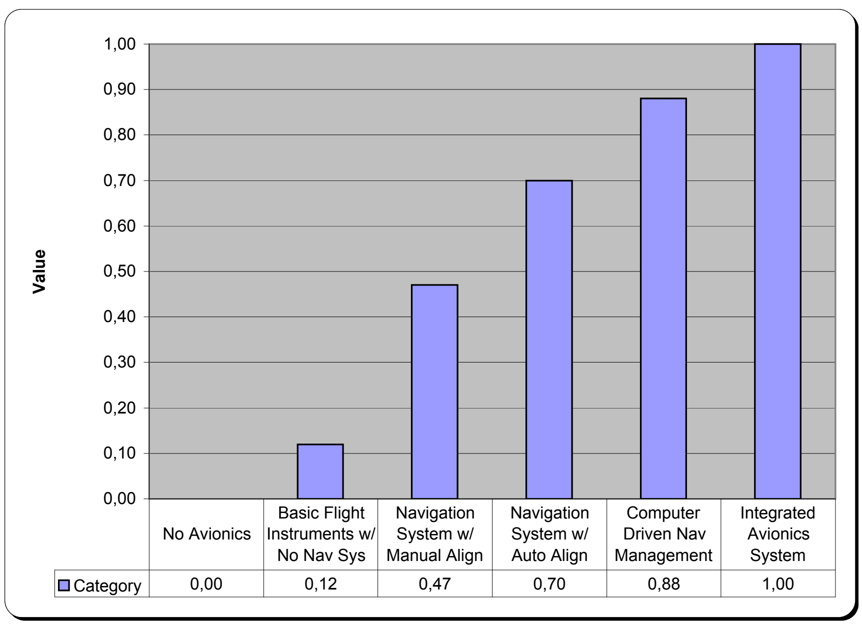

Figure A.17: DM-3 SDVF for Avionics Scale

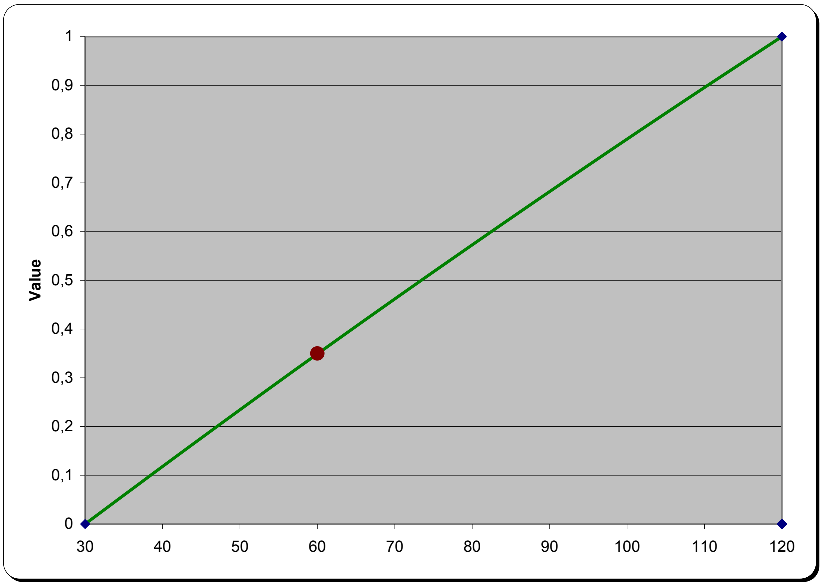

Figure A.18: DM-3 SDVF for Endurance in Minutes

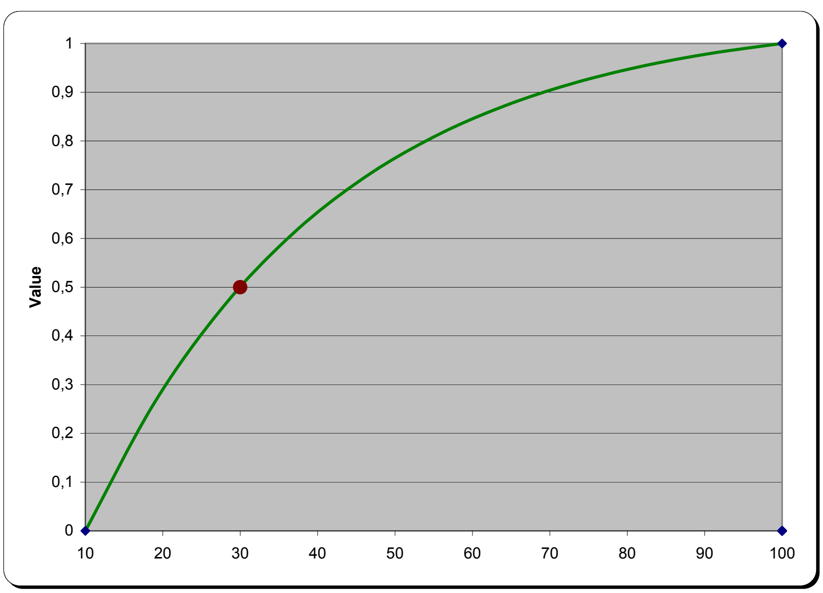

Figure A.19: DM-3 SDVF for MTBF in Hours

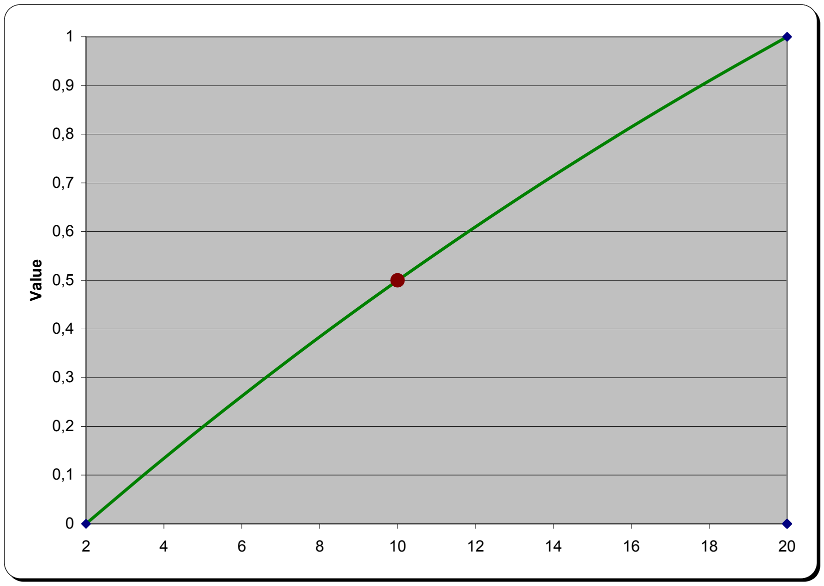

Figure A.20: DM-3 SDVF for MTBM in Hours

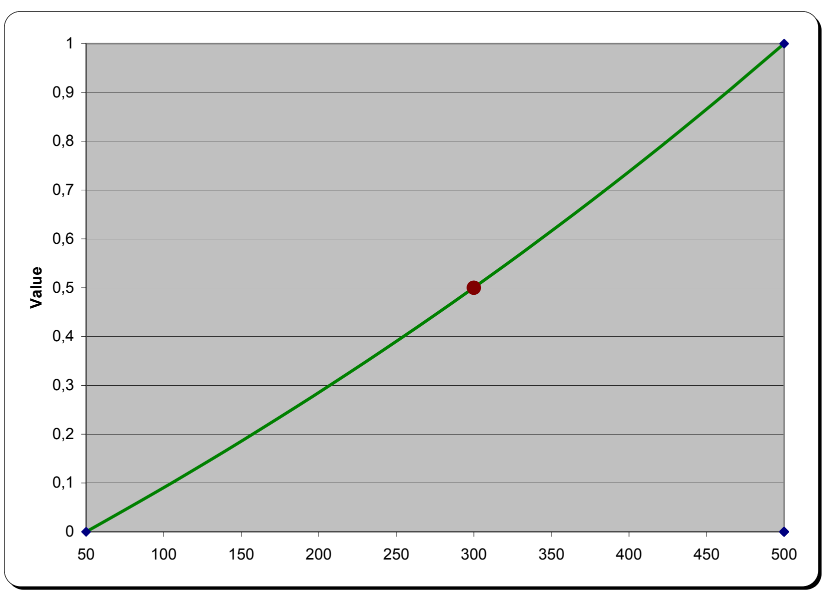

Figure A.21: DM-3 SDVF for TBO in Hours

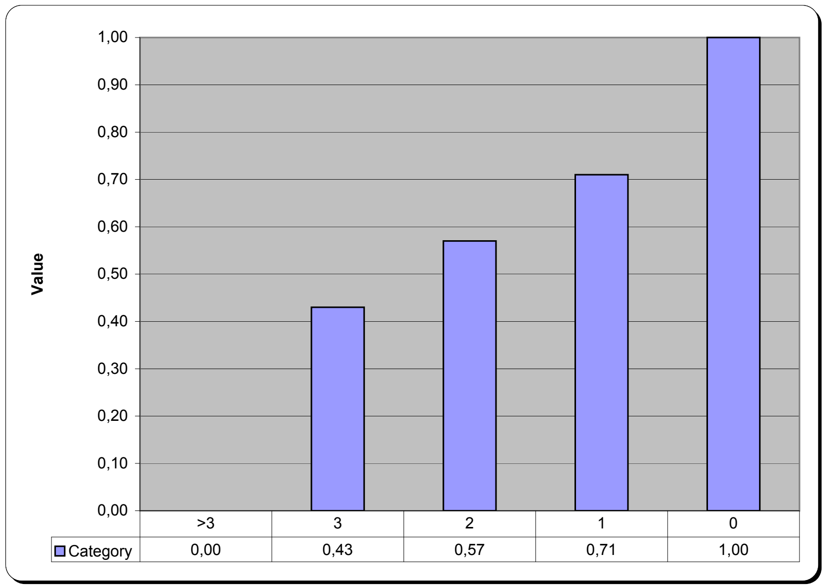

Figure A.22: DM-3 SDVF for Total Number of Safety Incidents (Class A & B & C)

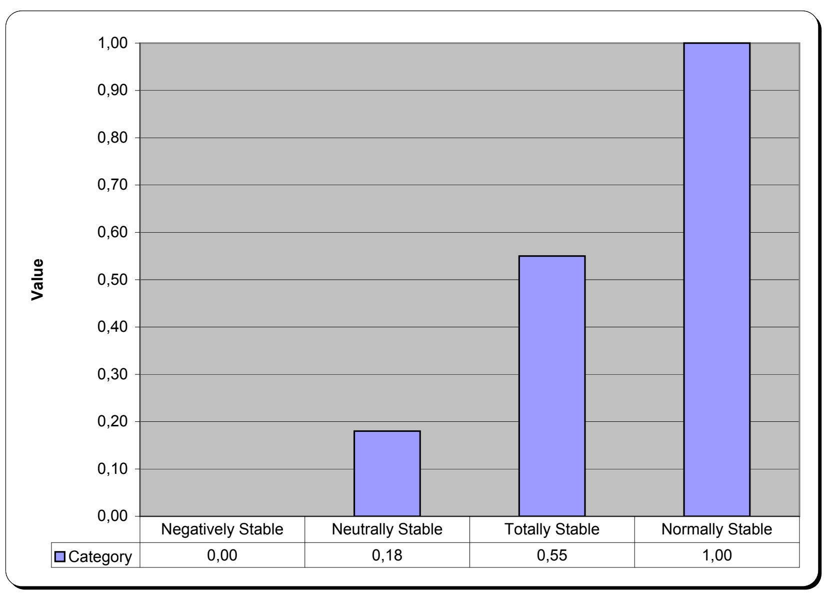

Figure A.23: DM-3 SDVF for Degree of Stability Incidents (Class A & B & C)

Appendix B. Aircraft Systems Terminology

Airframe is any component or structure that is essential to the structural integrity of the aircraft. Even though they aren't considered part of the structural integrity of the aircraft, the interior upholstery, the aircraft paint and the static electricity dischargers are also part of the airframe system.

Cockpit instrumentation is the minimum instrumentation required for general aviation aircraft flying under IFR conditions as defined in Federal Aviation Regulations (FAR) Part-9: airspeed indicator, altimeter, magnetic direction indicator, tachometer for each engine, oil pressure gauge for each engine, temperature gauge for each air-cooled engine, oil temperature gauge for each air-cooled engine, manifold pressure gauge for each engine if a variable pitch propeller is used, fuel gauge indicating the quantity of fuel in each tank, two-way radio communications system and navigational equipment appropriate to the ground facilities to be used, gyroscopic rate-of-turn indicator, slip-skid indicator, altimeter adjustable for barometric pressure, clock displaying hours, minutes, and seconds, generator or alternator, gyroscopic pitch and bank indicator (artificial horizon), gyroscopic direction indicator, and directional gyro.

Aircraft controls are any component that controls the aircraft's attitude, heading, and altitude or changes the aerodynamic characteristics of the aircraft in the air or on the ground (excluding powerplant). This system is composed of two primary systems: flight control and ground control.

Powerplant is any component or system that is essential to developing thrust for the aircraft.

Landing gear is a subsystem which includes the wheels, the tires, and all associated switches, controls, or systems for extending and retracting the gear. On some aircraft, the extension and retraction of the gear also requires a hydraulic system. However, this is usually an independent system.

Ground steering system includes the rudder pedals, any associated rods that connect the rudder pedals to the nose gear, and the steering collar on the nose gear itself.

Fuel system includes any component that contributes to providing fuel through the engine-driven fuel pump. This includes any fuel lines, fuel cutoff switches, fuel filters, tank switches, fuel boost pumps (including the on/off switch), and fuel tanks (if integral, they are included in both airframe and fuel system), and fuel tank related equipment in the tanks except for any fuel quantity transmitting equipment.

Heating/Cooling/Ventilation/Pressurization/Environmental Control System (ECS) incorporates all elements that control the temperature or the flow of air into the cabin. This subsystem includes all hoses leading from the engine or exhaust systems, outside air vent and their respective plumbing, and the cockpit controls to regulate the temperature. However, some aircraft are equipped with air-conditioning systems.

