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Estimating the Operating and Support Cost Difference among TUAF C-130, C-130B and USAF C-130J Aircraft

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ESTIMATING THE OPERATING AND SUPPORT COST DIFFERENCE

AMONG TUAF C-130E, C-130B AND USAF C-130J AIRCRAFT

THESIS

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Abstract
This study addresses the operation and support cost differences between the TUAF C-130E & C-130B, and the USAF C-130J aircraft. The TUAF C-130s have been being used for more than 30 years and changing world situations give armed forces different roles, and Turkey participates in all peacekeeping missions that are assigned by NATO (North Atlantic Treaty Organization) and the United Nations. While performing these roles, the importance of air mobility and the importance of reliability became widely appreciated. Moreover, the coming retiring age of the existing C-130s in the TUAF forced the TUAF to look for ways to improve its air mobility. Under these conditions the TUAF is trying to find a way to decrease these interruptions in the missions and to increase the capability of carrying more personnel and materials so as to increase the effectiveness of Air Lift missions. There are two ways to accomplish this target: 1.Refurbish the existing C-130s and increasing its reliability. 2.Buy the newest version of C-130 Hercules, the C-130J. This study investigates the O&S cost difference among the aircraft by establishing a model to assess the O&S cost that can be used to evaluate the competing alternatives as well as the replacement decision for the existing systems. Cost Oriented Resource Estimation (CORE) model utilized in establishing the model. Sensitivity Analysis, and Breakeven Analysis are applied to the cost figures over

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Table of Contents

Page

List of Figures

Page

List of Tables

AFIT/GLM/ENS/02-10

Abstract

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Refurbish the existing C-130s and increasing its reliability.

1. Buy the newest version of C-130 Hercules, the C-130J

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Cost Oriented Resource Estimation (CORE) model utilized in establishing the model. Sensitivity Analysis, and Breakeven Analysis are applied to the cost figures over

40 years. The analysis showed that C-130J amortizes itself in the lifetime of the cargo aircraft. In addition to that improved avionic, and propulsion systems increase the efficiency and effectiveness of the air mobility.

ESTIMATING THE OPERATING AND SUPPORT COST DIFFERENCE AMONG TUAF C-130E, C-130B AND USAF C-130J AIRCRAFT

I. Introduction

Chapter Overview

This thesis will compare the operating and the support cost (O&S Cost) of the C-130E, C-130B and the C-130J Hercules aircraft. This chapter includes the background, problem statement, and investigative questions; as well as the scope of the research, and its limitations.

The purpose of this research will be to establish a model for estimating the O&S cost for the aircraft in the Turkish Air Force (TUAF). By applying this model to the USAF C-130s, the relative O&S cost of the C-130E, C-130B and C-130J will be found. By making the analogy, the best decision for keeping and refurbishing C-130s already in the TUAF or replacing them with the C-130J will be investigated. The recommendations will be presented at the end of the thesis.

Background

In the TUAF C-130s have been used not only for Tactical but also for Strategic Air Lift purposes. There is just one airlift base that accommodates the C-130s in Turkey. The TUAF has been using 6 C-130B since 1981 and 7 C-130E since 1961 for personnel carrier, fire extinguishing, and cargo. C-130s have been used for channel missions that are programmed two times a week in order to carry the material shipments between the Turkish borders, and to carry materials overseas because of its ability to go further when we compare with the other airlift aircraft, the C-160s and CN-235s.

Changing world situations give armed forces different roles, and Turkey participates in all peacekeeping missions that are assigned by NATO (North Atlantic Treaty Organization) and the United Nations. While performing these roles, the importance of air mobility and the importance of reliability became widely appreciated. Moreover, the coming retiring age of the existing C-130s in the TUAF forced the TUAF to look for ways to improve its air mobility. In 1995, Turkish Aircraft Industry (TAI) started to produce the CN-235 aircraft with the help of the Spanish CASA firm. However, the problems faced with this aircraft and the capacity problems showed that this aircraft is not the one that is required by the TUAF. In addition to this, while C-130s are performing their missions, there can be unexpected problems that cannot be fixed by the aircraft crew and the maintenance crew of that base, in addition to these they might not even recognize the problem. At those times, the main C-130 base has to provide a maintenance crew and prepare the supply kit according to the illustrations taken from aircraft indicators. The mission sometimes has to be performed by another aircraft; or sometimes, the crew returns to the base and takes the correct materials to fix the aircraft. This causes not only delays in the mission of that aircraft but can also affect the missions of the other bases.

Under these conditions the TUAF is trying to find a way to decrease these interruptions in the missions and to increase the capability of carrying more personnel and materials so as to increase the effectiveness of Air Lift missions. There are two ways to accomplish this target:

1. Refurbish the existing C-130s and increasing its reliability.
2. Buy the newest version of C-130 Hercules, the C-130J

In the DOD acquisition process, a basic contract process is called the Firm Fixed Price Incentive. In this process, whichever company offers the lowest bid gets the contract, but this does not necessarily mean that it will provide the “best value.” If the requirements are not defined clearly, the low bid winning process will cause lots of problems in proceeding stages of the contract. Fabricky and Blanchard define the best value item as “all other factors remaining equal, people will meet their needs by procuring goods and services that offer the highest value/cost ratio” (13:5).

Under these circumstances, the TUAF wants to know what trade-offs are associated with the cost and performance of the contract, and which one of the alternatives would be best in terms of cost and performance to maintain the TUAF’s lifting capability.

Problem Statement and Contribution of Research

All the bases in the TUAF are connected to each other by fiber optic lines in order to answer the supply demands, and the only way to carry the materials demanded from one base to another is using either C-130s or C-160s. If the aircraft do not work properly, it does not matter if you have the most advanced supply-demand system. Having understood the current situation, the TUAF realizes that the old age of the existing aircraft require them to be refurbished or replaced by C-130Js.

These C-130s are the main body of the TUAF airlift groups. Since they are used frequently and their missions are various, their operating hours are high. This causes frequent failures, so every year the money spent to maintain them is increasing. However, because of the declining Defense Budget, the TUAF wants to make the best decision about keeping the existing C-130s and refurbishing them or buying the C-130J.

Research Question

The TUAF needs to know what cost-tradeoffs are involved in the replacement decision. To determine the trade-offs, the relative O&S cost of the C-130E, C-130B, and C-130J are needed. In order to reach the correct conclusion about the trade-offs, the following investigative questions have to be answered.

Investigative Questions

1. What are the relevant costs to compare?

Since TUAF has already been operating C-130E and C-130Bs, the procurement costs of the aircraft are considered to be sunk. The O&S cost is therefore the most significant cost in system or product life cycle. That is why O&S cost (labor costs of operating and maintenance personnel, fuel and power cost, operating and maintenance supply costs, spare and repair part costs, and related overhead costs) will be considered to be valid for the cost aspect of this comparison.

2. What is the best way to compare these costs?

Since C-130Js have been used in the USAF for only a few years, it is considered to be in the initial transient stage according to the bathtub effect; on the other hand, the C-130E and C-130B are supposed to be in steady state or wear-out stage. The comparison of the costs will be most useful if they are evaluated over years in order to give better idea to the decision makers to make their decision more accurate over long run.

3. What data would be needed to perform the comparison?

Maintenance plans, operating hours, man-hours needed to prepare and operate the aircraft, and maintenance and supply records would be needed to perform this analysis. As much as possible, data will be provided by the TUAF especially the data related to the operation of the aircraft. The maintenance and the supply data will be provided from US sources, and then a comparison will be made in order to reach a more accurate result.