Reliability is "the ability of an item to perform a stated function under stated conditions, for a stated period of time" as defined in ISO 8042: Quality Vocabulary. Reliability, in general, is the ability of a person or system to perform and maintain its functions in routine circumstances. In statistics, reliability is the consistency of a set of measurements or measuring instruments. This can either be accomplished whether the measurements of the same instrument give the same measurement, or two independent instruments give similar scores. In engineering, reliability is the ability of a system or component to perform its required functions under stated conditions for a specified period of time. Evaluations of reliability involve the use of many statistical tools. Reliability provides information about the failure-free interval. In aviation, the reliability is quantified as mean time between failures (MTBF) for repairable products of a system. It is the operative average time of a system divided by the total number of errors which have resulted in discontinuance in the usage of the system during the operative time and is often attributed to the useful life of the system. Calculations of MTBF assume that a system is renewed or fixed after each failure and then returned to service immediately after failure. When the MTBF is long compared to the mission time, it has perceived reliability (i.e., few chances for failure). When the MTBF is short compared to the mission time, it has perceived unreliability (i.e., many chances for failure).

The second criteria, performance, is defined as the examination of how well a plane meets its design requirements and includes many aspects of the airplane operation, such as endurance, thrust, fuel efficiency, speed, range, ceiling, max take-off runway length, power loading, and other elements of desirable performance.

Endurance is a measure of the time spent in the air. Endurance refers to how long (in time) the aircraft can fly for a given amount of fuel. Maximum endurance means to fly for the greatest amount of time for the fuel onboard. Endurance is sometimes erroneously equated with range. The two concepts are clearly different. Range is a measure of distance flown while endurance is a measure of time spent in the air. For example, a typical airplane may exhibit high endurance characteristics but poor range characteristics.

Thrust is one of the four aerodynamic forces acting on an aircraft in flight. It is the force that pushes an aircraft through the air. Thrust must be greater than drag to achieve the forward acceleration needed for takeoff and to increase an aircraft's speed in level flight. Thrust, like any other force, is measured in either newtons or pounds as the unit. Jet engines are usually rated according to the amount of thrust they can produce.

Fuel efficiency is the efficiency of a process that converts energy contained in a carrier into energy or work. In the context of aviation, fuel efficiency refers to the energy efficiency of a particular aircraft, where its total output (range, mileage or km) is given as a ratio of range units per a unit amount of input fuel. This ratio is used here in common measure as gallons per flight hour.

Speed makes common sense to everybody. It's used in knots as specified by airworthiness standards for civil and military aircraft in the USA Federal Aviation Regulations, which are equal to one nautical mile per hour (1.852 kilometers per hour, 1.1507794 miles per hour).

Range is the distance an aircraft can fly between takeoff and landing, as limited by fuel capacity in powered aircraft, or cross-country speed and environmental conditions in unpowered aircraft.

Ceiling is the maximum usable altitude of an aircraft. Specifically, it is the density altitude at which flying in a clean configuration (the flight configuration of an airplane when its external equipment, such as wing flaps, landing gear, slats, spoilers etc. are retracted), at the best rate of climb airspeed for that altitude and with all engines operating and producing maximum continuous power will produce a 100 feet per minute climb rate.