4. What additional non-cost factors would need to be considered?

Since the USA is one of the most important allied countries for Turkey, political factors are considered to be irrelevant for this thesis. Because of the declining budget and the role of the TUAF on the region and the peacekeeping missions, the performance and the cost are deemed to be the relevant factors that would be considered.

5. What recommendation should be made to the TUAF?

After analyzing the alternatives in terms of performance and cost, the most suitable alternative will be addressed to be considered while making decision. It should not be forgotten that LCC analysis would not be the final result for the decision makers. This will be one of the most important inputs for the decision makers while reaching the conclusion about the alternatives.

6. What trade-offs exist in the decision?

Capacity, speed, range, landing range and the cost are considered to be the main trade-offs in the decision. Additional factors will be considered and presented as required by the analysis.

After looking at the investigative questions, we have to address the sources of data to answer these questions.

Data Sources and Analysis

This research will estimate the O&S cost difference between the C-130E, C-130B and C-130J. As much as possible, data will be provided by TUAF (especially the data related to the operation of the aircraft). The maintenance and the supply data will be provided from US sources, and then a comparison will be made in order to reach a more accurate result. USAF cost information and Life Cycle Cost methodologies will be employed. When the data are not sufficient, secondary data will be employed. The specifications of the C-130E, C-130B and C-130J will be acquired from different publicly available sources. For question 1, 2, 3, 4, 5 and 6 the data will be provided from the US and TUAF archives, and the information available publicly will be evaluated by employing the suitable methodology that is being used in US Air Force.

Scope and Limitations

The purpose of this research is to estimate the cost differences between Turkish C-130E, C-130B and USAF C-130J's O&S cost in order to evaluate the cost aspect of the alternatives. It is not being established as a model that can be used for other systems and products, because of their different maintenance systems.

This research is not performed to find the absolute best alternative; here it is just aimed to show the O&S cost differences and analyze trade-offs. In the final analysis, the decisions on keeping and refurbishing the existed aircraft or buying the C-130J are up to decision makers. The purpose of this effort is to provide an analysis of one key part of that decision; the O&S costs.

US dollars will be used as a currency because of their stability. Almost all of the spare parts of the C-130s are provided from the USA, that is why it is the most suitable way to use US dollars as a currency in the all over analysis.

Research Assumptions

All the data provided for the US C-130E and C-130B are also valid for the TUAF C-130E and C-130B. Since they are the same brand and manufactured by the same manufacturer, and their maintenance implementations are the same, they can be considered to yield the same or similar result.

All US cost information associated with this analysis are accurate. Most of the parts of the aircraft are supplied from US. The costs of rest of the parts produced in Turkey are not significant statistically.

The US LCC analysis methodology is accurate and reliable, and appropriate for this study.

Summary and Research Organization

This thesis consists of five chapters. In Chapter I, the basic problem was introduced with background that addresses the current situation and the purpose of this thesis. The problem statement and contribution of research that describes the main problem that push TUAF to this research, research and investigative questions that have to be answered to reach a conclusion, scope and limitations that is the border of the thesis, and the assumptions that have to be made to solve this problem analytically were presented.

Chapter II presents a Literature Review that consists of descriptions of the concepts and some of the answers to the questions raised in Chapter I. Chapter III describes the research methodology of this thesis. Chapter IV will present results. Chapter V will present the recommendations based on the qualitative and quantitative analysis that shows the trade-offs between the C-130 alternatives.

II. Literature Review

Chapter Overview

The purpose of this chapter is to review the literature to compare the performance of the various C-130 types that are the subject of this research. In addition, this chapter will provide insight into the process of Life Cycle Costing (LCC), the cost elements that will be considered while employing the analysis, the LCC methods, and the Cost Breakdown Structure of the typical system. This review will serve as the basic foundation to understand the LCC process and choose the proper method for execution of the analysis. There are five basic parts to this chapter.

In the first part of this chapter, the performance comparison of the C-130 E/B and J are presented. While presenting the performance comparison, the avionic features will be presented as well. In the second part of this chapter, the concept of economic life will be presented. Obsolescence and deterioration will be explained as well as the concept of the "bathtub curve." The third part of this chapter will present information about LCC and its benefits. The fourth part of this chapter explains cost classifications, so as to understand the cost types and major cost classifications as well as the Cost Breakdown Structure. In the last part of this chapter, cost estimating methods will be explained, and the situations in which they should be used will be presented.

C-130 B/E/J

The C-130 Hercules primarily performs the tactical portion of the airlift mission. The aircraft is capable of operating from rough, dirt strips and is the prime transport for air dropping troops and equipment into hostile areas (11:1). Basic and specialized versions of the aircraft perform a diverse number of roles, including airlift support, Arctic resupply, aeromedical missions, aerial spray missions, fire-fighting duties for the U.S. Forest Service, and natural disaster relief missions (7:1). The flexible design of the Hercules enables it to be configured for many different missions. The C-130 can be rapidly reconfigured for various types of cargo such as palletized equipment, floor loaded material, airdrop platforms, container delivery system bundles, vehicles and personnel or aeromedical evacuation (11:2).

The C-130B variant introduced the use of the Allison T56-A-7 turboprops and the first of 134 entered Air Force service in May 1959 (7:2). The C-130E version uses the same Allison T56-A-7 engine, but added two 1,290 gallon external fuel tanks and an increased maximum takeoff weight capability (11:3). Other differences between the E and B variants are as described below:

> Maximum ramp weight of the C-130E soared to 155,00 lbs., an increase of 20,000 lbs. over the "B". Its fuel capacity was increased by over 17,000 lbs. All of this weight addition required extensive strengthening of the basic airframe, especially in the area of the wings and landing gear. More powerful Allison T-56-A-7A engines of 4050 hp were used and a pair of external tanks. (8:1)

The C-130J is the latest addition to the C-130 fleet and will eventually begin to replace retiring C-130E's and C-130H's. The C-130J incorporates state-of-the-art technology to reduce manpower requirements, lower operating and support costs, and provides LCC savings over earlier C-130 models (7:2).

When we compare the C-130J to the earlier versions of the C-130s, the C-130J climbs faster and higher, flies farther at a higher cruise speed, and takes off and lands in a shorter distance. The major improvements that distinguish C-130 J from C-130's early versions are:

- Advanced two-pilot flight station with fully integrated digital avionics
- Color multifunctional liquid crystal displays and head-up displays
- State-of-the-art navigation systems with dual inertial navigation and global positioning systems
- Mission planning system
- Low power color radar
- Digital moving map display
- New turboprop engines with six bladed, all composite propellers
- Digital auto pilot
- Improved fuel, environmental and ice protection systems. (7:2-3)

A new propulsion system provides the C-130J 29% more thrust, while increasing fuel efficiency by 15% with four Rolls-Royce AE2100D3 engines (9:3). The new C-130J has the same silhouette with the earlier version of C-130s, but in fact it's a brand new airplane with respect to performance. When we compare the C-130J with the earlier production C-130E, maximum speed is up 21%, climb time is down 50%, cruising altitude is 40% higher, and range 40% longer. The C-130J variant includes new engines and new props (9:2).

It also has superiority from the point of view of avionics. For difficult low altitude maneuvers, new avionics and dual head-up displays make it easier and safer to operate. It also offers reduced manpower requirements, lower O&S costs and LCC. It is equipped with four head-down Liquid Crystal Display (LCD) instruments for aircraft flight control, navigation and operating systems, and two holographic head-up displays. The displays are compatible to night vision imaging system and enable the aircrew operate in total darkness with special night vision devices in special operations (9:3).

Concept of Economic Life

In ideal conditions, once the system is produced and operations begin, it is expected to be useful forever. This is not true in reality. Because of the deterioration and obsolescence of the systems or products, their useful life is limited.

The economic life can be defined as the period of time that will elapse before the equipment is displaced from intended service by more economic equipment. Economic life is the period over which the equipment will continue to have the lowest annual cost compared to any contender for the service. It implies that the period will end with the appearance of equipment having lower annual cost (24:85). The causes behind the system replacement decision are deterioration and obsolescence.

Factors determining obsolescence

Obsolescence describes that the situations where the technological life of the system is about to be terminated, not by deterioration but by the fact that technological advances make necessary the replacement with up-to-date equipment. This replacement sometimes can be unfeasible. The machine's obsolescence can be determined by comparing its operating cost when new with the operating cost of the latest replacement model.

The following aspects illustrate some cost differences resulting from technological inferiority in design:

- Higher fuel and power consumption because of lower design efficiency
- Lower productivity because of lower productive speeds
- Higher maintenance and repair due to inferior design plans
- More breakdowns from design weakness
- Less reliability because of poorer design calculations

- Greater spoilage from less accurate design
- More labor and supervision because design is not as highly automated
- More floor space from less compact design. (24:190-191)

Obsolescence is the result of technological advancements. As the newer systems appear the old system becomes obsolete. Generally, the newer system demonstrates the state of the art technology with its size, efficiency and the effectiveness. In many cases, keeping the obsolete system is not a feasible alternative in terms of operating costs, especially when the first investment is not very high. The newer systems are desirable, because of their increased capability, speed and the lower energy consumption. On the other hand, if the old systems investments do not justify the replacement, in other words high first investment cost, upgrading, or refurbishing sometimes can be the feasible alternative.

The other concept that dictates the refurbishing or replacement decision is deterioration.

Factors determining deterioration

"Deterioration can be defined as the lowering of the engineering efficiency of equipment compared to that existing when the equipment was new" (24:190). Deterioration is related to the age of the system. As the system gets older, it requires more preventive and corrective maintenance. In addition to this, the efficiency of the system also decreases. This causes increases in operating and support cost. Taylor indicates some cost aspects related to the deterioration of the system:

- Increased fuel and power caused by lower machine efficiency
- Increased maintenance and repair due to failure of parts
- Increased labor idle time due to increased frequency of breakdowns
- Increased spoilage and increased labor and material wastage due to unreliability

- Increased labor due to reduced speed and lower productivity
- Increased inspection costs due to loss of reliability
- Increased overhead due to unreliable equipment (24:190-191)

Deterioration is different from obsolescence. While obsolescence is related to the emerging technologies, the deterioration is related to the age of the system. It indicates increases in supporting cost in terms of maintenance, also the operating cost from the point of view of decreasing efficiency.

The bathtub curve can show the effect of time or age to the reliability of system.

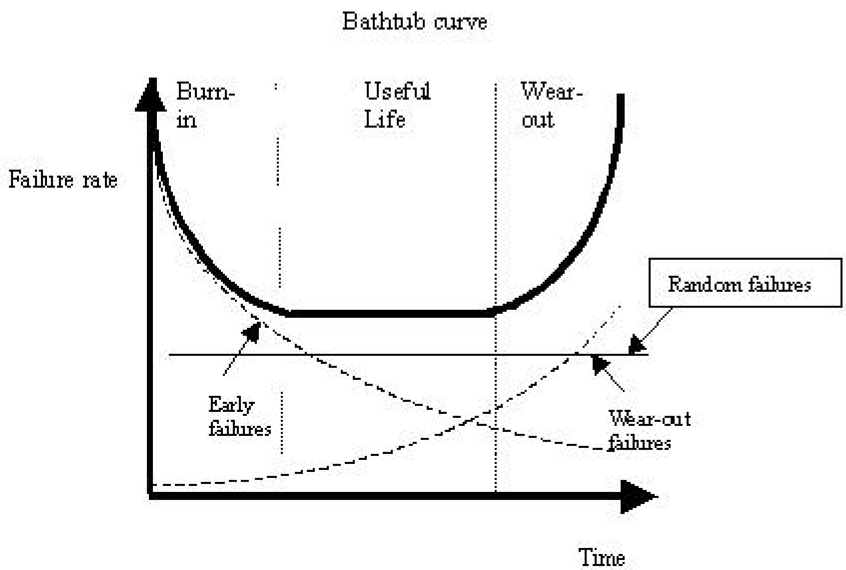

Figure II.1. Bathtub Curve (1:13)

Bathtub Curve

The bathtub curve shows us that a system near the end of its useful life will incur increasing maintenance cost while its reliability is decreasing. The bathtub effect takes its name from the shape of the graph of failure rate against the system age.

In the burn-in period of the system life, the failure rate starts high due to design problems or manufacturing defects such as: welding flaws, cracks, defective parts, poor quality control, and poor workmanship. This early failure decreases as these problems are fixed (1:12). In this period, testing, quality control, screening and acceptance testing can decrease the failure rate (12:32).

As the system matures, the failure rate becomes nearly constant during a useful life period. In this period, the reasons for the failures in the system can be environment, random loads, chance factor, and human error. Designing in excess strength can reduce the failure rate (12:32).

As the equipment ages, the failure rate starts increasing because of fatigue, corrosion, friction, cyclical loading, wear out, and old age of the system (12:31;3:355). In this period, the failure rate can be decreased by preventive maintenance, replacement of parts, and refurbishing (12:32).

Obsolescence and deterioration are the two main factors that determine the economic life of the system. Especially in a high threat environment, all armed forces want to dominate their rivals with the technology. Obsolescence can occur anytime. In a dynamic environment, upgrading or replacing the former version of the system is the alternative for this situation. However, deterioration is related to the age of the system. As shown in the bathtub curve, as the system gets older, the failure rate increases, and preventive maintenance, replacement of parts, and refurbishing is the ways to decrease the failure rate. The bathtub curve also shows us that in initial stage of the system the failure rate starts high, then decreases as manufacturing defects are fixed until it reaches steady state condition in terms of failure rate, and finally as the system gets older, the failure rate increases.