Take-off runway length is the horizontal distance along the takeoff path from the start of the takeoff to the point at which the aircraft attains and remains at least 35 feet above the takeoff surface, attains and maintains a speed of at least take-off safety speed and establishes a positive rate of climb.

Power loading (power-to-weight ratio) is a measure commonly used when comparing various vehicles, including automobiles, motorcycles and aircraft (usually aircraft engines). It is, simply, the power the engine develops, divided by the vehicle's weight. In an aircraft, any additional weight requires more lift to be generated by the wings in order to lift it. More lift from the wings automatically means more drag, through a process known as induced drag, slowing the plane down. Thus if any two engines deliver the same power, the lighter one will result in a faster plane. Power-to-weight ratio therefore has a major impact on overall performance in aircraft, including maximum speed. In this usage, the power-to-weight ratio is typically used to refer to the weight of the engine alone as a useful way of comparing various aircraft engines. The term applied to the aircraft as a whole is power loading.

Third criteria, maintainability, as defined in Wikipedia, is a characteristic of design and installation expressed as the probability that an item will be retained in or restored to a specified condition within a given period of time, when the maintenance is performed in accordance with prescribed procedures and resources. Maintainability measures the ease and speed with which a system can be restored to operational status after a failure occurs. Maintainability predictions enable the repair metrics (MTBM and TBO) of the systems be analyzed.

As explained in NATO Reliability, Maintainability, and Availability (RM and A) Parameters and Methods of Calculation document (Appendix C), MTBM measures the mean time between unscheduled, line or organizational maintenance actions caused by a design or manufacturing defect, with time expressed as total production aircraft flight hours. This measure includes inherent maintenance actions (failures which result from an internal cause), unscheduled maintenance, and time in flying hours (production aircraft).

Time between overhaul (TBO), a time recommended by the manufacturer, is one important measure of an aircraft engine's overall economics and is how often it has to be overhauled. The time between overhauls is generally a function of the complexity of the engine. Piston-based engines are much more complex than turbine-powered engines, and generally have TBO's of 1600 to 2000 hours of running time. Since the overhaul process requires the engine to be taken apart, it is typically an expensive process.

Increased aircraft maintainability results in shorter downtime, reduced removal and replacement time, increased troubleshooting capability, and less scheduled maintenance. Several decision makers also considered the maintenance specialty requirement, civilian airports cross service capability, and recording capability of the system as some important inputs to the maintainability of the system.

Maintenance specialty requirement is explained as when the aircraft requires any specialty maintenance in case of landing at another airfield which is either a civilian or another kind of aircraft base. The levels of that maintenance requirement are all specialty-certificate maintenance requirement, no safety-flight issues maintenance requirement, and no specialty-certificate maintenance requirement. Those specialty categories include aircraft electronics (avionics), composite structural repair, nondestructive inspection and metal structures repair. If the aircraft is all specialty-certificate maintenance required, in case of a breakdown in a cross country mission, the home base maintenance team arrives at that airfield in order to supply the aircraft with the special procedures required. If the aircraft has no safety-flight issues maintenance required, the general inspection and the first overhaul may be done by the maintenance team of that airfield, and the aircraft can fly back to its main base with the discrepancy causing no problem for the return sortie. If the aircraft has no specialty-certificate maintenance requirement, the entire repair can be done by the maintenance team of that airfield where the aircraft broke down.

Cross-servicing capability is defined by NATO Logistics Handbook (October,1997) as services performed on an aircraft by an organization other than that to which the aircraft is assigned, according to an established operational aircraft cross-servicing requirement, and for which there may be a charge. Aircraft cross-servicing is divided into two categories:

Stage A Cross-Servicing: The servicing of an aircraft on an aerodrome/ship which enables the aircraft to be flown on another mission, without change to the weapon configuration. The servicing includes the installation and removal of weapon system safety devices, refueling, replenishment of fluids and gases, drag chutes packing facilities and ground handling.

Stage B Cross-Servicing: The servicing of aircraft on aerodromes/ships which enables the aircraft to be flown on an operational mission. The servicing includes all Stage A services plus the loading of weapons and/or film/videotape and the replenishment of chaff and flares. This includes the processing and interpretation of any exposed film/videotape from the previous mission.

Data recording capacity aids both to maintenance team for diagnosing and determining any kind of discrepancy happening in flight and flight safety inspectors in order to determine the cause of the accident in case of a mishap. The flight data recorder (FDR) records various flight parameters such as engine status, fuel status, airspeed, altitude, attitude and control settings. The cockpit voice recorder (CVR) typically records the voice communications of the crew members, although it may also pick up other extraneous noise in the cockpit such as an explosion. The FDR and CVR have usually been provided in the form of on-board tape or disk recorders. They are typically packaged in an armored casing, sometimes called a black box, which is located in the tail section of the aircraft. This gives them the greatest chance of surviving a crash and yielding their recorded data for analysis by experts.

The fourth criteria, aircraft technology, includes quite a wide area of study. Aviation in general and military aviation in particular are driven by technology. Technologies are becoming outdated faster than the full utilization of aircraft. What is meant here is the technology level of the electronic systems, such as navigation aids, radar, and communication system etc, installed on the aircraft and the consistency and compatibility of those systems to the state-of-the-art systems currently in use.

The fifth criteria, safety, is one of the main considerations in design, acquisition and operational process of an aircraft. Safety includes all elements of design, manufacturing, operation, maintenance, servicing and infrastructure support that affect safe accomplishment of the flight mission. However, this study focuses on the emergency aspects of flight operation, aircraft maintenance, and airworthiness of the aircraft.

According to a briefing report (Military Aircraft Safety,1998) prepared by the US General Accounting Office, safety incidents (mishaps) involve any reportable damage to an aircraft that is preparing to fly, in flight, or completing a landing. Safety incidents are classified by DoD according to the severity of the resulting injury or property damage. Class A mishaps involve damage of $1 million or more, a destroyed aircraft, or a fatality or permanent total disability. The remaining classes of mishaps are distinguished primarily by their loss of value and severity of injury. Class B accidents involve damage ranging from $200,000 to less than $1 million, permanent partial disability, or inpatient hospitalization of five or more people. Class C accidents involve damage ranging from $10,000 to less than $200,000 or a lost-time injury. And Class D accidents involve damage of less than $10,000. Here, the 3 major incident classes have been taken into consideration as the major safety indicator.

Military aircraft are designed with some on-board emergency systems such as ejection seat, hook and drag chute. The ultimate technology in ejection seat use is a 0-Feet/0-Knot ejection seat which is designed to safely extract upward and land its pilot from a grounded stationary position, specifically from aircraft cockpits. The zero-zero capability was developed to help aircrew escape upward from unrecoverable emergency situations during low altitude and/or low speed flight as well as ground mishaps. The other ejection seats have to be used at minimum altitudes and airspeeds (in a flight envelope). In addition, military aircraft also have drag chute and hook systems to be used in case of a brake failure or difficulty in stopping the aircraft in the remaining length of the runway. Finally, the collision avoidance systems contribute to the safety criteria by providing the pilot with situational awareness in any flight condition. TCAS(Traffic Collision Avoidance System) is a computerized avionics device which is designed to reduce the danger of mid-air collisions between aircraft by monitoring the airspace around an aircraft, independent of air traffic control, and warning pilots of the presence of other aircraft which may present a threat of mid-air collision. GCAS(Ground Collision Avoidance System) is a warning system alerting the pilot if his aircraft is in immediate danger of flying into the ground, monitors the aircraft's height above ground as determined by a radar altimeter, and has a computer that keeps track of these readings, calculates trends, and warns the pilot with visual and audio messages if the aircraft is in certain defined flying configurations.

The sixth criteria, flying quality, includes different aerodynamic design considerations like recoverability, stability, maneuverability, handling quality rating and flight path stability.

Recoverability in this study is the term used for the potential to keep the aircraft in the controlled margin of the flight envelope. The stall warning before the stall margin is the measure of recoverability in Knots. Flying qualities are reported using qualitative comments and the Cooper-Harper Rating Scale and/or the Pilot Induced Oscillation Rating Scale where appropriate tasks are defined.

Stability is the aircraft's response when disturbed from a given angle of attack, slip or bank. There are 4 different types of stability: totally, normally (positively), neutrally (dynamically), and negatively (fully unstable).

Totally stable: Aircraft will return, more or less immediately, to its trimmed state without pilot intervention; however, such an aircraft is rare and undesirable. We usually want an aircraft just to be reasonably stable so it is easy to fly. If it is too stable, it tends to be sluggish in maneuvering and heavy on the controls. If it tends toward instability, the pilot has to continually watch the aircraft's attitude and make the restoring inputs, which becomes tiring, particularly when flying by instruments. Some forms of instability make an aircraft unpleasant to fly in marginal weather.