Life Cycle Cost Analysis (LCC Analysis)

The life cycle of a product or system is the entire life starting from design through disposal. All cost associated with this cycle is the Life Cycle Cost (LCC). The LCC of a decision (or system) is the variable cost associated with the decision (or system). If the decision is to proceed with an alternative, then the difference between total costs with and without the alternative (or any other) is the LCC (19:3). Declining military budgets motivate military organizations to make the correct decision, and selecting the best value item. Determining the best value item requires balancing performance (speed, payload, MTBF), schedule (Initial Operating Capability, production rate), supportability (mean time to repair, maintenance manpower), and cost (acquisition, operating, support) (20:28-30). Benson categorizes the benefits of LCC analysis as:

- Justify for "spend to save" decisions.
- Enables to compare competing systems.
- Evaluation of alternative systems.
- Enable decisions to be better informed.
- Monitoring a program or process effectively.
- Performance and cost trade-off decisions. (3:3)

Seldon provides a similar list of benefits:

- Long-range planning and budgeting: LCC aims to reach more detail for planning purposes and a quantitative basis for the total budget.
- Comparison of competing programs: LCC analysis gives opportunity to the analyst to compare the costs of alternatives that meet the operational requirements.
- Comparison of logistic concepts: The cost comparisons of various logistic support concepts of a system can be evaluated for the entire life cycle.
- Decisions about the replacement of aging equipment: Cost analysis shows the facts about the importance of replacement of the aging equipment.
- Control over an ongoing program: LCC can be used as a decision criterion as the program progresses; decisions must be made regarding the LCC.
- Selection among competing contractors: It is also the criteria in source selection, especially in DOD acquisition process. (22:11-12)

The life cycle is the entire life of a system from design to disposal and the money incurred for the system in its entire life cycle is called the LCC. Seldon and Benson point out that the LCC analysis is useful for evaluating alternatives from the point of view of cost, providing insight about the cost of the product to be manufactured, giving opportunity to the managers to monitor the program effectively, and showing the trade-offs to the manager in terms of cost and performance.

Sensitivity Analysis

While performing LCC analysis, the analyst might use some uncertain data, due to "inadequate input data, initial assumptions, pushing the state of the art, or any combination of these factors" (5:96). In these cases, the analyst has to employ sensitivity analysis in order to evaluate how the result would change based on the inputs. He has to estimate the result of changes in the parameters. The analyst has to evaluate the risk and uncertainty when decisions are made according to the result taken from the analysis.

While applying the sensitivity analysis, the analyst changes some uncertain parameters in order to find in which range the solution justifies the decision made. This analysis is important to reducing risk.

Decision makers are typically interested in the full range of possible outcomes that would result from variances in estimates. Sensitivity analysis, when used as part of a LCC analysis, allows us to determine how sensitive final results are to changes in the values of estimates (13:180).

Cost Drivers

In LCC analysis, there are often too many details that cannot be assessed. That is why the analyst should focus on the important areas in order to reach the best conclusion.

To determine the trade-offs, the cost drivers must be known. Cost drivers are "those activities that cause the incurrence of costs" (23:21). "Pareto's law" states that most of the costs of a product are concentrated on a few parts of that product (22:197). If the analyst concentrates on the few significant cost drivers, an efficient LCC program is possible.

According to Seldon there are some common sense, general ideas for the system and process costs:

- New development are expensive
- Tight schedules are more expensive than a relaxed pace, though too leisurely a schedule is also costly.
- Manpower requirements during the O&S phase are cost generators.
- Any requirement that increases the total force needed to meet the user's specifications is a cost driver. (22:198-199)

The analyst should list the significant cost drivers before performing a LCC analysis. In the production phase, as the process goes further, the detail for the cost drivers can be better defined to reach a more precise LCC estimate.

Some Classifications of Cost

While dealing with LCC, one of the most important tasks is defining the types of costs accurately. There are several types of costs associated with LCC. Some of them will not be considered to be important, depending upon the type of decision. The analyst must include all appropriate types of costs in his list to make an accurate estimate and provide correct data to the decision maker.

Sunk Cost

The portion of cost that is not recoverable (10:28). This is the cost already incurred or which cannot be recovered by any action. A sunk cost is "one that cannot be recovered or altered by future action and is therefore irrelevant" (13:27). Edwards and Black define sunk cost as "cost of resources already acquired and will remain unchanged by any choice between alternatives" (4:47). LCC analysis searches for the best alternative by looking at the future costs of the alternative systems. Because of this, sunk cost is not relevant for LCC analysis. For example, the depreciation on a piece of production machinery will have no effect on a decision with respect to replacing that machine. In addition to this, cost of a specialized warehouse for the new system built is also sunk and cannot be recovered even if the procurement of the new system would be canceled.

Investment Cost

It is the cost of acquiring the system or capability that cannot be recovered after the project starts. For purchased equipment, these include the purchase price plus shipping cost, installation cost, and training cost. For fabricated systems, structures, or items of equipment, they include engineering, design, and development costs, test and evaluation cost, and construction or production costs as well as shipping, installation and training costs (13:22).

Fixed Cost

A cost that does not vary in the short run. Fixed cost is ordinarily defined as that group of costs involved in a going activity whose total will remain relatively constant throughout the range of operational activity (13:23).

Charlton and Perloff define fixed cost as “costs that do not vary with the level of output” (10:28). Fixed costs are made up of such cost items as depreciation, maintenance, taxes, insurance, lease rentals, interest on invested capital, sales programs, certain administrative expenses, and research (13:23).

Variable Cost

A cost that changes with the level of output. For example, the consumption of fuel or raw material for a production process. These costs change according to the number of units produced. These costs may include direct and indirect costs. (6:2-3)

Direct Cost

The costs of the basic elements of the system, this cost is the most perceived cost while operating or producing the system. Examples could be fuel, oil, and wages of the personnel and raw material. This is the cost that can be traced in the production process. Direct cost is usually categorized as direct labor and direct material. Direct materials include those materials which can be specifically identified with a product; direct labor includes that human effort which can be traced directly to the manufacture of the specific product.

Indirect Cost

The cost elements that are not directly related to the operating utilization of the system, that is why it is difficult to evaluate this cost. Indirect cost include items such as social security payments, group insurance, holidays and sick pay, hangar lighting (13:25; 6:2-3). This is the element of cost that is not directly traceable to a specific product (4:45). Other indirect cost categories include indirect labor, indirect material, and generated administrative costs.

Cost Breakdown Structure

A Cost Breakdown Structure (CBS) links objectives and activities with resources, and constitutes a logical subdivision of cost by functional activity area, major element of a system, and/or one or more discrete classes of common or like items. A CBS is usually adapted or tailored to meet the needs of each individual program (5:33). It is a systematic approach to break down the cost into logical, traceable subdivisions at lower and lower levels of detail. The CBS should exhibit the following characteristics:

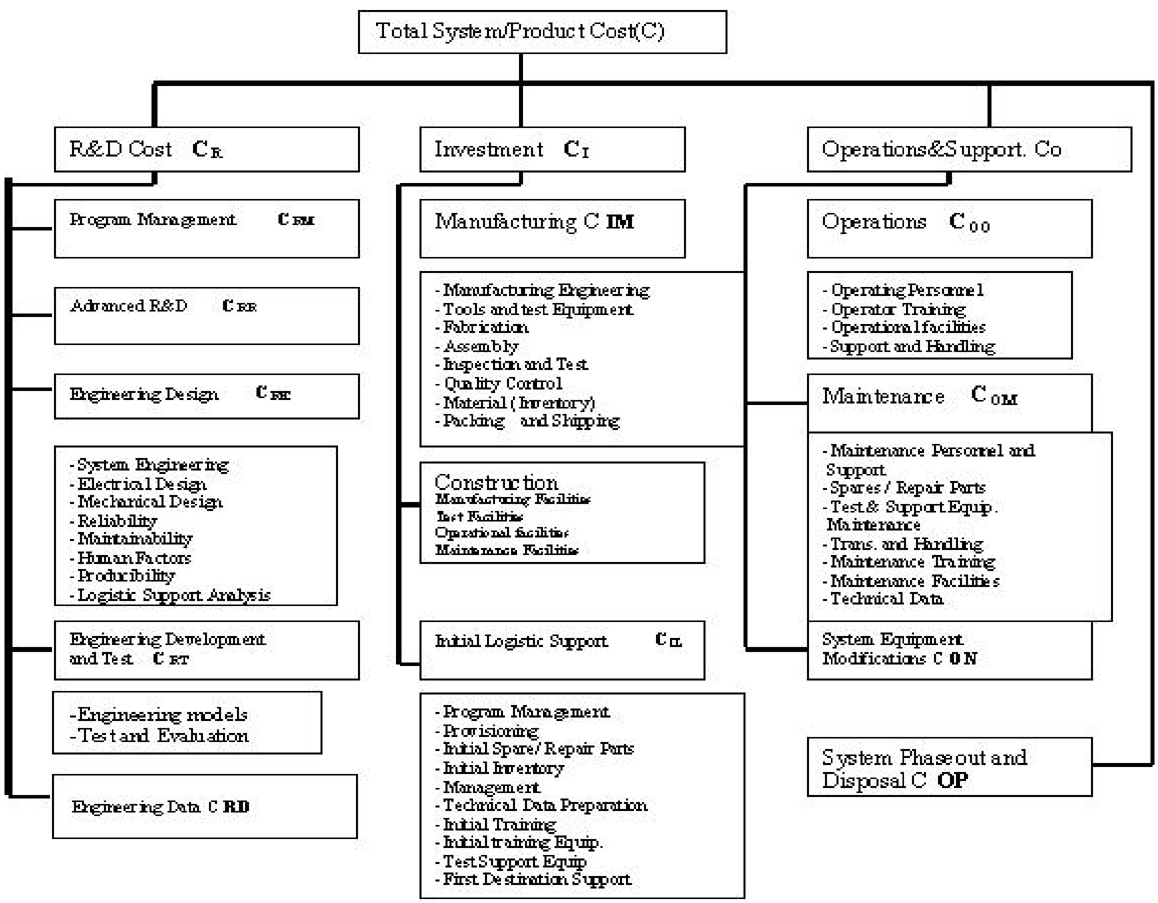

Figure II.2. Sample Cost Breakdown Structure (13:333)

- All costs should be considered and identified in the cost breakdown structure.
- All cost categories should be well defined; there should not be any doubling or omissions.

- Cost must be broken down to the depth necessary to provide management the sensitivity required in evaluating system design, production and operations.
- Cost Breakdown Structure should be designed according to the analysis objectives.
- The CBS and the categories should be coded so as to be separated easily.
- The CBS should be directly compatible with planning documentation, the work breakdown structure, work packages, the organization structure, PERT/CPM, and so on. (5:33)

In this section we reviewed the cost classifications in order to have insight about cost types in LCC analysis. In addition to this, the CBS was presented as a systematic approach to break down the cost into traceable subdivisions in order to include all major cost drivers that affect the LCC of a system. CBS is the most important step of the LCC analysis. This structure provides the opportunity to trace and evaluate the cost. The major cost types (sunk cost, investment cost, fixed cost, variable cost, direct and indirect cost) were also discussed.

Program Costs Over Time

A major weapon system program can be divided into two major time periods: Acquisition and Utilization. The acquisition period starts with an identification of the need of the users, and then progresses by phases through conceptual design, detailed design development, and production. After production, the utilization period starts that includes operating support and disposal of the system (13:2-3).

Acquisition Period

When the need is identified, these are stated by the operational commanders. If the need must be served by new equipment, the acquisition period starts. The first phase of the acquisition period is research and development, which includes conceptual design and detailed design/development. In conceptual design, key activities that have to be completed are market research and analysis, selecting the preferred alternative, developing the initial acquisition strategy, and preparing the LCC estimate. In detailed design, the appropriate subsystems of the system have to be determined. A primary goal is risk reduction. When the “system architecture” is developed, the production phase starts (2:3). This phase includes activities such as selecting the manufacturing requirements, establishment of work methods, manufacturing, quality control, and determining initial logistic support requirements (initial consumer support, spare/repair parts, test and support equipment, technical data, and training) (6:11-12; 13:3). Costs are associated with each of the phases in the acquisition period, and will be discussed below.

Research and Development Cost: This is the cost which is incurred in the first phase of the product life cycle, and it is estimated that 10% of the product or system LCC is incurred in this phase for a typical aircraft (15:3). The proportion of LCC in each category varies greatly by type of system: aircraft versus missiles versus ships, etc. This is the cost incurred during the concept, demonstration, and validation, and full-scale development phases of the acquisition process (16:170).

Research and development (R&D) cost include all of the expenses necessary to produce a set of engineering drawings and specifications for release to manufacturing; this covers the conceptual, validation, and full-scale development phases. It also includes systems engineering studies, design, development, testing, prototype fabrication and testing pilot line fabrication, operations and support planning, and manufacturing planning. (22:21)

In this phase, all the costs incurred to justify the design, analysis of the alternatives and demonstrate feasibility works to put the project into production phase are considered as research and development cost.

Production Cost: This is the cost incurred in the second phase of the product Life Cycle. Production cost is estimated as 30% of the total system LCC for a typical aircraft (15:3). This includes industrial engineering and operation analysis, process development, facility construction, and manufacturing (fabrication, assembly, and test of operational systems), quality control, operation and maintenance of the production capability, and initial logistic support requirements (initial consumer support, spare/repair parts, test and support equipment, technical data, and training) (6:11-12).

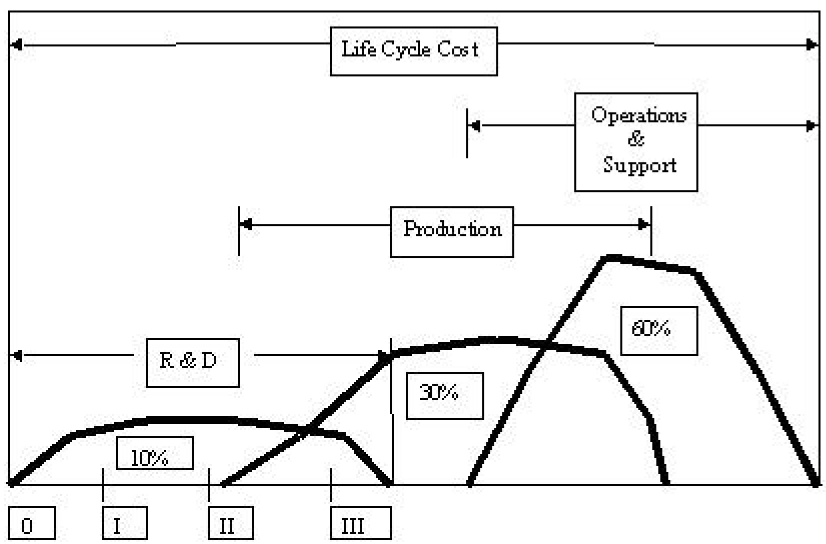

Figure II.3. System Life Cycle Milestones (15:3)

This cost is considered to include the initial customer costs, such as personnel training, testing, transportation, and facilities (22:43). Production actually begins from the point where system design is considered fixed and includes total flow of materials, from the acquisition of the raw materials to the delivery of the finished product (13:10).

Production cost includes all cost associated with the production of the system such as labor, material, quality control, test and support equipments, data and training. After the production phase the system is delivered to system users for operation.

Utilization Period

In the utilization period, we incur costs associated with the operation, support and disposal of the system. In the operation and support phase, the system is distributed and started to be used. Modifications and maintenance activities are in progress. In the disposal phase of the system, system can either be disposed of, or recycled. Costs are associated with each of the phases in the utilization period, and will be discussed below.

Operation and Support Cost: These costs are incurred from the beginning of operation and continue to be incurred through the useful life of the systems until disposal. This is also called ownership cost. For a typical aircraft, it consumes the 60% of the system LCC (15:3). This cost includes the labor costs of operating and maintenance personnel, fuel and power cost, operating and maintenance supply costs, spare and repair part costs, costs for insurance and taxes, and overhead costs (13:22). Kankey points out that not all decisions generate all categories of LCC. He further notes that average percentages by Life Cycle phase vary by type of system (aircraft, missile, electronic), and on a case-by case basis (19:1).

Disposal Cost

This is the cost incurred in the disposal phase of the system Life Cycle. This cost is usually relatively small, but if the system is explosive, nuclear, or uses harmful chemical or biological product, the disposal cost can be high. Such cost may have a significant impact on the predicted LCC (16:173).

Summary of Program Costs

A major weapon system program can be divided into two major time periods: Acquisition and Utilization. The acquisition period includes research and development and production phases, while the utilization period includes the operations, support and disposal phases.

There are four major cost areas in system LCC. These begin with research and development costs which are incurred in the first phase of the acquisition and utilization of the system, including conceptual and detailed design. Next are production costs that are incurred to manufacture the system and all related cost to produce the system. Operation and support costs are incurred next and include operators, energy, fuel, support personnel and the material cost for maintenance. Finally we face disposal costs which are incurred to dispose of the system at the end of its useful life.

Cost Estimating Methods

A cost estimate is an opinion based on analysis and judgment of the cost of a product, system or structure. This opinion may be arrived at in either a formal or an informal manner by several methods, all of which assume that experience is a good basis for predicting the future. In many cases the relationship between past experience and future outcome is fairly direct and obvious; in other cases it is unclear, because the proposed product or system differs in some significant way from its predecessors. The challenge is to project from the known to the unknown by using experience with existing entities. "The techniques used for cost estimating range from intuition at one extreme to detailed mathematical analysis at the other" (13: 144-145).

There are four basic methods for cost estimating: Analogy Method, Parametric Method, Engineering Method, and Expert Opinion. Each of the four basic methods of estimating is effective for research and development costs. Expert opinion is more subjective and requires less data. Analogy is the easiest and is usually used early in the program. If more information and preparatory work are available, parametric methods can be used. Later in the program, when detailed, specific tasks are known and increased accuracy is desired, and it is worth spending the time and money to develop such estimates, an engineering estimate should be used (22:23).

Analogy Method

This method estimates the cost of the new system or product by looking at previous similar systems' cost. While estimating the new system cost the differences have to be evaluated and adjustments have to be applied, so as to reach a more accurate result. Especially in the early stage of the product or system, when the firm is entering into a new activity, estimating by analogy can be used effectively, and appropriate adjustments have to be made for differences "in size, number, performance, complexity, schedule, and advancements in the state of the art" (13:146;22:23). Judgment is very important for the accuracy of the estimation with this method. This method is fairly easy and quick.

Parametric Method

In this method, the analyst tries to find a functional relationship between changes in costs and the factor or factors upon which the cost depends (such as output rate, weight, lot size) by using statistical techniques (13:147).

These methods assume that one or more parameters of the program explain the cost. This method can be simple mathematical model or complex statistical formulas. For example, the cost of the fuel consumed by the aircraft can be computed by using the hours flown by the aircraft. Assuming that fuel is consumed by any one aircraft at the same rate per hour, total fuel cost can be predicted using:

$$FC = N * FH * CR * C \quad (1)$$

where,

FC: Fuel Cost (dollars)

N: number of aircraft

FH: flying hrs per aircraft (hours)

CR: fuel consumption per hour (gallons)

C: cost of the fuel/gallon (dollars)

Many times, more than one cause is responsible for the cost. In that case, the cost estimating method must use more than one independent variable (cost driver) to determine the total cost. In this instance, regression analysis is utilized to determine the relationship between the variables. (23: 23)

Engineering Method

This is the method, which is generally the most costly, detailed, time consuming and accurate. The analyst has to determine each part of the system and show all the lowest detail in his cost breakdown structure and assign the cost to them.

The engineering estimator begins with a complete design and specifies each production or construction task, equipment, and tool need and material requirement. Costs are assigned to each element at the lowest level of detail. These are then combined into a total for the product and system. (13:145)

This method is not feasible for the most complex systems. It requires more hours of effort and data. However, it is hard to find the detailed data for the complex systems. This may cause strange results when we combine the cost of detailed data estimates; the cost of the whole often becomes greater than the sum of the cost of the parts. (13:145)

Expert Opinion

In this method, the cost of the new system or product is estimated by consulting with experts who have experience with similar projects. The strength of this method is that the expert can take the exceptional characteristics of the new system into account, and integrate his or her past experiences with the new techniques and applications for the future projects. On the other hand, the weakness of this method is that the quality of the estimate will be highly dependent on the expert's judgment, which can be biased, optimistic or pessimistic with respect to the system (17:3).

An expert-consensus mechanism such as the Delphi technique may be used to produce the estimate. In the Delphi technique, experts are asked questions which they answer independently and anonymously. In this way, they are answering the questions without being affected the other's ideas. They independently provide numerical estimates, which are gathered and analyzed statistically. The experts who provided estimates outside the middle two quartiles are asked to provide justification for their response, which is shared anonymously with the other experts. This process continues for several iterations, and the responses will eventually seek consensus. This method is somewhat labor intensive, expensive and time consuming (14:262-263).

This method is often used in combination with the other LCC estimation techniques. For example, expert opinion is used with the analogy method for quantifying the relationships between the new and the old systems (17:3). It is also used in parametric method to identify the cost drivers and to specify the expected cost functions (17:4).

It should be noted that a larger problem (system) could often be broken into smaller problems (systems). Different techniques can be used on the smaller pieces. Analogy on some, parametric where appropriate, engineering methods where the data is highly valued, and the expert opinion can be used where the data is unavailable.

Breakeven Analysis

A breakeven analysis should be accomplished prior to arriving at a final decision in connection with the selection of a preferred approach (5:62-63). When we evaluate the alternatives to be selected for procurement from the operation and support cost standpoint, by looking at the LCC of the alternatives we might select one alternative which is not favorable in the long term. That is why breakeven analysis has to be employed in order to make the assessment of which alternative would be best over different time spans.

In the evaluation of the alternatives, breakeven analysis shows us which alternative would be favorable and when. After breakeven analysis, we can choose the alternative according to the organizational strategy and the financial opportunities we have. It would be desirable to see the cumulative cost of the alternatives over the years in order to reach a conclusion about the alternatives. The total cost would depend on the time horizon that the systems would be used by the organization. If the systems are considered to be employed for a long time period, the selection decision would favor longer-term cost savings over short term costs.

Breakeven analysis can also serve to compare the risk and cost evaluation of the systems. For instance, if the total life cycle costs of the systems are not significantly different in the long run, it can be decided to choose the expensive system in order to avoid the risk of the cheaper system. Breakeven Analysis is the essential technique to determine the favorable alternative.

Summary

This literature review presented the performance features of the C-130E/B and J model aircraft. Then, basic concepts related to LCC analysis and the cost factors relevant for weapon system acquisition and utilization were presented as well.