Normally (positively) stable: Aircraft, when disturbed from its trimmed flight state, will commence an initial movement back towards the trimmed flight state (without pilot intervention), but it then starts a series of damping oscillations about the original flight state. This damping process is usually referred to as dynamic stability, and the initial movement back towards the flight state is called static stability. The magnitude of the oscillation and the time taken for the oscillations to completely damp out is another aspect of stability.

Neutrally (dynamically) stable: Aircraft will continue oscillating after a disturbance, but the magnitude of those oscillations will neither diminish nor increase. If these were oscillations in pitch, the aircraft will just continue porpoising.

Negatively stable (fully unstable): Aircraft may be statically unstable and never attempt to return towards the trimmed state. Or it can be statically stable but dynamically unstable, where it will continue oscillating after disturbance with the magnitude of those oscillations getting larger and larger. Significant instability is an undesirable characteristic, except where an extremely maneuverable aircraft is needed and the instability can be continually corrected by on-board fly-by-wire computers rather than the pilot. For example, a supersonic air superiority fighter. The best piston-engined WWII day fighters were generally designed to be just stable longitudinally, neutrally stable laterally and positively stable directionally.

Maneuverability is determined by the aircraft's ability to change attitude and velocity around its three axes (longitudinal, lateral, and vertical). Changes in attitude on each axis are created by the moments acting on the aircraft on that axis and are resisted by the mass moments of inertia of the aircraft on that axis. Changes in velocity on each axis are created by the forces acting on that axis and are resisted by the mass inertia (mass, or weight) of the aircraft. Maneuver capacity of an aircraft is measured by roll rate and g-capacity.

Handling qualities may be defined as dynamic and static properties of an aircraft that permit the pilot to fully use its performance in a variety of missions and roles. Handling quality is measured using the Cooper-Harper rating and done subjectively by the human pilot. The Cooper-Harper rating, a set of criteria to evaluate the handling qualities of aircraft, has been taken as a standard for measuring the performance of aircraft since it was introduced in 1966. Aircraft performance, ability to control the aircraft, and the degree of pilot compensation needed are three major key factors used in deciding the aircraft handling qualities in the Cooper-Harper rating. The Cooper-Harper rating scale ranges from 1 to 10, with 1 indicating the best handling characteristics and 10 the worst. The criterion is evaluative and thus the scale is considered subjective.

Flight path stability is basically a measure of an aircraft's ability to maintain the glidepath at a defined approach speed. Flight path stability is the slope of the flight path angle versus the velocity curve at approach speed. Since flight path stability affects an aircraft's handling qualities during final approach, the military uses it as a criterion for power approach and landing handling qualities. It's measured in degrees per knot.

Seventh criteria, training quality, is the evaluation of different phases of the flight training. This training is composed of basic handling, aerobatics, instrument flight, formation flight, night flight, low-level flight and ground handling. All these phases have been mentioned by the decision makers except basic handling and night flight.

Aerobatics is the demonstration of flying maneuvers for training. Many aerobatic maneuvers involve rotation of the aircraft about its longitudinal axis (rolling) or the pitch axis (looping). Some complex maneuvers, such as a spin, also require that the aircraft be displaced around a vertical axis, known as yawing. Maneuvers are often combined which demand a higher level of skill from the pilot, but greatly increase the performance of an aerobatic flight sequence. The aerobatic maneuvers mentioned below are in the order of their difficulty beginning from the easier to the hardest: Chandelle, hammerhead, loop, immelman, cuban-8 and spin. Aerobatics are taught to the military pilots as a means of developing precise flying skills and for tactical use in combat.

Chandelle is a maneuver designed to show the pilot's proficiency in controlling the aircraft while performing a minimum radius climbing turn at a constant rate of turn (expressed usually in degrees per second) through a 180 degree change of heading, arriving at the new reciprocal heading at an airspeed in the slow-flight regime, very near to the aerodynamic stall.

Hammerhead is essentially an aeronautical cartwheel. The maneuver begins from a horizontal line pulling the airplane up smoothly but aggressively to establish a vertical line and hold the vertical line until the airplane almost runs out of airspeed, and just at that point, pushing full left/right rudder to make the airplane pivot, or cartwheel, around its left/right wing, then establishing and holding a vertical dive before pulling the nose back up to a horizontal line. The hammerhead ends with the airplane flying 180 degrees from its original heading.

Loop is a vertical circle entered from straight and level flight. A positive pitching movement is used at all points in the loop to draw the circle, so that the aeroplane canopy is pointing inwards.

Immelman is a half loop followed by a half roll. There should be no pause between the end of the loop and the start of the roll to upright flight. Cuban-8 is a combination of 2 loops and 2 rolls. It starts with 5/8s of a loop to the 45 degree nose down, 1/2 roll at that point, and then another 5/8s of a loop to the 45 degree nose down, 1/2 roll to the upright position and completes the maneuver with 3/8s of a loop to level flight.

Spin is an aggravated stall resulting in rotation wherein the aircraft follows a downward and winding path. Spins can be entered unintentionally or intentionally, from any flight attitude and from practically any airspeed. The only thing required is sufficient yaw at the moment an aircraft stalls.

Instrument flight has two phases coming one after another: Basic instrument flight training and radio instrument flight training. Basic instrument flight training provides an introduction to basic instrument flight rules (IFR) procedures and regulations, an introduction to airplane instruments and instrument flying techniques, IFR airspace and air traffic control procedures, IFR weather and weather services, decision making in instrument conditions, proper instrument crosscheck and interpretation, and IFR flight planning. Basic instrument flight maneuvers are straight and level flight (pitch, bank, and power relationship, trim and control usage), turns (speed, bank angle, and standard rate turn relationship, constant rate, standard and half-standard turns, bank control during roll-in and out, coordination), airspeed changes (using trim and altimeter), climbs and descents (constant airspeed vs constant rate, level-off techniques, entry procedures, power-FPM relationship), steep turns (cross-check, coordination during roll-in, turn, and roll-out, priority of the attitude indicator) within the limits of altitude (100 feet), heading (10), airspeed (10 knots), and bank (5) as determined by Federal Aviation Administration (FAA) Instrument Rating Practical Test Standards (2004). Radio instrument flight training provides all the knowledge about basic enroute radio navigation procedures for SIDs (Standard Instrument Departures), radial/bearing intercepts, radial intercept, arcing, point-to-point navigation, correction for wind drifts, ground speed checks, time/distance checks, voice procedures, direct routing, indications of station passage on the VOR-TACAN/ VOR / VOR-DME, flying a TACAN / VOR-DME arc, instrument approach holding procedures, instrument landing system (ILS) approach procedures, circling approach procedures, missed approach procedures, climb/cruise/descend profiles, emergency procedures in IFR flight and so on. If the aircraft is equipped with the required training materials (hood or similar systems), both the basic and radio instrument flight training can be given in full IFR conditions which disables the student to get any kind of help from the outside visual references to align his spatial orientation.

Formation flight is a disciplined flight of two or more aircraft, which requires attitude, focus, and practice, under the command of a flight leader, using a standardized set of signals and commands to direct the wingmen. Formation flight is derived from the military need, mostly tactical in nature, for protection and strike capability. Since it is a kind of special flight requiring utmost coordination of speed and aircraft handling, the formation flight is evaluated according to the altitude and speed regimes, the lower the altitude, the harder to coordinate and accomplish the other checks.

Aircraft's ground handling is accomplished by the nosewheel steering system. To steer the aircraft on the ground, the pilot uses the nose-gear steering button in the cockpit to activate the system together with the rudders. During take-off and landing, directional control of the aircraft is maintained solely by the rudder. If the pilot wants to turn right/left, s/he simply turns the steering wheel in the desired direction. When no input is applied to the steering wheel, the selector valve returns to the null point and allows the nose wheel to pivot freely as differential braking is applied. Another steering system is the castering nosewheel. The castering nosewheel isn't steerable in the conventional sense. It swivels freely, 90 to the left and right; steering is by differential braking. This arrangement allows aircraft to turn tighter than planes with conventional nosewheels. By applying brakes to only one side, it's possible to get the aircraft to spin around a wheel like a taildragger.

The eighth criteria, design, comprises a large number of design subcriteria allowing the aircraft to be handled much more efficiently and comfortably. These subcriteria are robustness, simplicity, ergonomics, systems complexity, system dependency, user friendly, upgradeability, and deactivation capability.