This chapter noted that the C-130J is the latest version of the C-130s, and it is equipped with the state-of-the-art technology that enables it to climb faster and higher, and to land and take off in a short distance. Moreover, it is more fuel-efficient, and flies farther, when we compare it with the earlier versions of the C-130s.

The concept of economic life was explained, and obsolescence and deterioration were noted as factors that determine the economic life of a system. Obsolescence occurs as a result of environmental or technological changes. Deterioration is related to the age of the system, as reflected in the bathtub curve. As the system gets older, the failure rate increases, and preventive maintenance, replacement of parts, and refurbishing are the ways to decrease the failure rate.

In the third part of the chapter, the LCC concept and its benefits are explained. Life cycle is the entire life of a system from design to disposal and the money incurred for the system in its entire life cycle called LCC. LCC Analysis is useful for evaluating the alternatives from the point of view of cost, providing insight about the total system cost.

Finally, the cost classifications are explained and related to the phases of purchasing and operating major systems. These costs include the research and development cost, production cost, operation and support cost, and disposal cost.

Cost estimating methods were presented, and characteristics indicating their use were discussed. Analogy, parametric, the engineering, and expert opinion were the four methods discussed.

In the next chapter, the methodology to be used in this research will be presented and described.

III. Methodology

Chapter Overview

This chapter explains the process that will be used to meet the objectives of this research. The Literature Review presented the performance of the various C-130 types, LCC, cost elements of the LCC methods, and the Cost Breakdown Structure of the typical system. This chapter discusses the needed C-130 O&S cost elements, the data collection process, and the LCC method that will be employed. It includes the research objectives, research design and implementation, expected results and scope and limitations.

Research Objectives

The C-130s are the main body of the Turkish Air Lift group, but their operation and support cost is constantly increasing due to their age. Because of this reason, the TUAF needs to find a way to decrease their O&S cost and increase the effectiveness of the Air Lift group. In this case there are two alternatives to be evaluated:

1. Refurbishing the existing C-130s.
2. Buying the newest version of C-130s and replacing the existing C-130s.

The TUAF does not have O&S cost estimates for the C-130E, C-130B, and C-130J. In addition to this, the TUAF does not currently have a system to estimate these O&S costs. Under these circumstances, the objectives of this research are:

1. Determine the most suitable way to evaluate the O&S cost of the C-130E/B and J models.

2. Estimate the O&S cost of the 130E/B and J models by using that technique.
3. Perform sensitivity analysis to determine cost drivers and breakeven points.

Review of the Cost Accounting Methods

The first step in the research is to investigate and structure a suitable LCC model. The starting point of LCC Analysis was to follow the general guidelines presented in the AFIT Graduate Logistics Management class LOGM 614, Acquisition Logistics Overview Course. The handouts and the class project helped to clarify LCC Analysis, and the importance of LCC Management in decision-making. Additional sources that had to be applied were the library search engines, to include the Online Public Access Catalog, the CD-ROM based ProQuest, and Copernic.

This effort captured the principles contained in several theses, books, and DOD manuals. The DOD manuals, previous theses and the book written by Fabricky and Blanchard served as the sources that gave insight into LCC Analysis and provided a necessary framework and the techniques that had to be employed to implement the subsequent parts of the research.

Once the model and approach were determined, the second step was to perform the analysis of the C-130 E/B and J models' Operation & Support Systems.

Analysis of the C-130 Operation & Support Systems

In this step, the aim is to understand the cost elements related with the O&S systems of the C-130 models that will be compared. In the Literature Review part of this research, the Cost Breakdown Structure was presented, with the O&S cost elements. Data requirements for the analysis were identified.

The database format was prepared and sent to the Supply and Maintenance Squadrons, and Personnel and Comptroller Departments of the 12th Airlift Base. The confidential data such as the personnel number in the 12th Airlift Base and some confidential fiscal data will be notional. The data related to the C-130J was taken from C-130 System Program Office (SPO) located at Wright-Patterson Air Force Base; any vital data that could not be obtained from these sources was taken from secondary sources. Sensitivity analysis was performed on any questionable secondary data. Some secondary data, such as the acquisition cost of C-130J, can be rough estimates, but have a large affect on the O&S costs of the C-130 types. In this case sensitivity analysis was performed. The next step in the analysis was to perform the cost breakdown structure of the C-130 aircraft. There are several cost breakdown structures for different systems.

Cost Breakdown

In this step, the main task is to develop the Cost Break Down Structure for O&S costs of the C-130 aircraft. The main steps are presented in the "Operating and Support Cost Estimating Guide" issued by Office of the Secretary of Defense Cost Analysis Improvement Group (21:C-1). In this guide, the O&S cost breakdowns are provided for major systems such as aircraft, ships, missiles, combat vehicles, and electronic systems. In addition to this, this guide is parallel to the structure of the Cost Oriented Resource Estimation (CORE) model that was employed to execute the LCC Analysis (18). Cost personnel in Office of Secretary of Defense have currently used the CORE model, and the reasons for choosing this model are:

1. It can deal with the different cost estimating techniques.

2. It is oriented for aircraft-level estimates.

3. The spreadsheet can be easily used to implement this model.

The CORE model was used as the fundamental baseline for organizing the cost data for this research.

Estimation of Ownership Cost

The final step in this research was to estimate the total ownership costs of the C-130 types. After estimating the annual costs of each cost element in the O&S Cost Break down structure, they are summed to find the grand total for each type of aircraft to be compared. This is an accounting model, and the main step is determining the cost elements and their values. The values for each cost element are in a constant year dollars.

After estimating the grand total of the Ownership Cost of each type of C-130, a sensitivity analysis was performed over the costs that are subject to change. This reveals more credible estimates based on the vagueness of some values.

The last step is the break-even analysis. When comparing the alternatives over time, the break-even analysis may reveal that the alternative that seemed to be favorable can later become unfavorable. The selected alternative could change based on the corporate strategy of the organization. In this research the aircraft are in different stages of their life cycle. When we consider the life cycle of the aircraft to be 50 years, C-130E and B models are in the wear-out phase, and the J model can be either in the burn-in or useful period. Details about the model will be presented in Chapter IV.

Expected Results

The expected results of this research is a set of cost values for each different cost elements in the Cost Break Down structure of O&S related to C-130 aircraft over ten years. These sets of cost information show what cost elements are the cost drivers and have the most affect on the O&S cost of the C-130 aircraft model. This also may reveal the inefficient parts in the operation and maintenance of the C-130s, therefore, can show the quality improvement or efficiency improvement sides of the activities.

In addition to this, this research may provide a guide for performing LCC Analysis for the TUAF.

Scope and Limitations

The purpose of this research is to estimate the cost differences between Turkish C-130E, C-130B and USAF C-130J's O&S cost. It is not to establish as a model that can be used for other systems and products specifically. The general modeling approach could, however, be extended into analyzing other systems.

This research is not performed to find the absolute best alternative; but rather to reveal the O&S cost differences and analyze trade-offs. In the final analysis, the decisions on keeping and refurbishing the existed aircraft or buying the C-130J are up to the decision makers. The purpose of this effort is to provide an analysis of one key part of that decision the O&S costs.

US dollars will be used as a currency because of their stability. Almost all of the spare parts of the C-130s are provided from the USA, that is why it is suitable to use US dollars in the analysis. The values were converted into "then-year dollars" (adjusted for inflation) using the year 2000 as a baseline.