Robustness of the landing gear and airframe is one of the most important requirements for a training aircraft. The landing gear is a vital and robust component of the aircraft, for which there is no built-in redundancy. This sophisticated assembly must ensure that the shock of a very bad landing, especially by a student pilot, can be reliably withstood without any problems. A good measure of robustness of the landing gear is the failure rate per 100,000 flight hours. Flying hours play the dominant role in the failure rate estimates. The service life of the airframe is another important factor taken into consideration during the procurement phase. According to a study report (Aircraft Historical and Future Developments) carried by World

Meteorological Organization (WMO) and United Nations Environment Programme (UNEP), average service life of an airframe is 25 to 35 years. The airframe experiments, which are designed to demonstrate airframe structural reliability, airframe turn time, and airframe lifetime, are accomplished by simulating the essential loading events the airframe can expect to see during an entire mission cycle, and then repeating the cycle. All significant airframe processing issues such as fuel fill and drain cycles, repair and replacement of thermal protection system components, and the integrity/ repair / replacement of thermal and or other are considered.

Simplicity of cockpit design and the emergency procedures provide an evident contribution in the reaction pace of the pilots in case of accidents and incidents. Because of this, over the years, some aircraft are considered safer, with lower risk compared to others based on accident statistics. That statistic is directly related to design features of the airplane. Basic 6-pack cockpit configuration is an array of 6 essential gauges arranged in 2 rows of 3, directly in front of the pilot. In clockwise order from the upper left are found the airspeed indicator, artificial horizon, altimeter, vertical speed indicator, heading display, and turn coordinator. Uniform positioning of instrumentation makes it easy for the pilot to transition from one type of aircraft to another and minimizes the amount of time required for airborne flight crews to obtain situation awareness in dynamically changing environments. Even in modern commercial aircraft equipped with glass cockpits (computer displays instead of gauges), a computer-generated representation of these 6 gauges is often displayed on one of the screens. Standardized cockpits allow the aircrew to develop a spatial orientation to information. Aircrew can develop a scan pattern habit that is well defined and practiced so that data are transferred consistently and efficiently from the controls and displays for the aircrew to accomplish their mission safely and effectively. This inherent standardization also aids the crew in the coordination of tasks and responsibilities to manage mission workload. Another significant benefit to standardization between cockpit designs is that it should improve pilot performance, reduce pilot errors, and reduce task performance times when transitioning between different aircraft systems.

Ergonomics of the cockpit is more than just a convenience. It also helps counter tiredness and fatigue during long flights. Comfort is thereby an important contribution to both performance and active safety. The cockpit should be able to be adjusted to perfectly fit almost any pilot. The seat bottom should move up and forward for smaller pilots, thus always keeping the pilot on the same horizontal plane, and making sure that the stick is always in the optimal position relative to her or his hands. The rudder pedals should move away from each other when adjusted for shorter pilots, this avoids the well known problem of shorter pilots only reaching the outer parts of the pedals when flying an aircraft with a centrally mounted instrument console.

Visibility is one of the main topics of the aviation studies since accidents in degraded visibility continue to account for a disproportionately large number of fatal crashes in general aviation. Most aircraft cockpits severely limit the field of view available to the pilot. Visibility is most restricted on the side of the aircraft. Any aircraft characteristics relating to cockpit visibility, proper eye height, seat position or instrument lighting intensities related to transition through areas of varying brightness, visual conditions can also affect a pilot's spatial orientation. The different cockpit types for the visibility mentioned in this study are binocular cockpit visibility (B737), clam-shell type canopy (T-37), shoulder level canopy (F-4), bubble canopy (P-47) and bubble canopy with the transparency (F-16) which allows the same clarity in vision over the entire canopy because of the components within the canopy material.

Noise level in the cockpit is another consideration since the pilot's hearing may be injured is, a common problem. The noise level was measured in the cockpit in a study carried out by Wu and Ding [39]. The temporary threshold shift (TTS) was studied in 20 healthy young men, and permanent threshold shift was examined in 166 fighter pilots. The results showed that noise level in the cockpit was 110 dBA and TTS after 2 min noise exposure decreased significantly and reached 13 dB at a particular frequency. It was also found that 56% of the 166 pilots suffered from high frequency hearing loss, and the percentage increased with flight time. This indicates that cockpit noise may cause a permanent threshold shift of hearing.

Environmental control systems (ECS) provide both heating and air conditioning to the cockpit and nose bay environments, cooling down or heating a given amount of air for the comfort of the aircrew and the safety of electrical equipment. Changes in atmospheric conditions (temperature, pressure, altitude, relative humidity) necessitate the careful design of environmental control systems. Monitoring air flow in the aircraft, ECS is critical to ensure the adequate cooling of critical areas, such as, the avionics. As aircraft became capable of obtaining altitudes above that at which flight crews could operate efficiently, a need developed for complete environmental systems. Air conditioning provides the proper temperature and supplemental oxygen which could provide sufficient breathable air. One problem was that not enough atmospheric pressure exists at high altitude to aid in breathing, and even at lower altitudes the body must work harder to absorb sufficient oxygen through the lungs to operate at the same level of efficiency as at sea level. This problem was solved by pressuring the cockpit/cabin area.

Increasing system complexity of aircraft technology coupled with requirements to operate at very low level and in all weather conditions creates a heavy workload in military cockpits, especially in single seat aircraft (NATO Case Studies and Future Applications, RTO-TR-IST-037). A pilot's top priority should be to fly the aircraft, which requires the use of his hands and eyes. The operation of other equipment, although necessary for the mission, may be a distraction from the primary task. A study carried out by Essential Skills Research Unit Skills and Labor Market Information Division Skills and Employment Branch, Canada, defines the complexity levels as follows: Many essential skills have been given two types of ratings for complexity - a) the range of complexity of typical tasks for the occupation (uncomplicated- a task which is typical and occurs frequently in the job or occurs less frequently, but nevertheless is required by virtually all incumbents), and b) the range of complexity of the most complex tasks for the occupation.

System dependency is a problem in some of the aircraft since the engine start requires an auxiliary power unit, and if it has a second engine, the second one also may depend on the first one's turning.

User friendly aircraft systems improve safety and handling qualities of the aircraft. User-friendly control systems should shape handling qualities of an aircraft in such a way that control becomes easy and safe. The autopilot function reduces the complexity of interactions between aircraft attitudes, power settings, and rate of motion, and in conclusion, limits the possibility of loss of control. The throttle types which definitely contribute to improving flying safety as well as being a user friendly aircraft control are: MLEC (Multi-Lever Engine Control System), Mechanical SLPC (Single-Lever Power Control), Digital fly-by-wire SLPC and Combined SLPC. An SLPC system increases engine performance and fuel efficiency while substantially reducing pilot workload and increasing flight safety in comparison to older and less user-friendly, multi-lever engine control systems. The benefits of using SLPCs for general aviation aircraft are to improve flight safety through advanced engine diagnostics, simplify powerplant operations, increase time between overhauls, and provide cost-effective technology (extends fuel burn and reduces overhaul costs).

Upgradeability is another issue for the aging aircraft fleet. Some levels of this are software upgradeability, modular design improved LRU (Line-Replaceable Unit), modular open system, and built-in upgradeability. Software upgradeability includes the systems such as flight director, weather (WX), and approach chart display. Modular design improved LRU modules enhance serviceability and interchangeability. A modular open system uses standard, well-defined interfaces (i.e. electrical, mechanical, software) and eliminates proprietary point designs. Built-in upgradeability is the ability to update entire aircraft quickly and efficiently without the usual downtime and panel teardowns for traditional avionics enhancement. "Modular Design means a design where functionality is partitioned into discrete, cohesive, and self-contained units with well-defined, open and published interfaces that permit substitution of such units with similar components or products from alternate sources with minimum impact on existing units". (A Modular Open Systems Approach (MOSA) to Acquisition document, Open Systems Joint Task Force (OSJTF)).

Deactivation capability is a feature especially used by instructor pilots in order to disable some capabilities of the aircraft for the training of the student to fly without these systems. This necessitates that the student practise using back-up systems and improve his skills in case of a discrepancy. Those systems, which have deactivation capability, are the intercom/radio system, multi-function display (MFD) modes, the stall warning system, and some of the navigational aid systems (NAVAIDS) .

The ninth criteria, supporting systems, includes synthetic trainer systems, debriefing systems and life support materials (including G-suit).

Synthetic training is recognized as being important for aircraft training. A combination of synthetic training and training in a real aircraft, makes for a better, safer pilot. According to the studies, pilots who receive regular, recurrent synthetic training have far lower accident rates (and in the particular study conducted, not one of the randomly selected pilots had been involved in a fatal accident, which yielded a probability of less than one percent of occurring). Here are the synthetic training systems mentioned in this study:

Part-Task Trainers (PTT): PTTs feature high-fidelity simulation models, providing a realistic environment for effective training independent of the actual training aircraft. PTTs offer a flexible, economical means of training students on specific aircraft devices and subsystems. Thus, the student knows how best to handle and use complex systems such as avionics or mission management equipment before starting simulator or aircraft missions.

Flight and Navigation Procedures Trainer (FNPT): The main role of the FNPT is to enable the student pilot to practise instrument flying and real-world navigation. Accordingly, the FNPT is designed and configured to integrate all flight and navigation systems. The practices of limited ground operations, take-off, departure, in-flight manoeuvres, radio navigation, GPS operations, approach, landings, and major emergency procedures can be executed with reference to aircraft instruments and navigation controls. The FNPT is an inexpensive means of providing high performance training in a safe environment, completely independent of weather conditions and aircraft availability.

Flight Training Device (FTD): FTD enables the student pilot to learn, develop, and practise normal, abnormal, and emergency aircraft specific procedures. In addition, the FTD allows the student to gain essential IFR training and system management skills necessary for understanding and operating modern interactive navigation and mission avionics systems. Depending on the type of visual system and database selected, the FTD can also provide training for VFR, Night Flight, Formation Flight, Low Level Flight and Mission Rehearsal.

Full Simulator: Full simulator includes features such as motion platform, g-seat and vibration platform, anti-g suit, wide visual system field of view, and simulation models enhancement, elements which are considered optional with the FTD. It replicates the aircraft's flight and ground-handling characteristics to a realistic level, integrating the latest in visual realism and high-fidelity avionics simulation technologies.

Debriefing systems comprise GPS data recorders, digital video debriefing systems and ACMI (Air Combat Maneuvering Instrumentation).

GPS Data Recorder: The GPS data recorder is a portable device which may be hand carried or installed permanently in the aircraft. After the flight, the flight track is downloaded and can be used as material for the flight debriefing.

Digital Video Debriefing System (DVDS): Digital Video Debriefing System is an advanced PC-based application for producing highly effective, comprehensive real-time and post-flight analysis and debriefing of video and audio.

ACMI: ACMI is an on-board pod carried on a missile launcher which sends real time flight data and on-board pickle signals to the ground-based station for both online and after flight briefing.

Life support materials are CSU-13 B/P anti-G suit (standard) and advanced technology anti-G suit.

Finally, the last criteria is the cost, which is a primary and important criteria in most of the procurement process as it is in the nature of the job. Operating an aircraft for training is always going to be expensive. However, for primary training, a cheaper aircraft and low-cost operation is clearly required. The most important cost figure is the life cycle cost. In addition to this, there are also secondary costs such as maintenance and logistic support costs, and costs for training aids such as simulators and other equipment, possibly including airfield facilities. Since cost increases gradually from primary to advanced training, any exercises that can be applied to an earlier phase will be a cost saving factor within the overall training system. This not only applies from one aircraft type to another, but also from aircraft to simulation devices, because, giving the training in a simulator is always much cheaper than operating the same training in an aircraft. If techniques and systems can be taught at the primary training aircraft level rather than in the advanced training aircraft (or transferred to simulators), a large overall saving could be realized. Furthermore, if the aircraft flying hours can be reduced, the service life of the aircraft fleet can be extended. That can be a huge saving in the long term since the fleet replacement is not only very costly but is also politically sensitive, increasing with the complexity and the capability of the aircraft involved. The aircraft cost has been measured in million dollars in this study.

The maintenance cost, which is measured in hundred dollars, is the total of the labor and material cost per flight hour. Military base or line maintenance includes general support man-hours cost but not depot or material costs as in the commercial sector.

D.1 Step 9: Sensitivity Analysis

Sensitivity analysis is implemented to verify that the value models are built on proper assumptions. One of the biggest assumptions in the models is that the evaluation measures have been given the proper weighting and accurately shows the decision makers preferences. Sensitivity analysis helps the decision maker verify these weightings by showing how the ranking of alternatives may change based on variations in measure weights. The weight of a single value is varied, while the weights of the remaining values remain proportional. The sum of the values in each tier will still sum to 1. A graph is generated that shows how the alternative ranking will change with respect to variation in this value. This is useful for several reasons. First, the decision makers may have made errors in estimating or communicating their weights in the hierarchy. Second, external changes can change the weights of the hierarchy. Rather than having to perform the entire analysis again, sensitivity analysis lets the decision maker see how a different weight would change the results.

There are two basic methods of examining the sensitivity of the alternatives to changes in the weights of the value or measures. The first is a global sensitivity analysis, where the weight of the value or measure of interest is varied while all of the other weights in the hierarchy vary proportionally. The second is a local sensitivity analysis, where the weight of the value or measure of interest is varied, while all of the weights of the values in the same tier of the hierarchy vary proportionally. This type of sensitivity analysis begins by moving a selected measures weight from zero to one, regardless of the predetermined weight. As the measures weight changes, the weights of all other evaluation measures are proportionally adjusted to ensure all weights still sum to one. Each alternative receives more or less value depending on the weight of the selected evaluation measure.

Based on the data collected for the alternatives that have been identified for the primary training aircraft, some measures and values will be less sensitive than others. The measures ,which are the same or similar across all alternatives, should not be as sensitive to changes in the weight as other measures. The significant findings of the sensitivity analysis are explained below.

Figure 1 shows the global sensitivity analysis for the top tier value "Flying Quality". This graph shows that a minor increase in the current weight results in the top alternative changes from T-6A to T-37B. Therefore, the alternatives are not very sensitive to the changes in weight. It is only for the lower weights that the top alternatives change. Right after 0.245 range for the current weight, the top alternatives remains the same. If "Flight Quality" becomes less important to the group, alternatives that do poorly in "Flight Quality" but well in the other measures may become more preferred. Another important factor to notice is the fact that, the more the weight increases the more the values of the alternatives increase. We should realize that the "Flying Quality" is one of the most outweighting values of all throughout the group hierarchy. Thus, all the alternative values increase more or less with the increase in this weight.

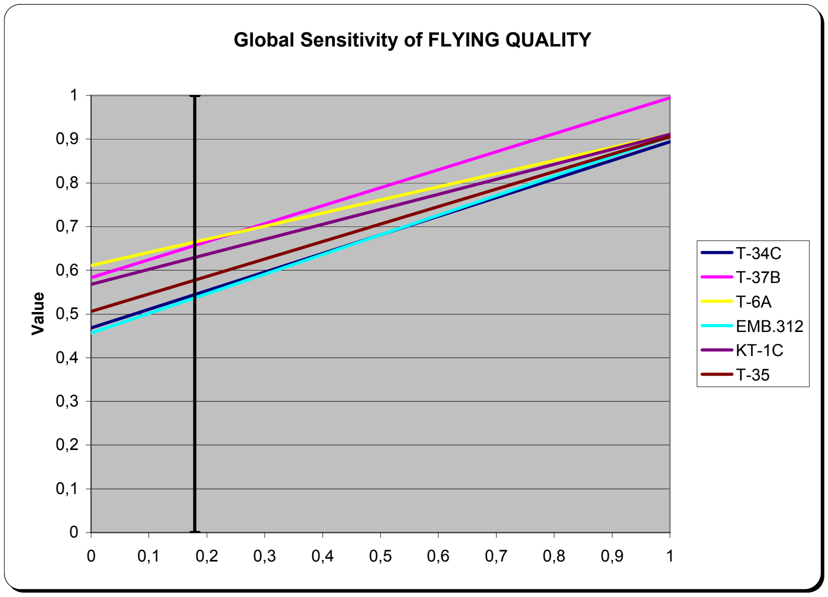

Figure 1: Global Sensitivity of Flying Quality for the Group

The sensitivity analysis for "Training Quality", shown in Figure 2 , shows how stable are the alternatives as the weight is varied. This graph shows that for all the weights, the top alternatives remain the same. The alternatives are not very sensitive to the changes in weight.

The sensitivity analysis for "Design", shown in Figure 3 , shows how the worst alternative at the beginning gains value as the current weight increases. After the range of 0.31 of current weight, the top alternatives are not sensitive; however, when the weight changes from 0.126 to 0.165, then the ranking of the worst alternatives starts to change.

The sensitivity analysis for "Performance", shown in Figure 4 , shows that for the range immediately surrounding the current weight, the top alternatives are not sensitive; however, if the weight doubles from 0.105 to 0.210, then the ranking of

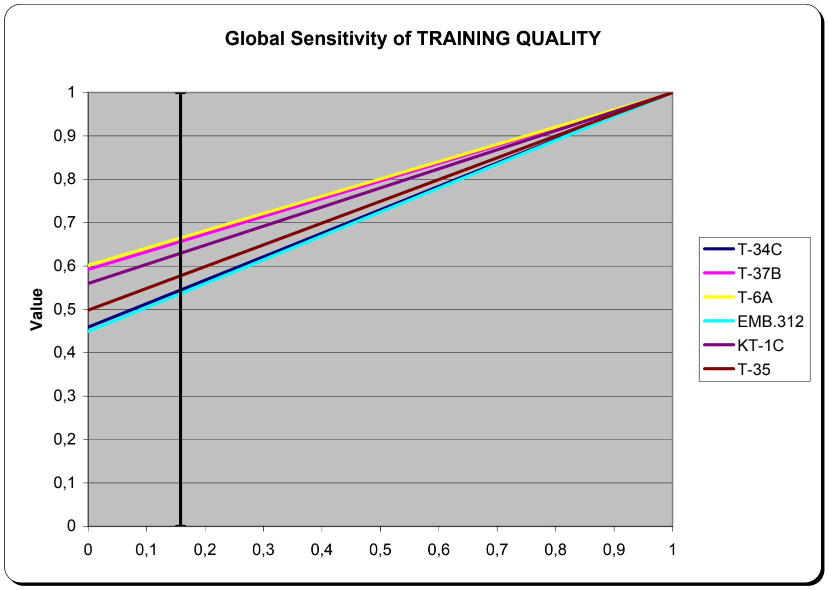

Figure 2: Global Sensitivity of Training Quality for the Group

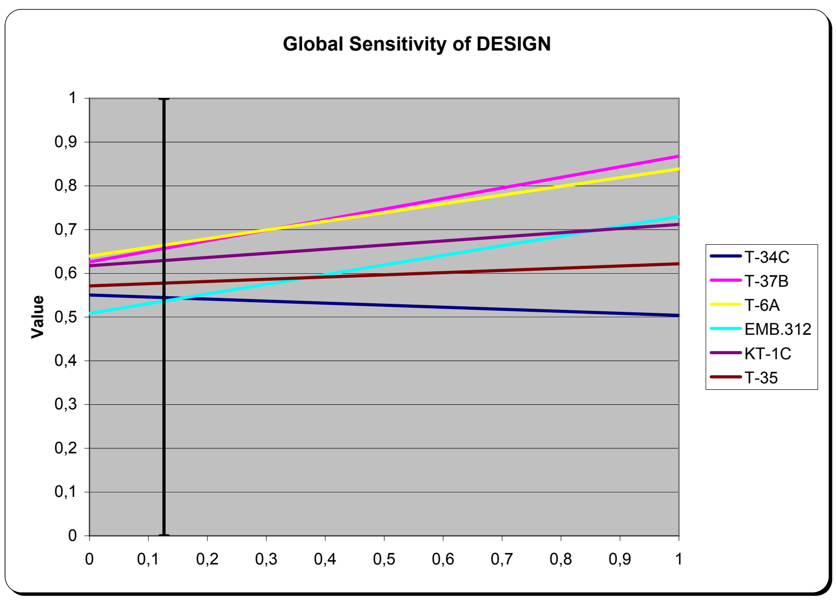

Figure 3: Global Sensitivity of Design for the Group

the alternatives starts to change. After the range of 0.31 of current weight, the top alternatives are not sensitive; however, when the weight changes from 0.126 to 0.165, then the ranking of the worst alternatives starts to change. The values for the aircrafts converge into two separate areas. First, relatively old version primary training aircrafts T-34C and T-35, increase dramatically in value as the weight increases and converge at a value of 1. The only double-engine primary trainer T-37B converge at a value of 0 even though it starts with the most value at the beginning of the current weight scale. This graph shows that the alternatives are very sensitive to increases in weight for "Performance".

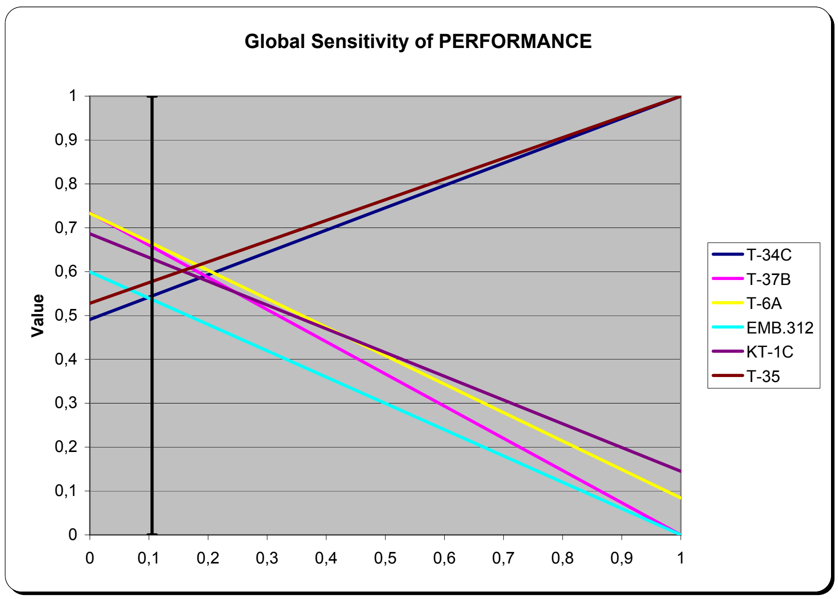

Figure 4: Global Sensitivity of Performance for the Group

The sensitivity analysis for "Safety", shown in Figure 5 , shows very interestingly the only alternative, T-37, increases and all other alternatives decreases in value as the weight increases. When we look the top-tier value "Safety" in Figure A.1; "Engine", "Ejection Seat" and "Collision Avoidance System" are the sub-tier values. "Engine" , with the highest local weight of 0.625, contributes dramatically to T-37B increase in value since it's the only double-engine primary training aircraft.

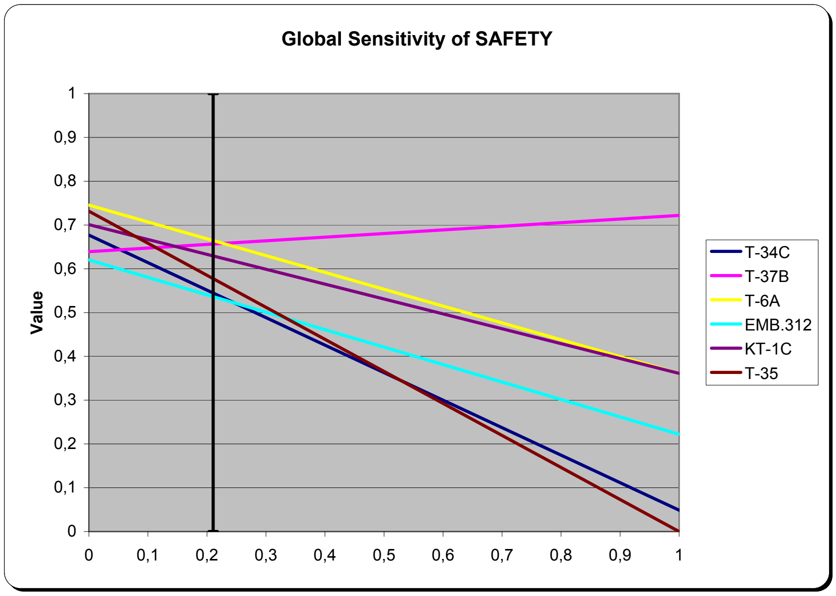

Figure 5: Global Sensitivity of Safety for the Group

The sensitivity analysis for "Maintainability", shown in Figure 6, shows that all the alternatives decrease in value as the weight increases. At the current weight, the best alternative changes from T-37B to T-6A and remains the same to the highest weight.

The sensitivity analysis for "Supporting Systems", shown in Figure 7, shows the sensitivity for the "Synthetic Trainer Systems" and "Debriefing Systems". For the range immediately surrounding the current weight, the top alternatives are not sensitive; however, if the weight doubles from 0.053 to 0.1, then the ranking of the alternatives starts to change. The values for the alternative primary training aircrafts converge into three separate areas. First, the newest generation trainers T-6A and KT-1C, those with the full simulators and digital video debriefing systems, increase dramatically in value as the weight increases and converge at a value of 0.96 . The

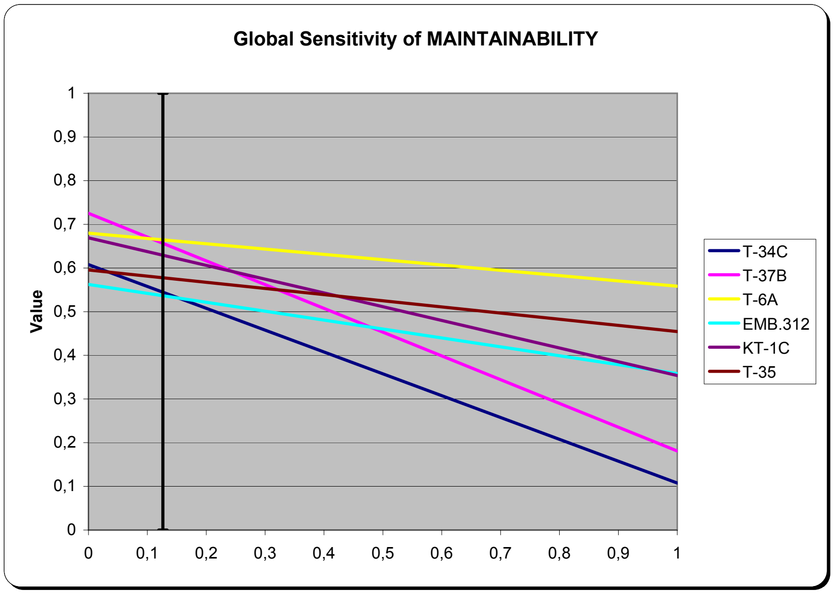

Figure 6: Global Sensitivity of Maintainability for the Group

aircrafts with the flight & navigation procedures trainers converge at a value of 0.28 and the aircrafts without a synthetic trainer and a debriefing system converge at a value of 0.

The sensitivity analysis for "Cost", shown in Figure 8, shows how the groups weights the "Cost" to the minimum extent in comparison to the other values. If the current weight increases from 0.011 to 0.13, the alternatives change dramatically in value. The newest generation aircrafts T-6A and KT-1C converges at a value of 0 as the weight increases to 1 since they have the highest unit cost. Even though T-35 has the lowest unit cost, T-37B gets the highest value due to lower maintenance cost than T-35 when the weight is increased to 0.21 and then.

The sensitivity analysis for "Technology", shown in Figure 9 , shows the sensitivity for the consistency of the systems on-board to the current technology. For

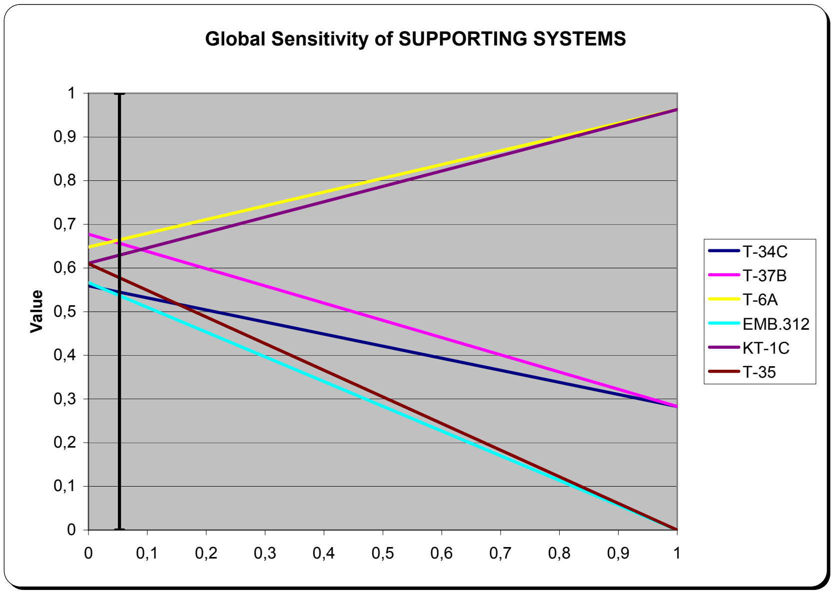

Figure 7: Global Sensitivity of Supporting Systems for the Group

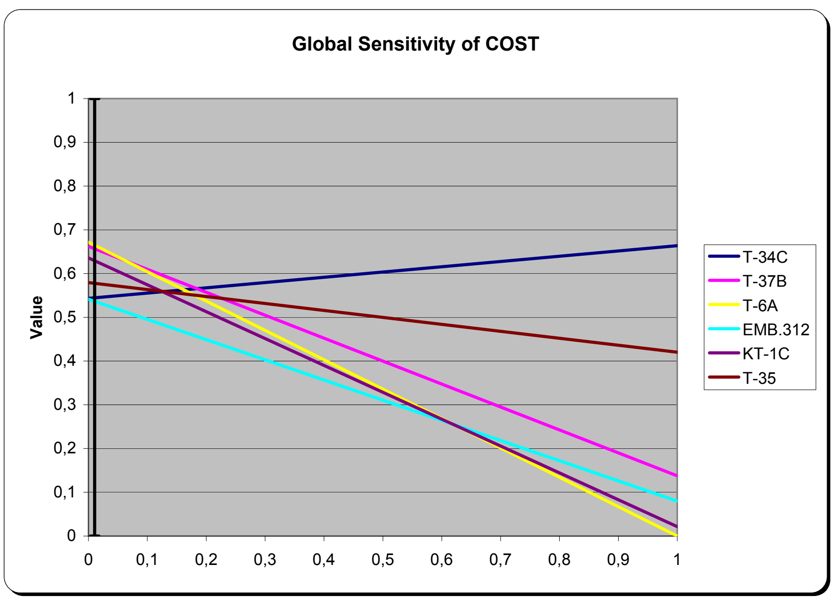

Figure 8: Global Sensitivity of Cost for the Group

the range immediately surrounding the current weight, the top alternatives are not sensitive; however, if the weight changes from 0.03 to 0.1, then the ranking of the alternatives starts to change. The values for the aircrafts converge into three separate areas. First, T-6A, KT-1C and EMB.312, with the most current technology, increase dramatically in value as the weight increases and converge at a value of 1. T-37B relatively keeps its value with the changing weight and converges at a value of 0.63 and T-34C and T-35, with the earliest technology on-board, converge at a value of 0.48 .

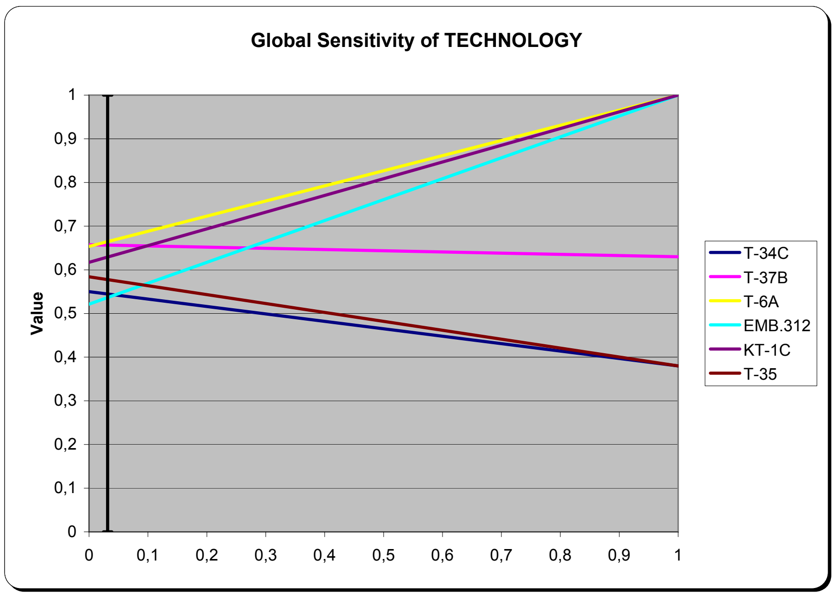

Figure 9: Global Sensitivity of Technology for the Group

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14. ABSTRACT

Many "real world" decisions are made by groups. It is rare that the responsibility for a very important decision is given to a single decision maker with complete authority. Group decision making adds both advantages to the process as well as disadvantages. The time required to coordinate a deliberated decision within the group is the biggest difficulty in the group decision making process. In addition to this, the perceived influence of more senior participants and their ideas affect the originality of the group decision and the credibility of the contribution of "all" the participants. The focus of this research is to explore the answer to the problem: "Are decisions made by groups really that much different from the decisions made by individuals in the group?" A slightly different focus can also be employed: "Do individuals really conduct themselves differently when they make decisions as members of a group or when they reach decisions by themselves?" In order to find the answer, the evaluation will be implemented by nonparametric statistical methods to test if there is any concordance among the group and individual decisions. The resulting values for the evaluation and a general conclusion for selecting the best primary training aircraft will be provided at the end.

15. SUBJECT TERMS

Decision Analysis, Value-Focused Thinking, Group Decision Making, Individual versus Group Decision Making, Advantages and Disadvantages of Group Decision Making, Case Study: Best Primary Training Aircraft

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