In addition, this research has not been officially sponsored by the TUAF. That is why the data included and used here might not be supported by the TUAF and they may not match exactly with official values. It is also the same for the J model, which has been used in the United States Air Force (USAF).

Summary

The development of the cost breakdown structure for the C-130 aircraft, data collection, and application of the cost estimation techniques was used to estimate ownership costs for the C-130 E/B and J models. The data collected for each cost element in the O&S Cost Break Down Structure will be accompanied by the costs that are related with the operation and support activities. Then they will be summed and the grand total for the ownership cost of each type of aircraft will be found. Sensitivity and break-even analysis will be employed. Chapter IV will present the explanation and the rationale behind the allocation of each different cost element as well as the final results of this methodology.

IV. Data Description and Results

Chapter Overview

This chapter presents the analysis and the results of the O&S cost estimation methodology presented in Chapter III. This chapter includes the description of the cost elements of the C-130 and their cost allocation rationale. The chapter ends with a sensitivity analysis of the C-130 cost figures over the years according to the inflation rate.

Cost Breakdown Structure of C-130 Aircraft

The typical cost breakdown structure of the C-130 aircraft shown in Table IV.1 (21:C-1) is based on the CORE model.

Table IV.1. Cost Breakdown Structure

1.0 Mission personnel:
- 1.1 Operations:
- 1.2 Maintenance:
- 1.3 12th Airlift Base:

2.0 12th Airlift Base Material Consumption:
- 2.1 Fuel and Lubricants (POL), and Energy:
  - 2.1.1 Fuel and Lubricants:
  - 2.1.2 Electricity:
- 2.2 Consumable Material:
  - 2.2.1 Maintenance Material:
  - 2.2.2 Mission Support Supplies:
- 2.3 Other Unit Level Consumption:

3.0 Intermediate Maintenance:

4.0 Depot Maintenance:
- 4.1 Overhaul:
- 4.2 Other:

5.0 Contractor Support:

6.0 Sustaining Support:
- 6.1 Support Equipment Replacement:
- 6.2 Modification Kit:
- 6.3 Sustaining Engineering Support:

7.0 Indirect Support:
- 7.1 Personnel Support:
  - 7.1.1 Specialty Training:
  - 7.1.2 Medical Support:
- 7.2 Installation Support:

Table IV.2. Cost Allocation

COST ELEMENTS	ALLOCATION REQUIRED? (Y/N)
1.0 Mission personnel:	
1.1 Operations:	Y
1.2 Maintenance:	Y
1.3 12th Airlift Base:	
2.0 12th Airlift Base Material Consumption:	
2.1 Fuel and Lubricants (POL), and Energy:	
2.1.1 Fuel and Lubricants:	N
2.1.2 Electricity:	Y
2.2 Consumable Material:	
2.2.1 Maintenance Material:	Y
2.2.2 Mission Support Supplies:	Y
2.3 Other Unit Level Consumption:	Y
3.0 Intermediate Maintenance:	
4.0 Depot Maintenance:	
4.1 Overhaul:	N
4.2 Other:	Y
5.0 Contractor Support:	N/A
6.0 Sustaining Support:	
6.1 Support Equipment Replacement:	Y
6.2 Modification Kit:	Y
6.3 Sustaining Engineering Support:	N/A
7.0 Indirect Support:	
7.1 Personnel Support:	N/A
7.1.1 Specialty Training:	N/A
7.1.2 Medical Support:	Y
7.2 Installation Support:	Y

The Cost Breakdown Structure (CBS) includes all operations and support (O&S) resources consumed for C-130 missions. It includes all operation, direct, and indirect support personnel pay and allowances, all fuel, oil and repair part consumed as well as the cost of supporting activities of personnel.

After reviewing the typical cost breakdown structure of the C-130 aircraft, each of the costs should be handled individually in order to reach a better O&S cost estimate.

While analyzing each cost element, the raw cost data should be allocated if the cost information does not definitely belong to one type of the aircraft.

In this research, since most of the cost data was not precisely separated between the aircraft types, and (in some instances between C-130E and C-130B), those cost data were allocated between the flight squadrons and the C-130 aircraft type. Table IV.2 shows the cost elements and whether they required allocation.

The C-130E and C-130B data utilized in the analysis is taken from the 12th Airlift Base Supply Squadron, and is revealed in Appendix H, (English version in Appendix I), while the C-130J data is taken from the Air Logistics Center at Warner-Robbins AFB (WR-ALC) revealed in the Appendix J.

1.0 Mission personnel:

This is the cost element that refers to the pay and allowances of the 12th Airlift Base personnel that are directly or indirectly related to the operation and support of the C-130 aircraft. The mission personnel cost and its allocation are revealed in Appendix A.

1.1 Operations: This is the cost element that refers to the pay and allowances of the aircrew that are required to operate the C-130 aircraft. This cost element includes the pay and allowances of the pilots, navigators, flight engineers and the loadmasters. Since the personnel of the 222nd flight squadron do not fly for the other flight squadrons, cost will be obtained by multiplying their salaries by the number of crewmembers. Then, since both aircraft have the same number of aircrew, obtained cost for the C-130 aircraft is allocated between C-130E and C-130B. In this instance the allocation factor is the ratio of total number of C-130E to the total number of C-130s for C-130E allocation factor, for the C-130B allocation factor, the ratio is the total number of C-130B over total C-130s.

While estimating the operating personnel cost of C-130J, it should not be forgotten that the superior navigation systems and trouble shooting systems of C-130J allows it to be operated without flight engineer and navigator.

1.2 Maintenance: This is the cost element that refers to the pay and allowances of the maintenance personnel including the officers, non-commissioned officers (NCO) and the civilian personnel in the 12th Airlift Base Maintenance Squadron. The base and the intermediate maintenance of the C-130 aircraft are performed by the maintenance squadron, since these resources are shared across aircraft types these costs must be allocated. The allocation factor for the Base and the Intermediate Maintenance will be the ratio of number of C-130 aircraft to the total number of aircraft in the 12th Airlift Base, since the man hours spent for the type of the aircraft are not kept in the database. The maintenance cost will be obtained by multiplying the number of the personnel by the corresponding annual salaries and the allocation factor. After getting the grand total cost of the maintenance personnel, it is allocated between the C-130 types using the allocation factor stated in the cost element 1.1. Since both C-130E and B are old aircraft, and have been serving more than 30 years, they are considered to be equally reliable and maintainable.

1.3 12th Airlift Base: This is the cost element that refers to the pay and allowances for the personnel that are not assigned to work in the flight squadrons and the maintenance squadrons. This cost element includes the cost of pay and allowances for the personnel working in the Civil Engineering, Supply, Communication, Administrative, and the Security Squadrons. Since the personnel numbers of the squadrons are set by the regulations, and do not change according to the type of aircraft, and since all these services are being used by all flight squadrons, the cost of these services are allocated by using the ratio of total number of C-130s to the total number of aircraft (C-130s, C-160s, and CN-235s) in the 12^{th} Airlift Base. All these aircraft types are cargo aircraft, and similar to each other.

In addition to this, every man in Turkey has to make 18 months obligatory commitment. Since all those soldiers work for security, communication, administrative, supply and civil engineering, their food and salary expenditures have to be accounted for by using the allocation factor stated above, then it is allocated between the C-130 types by using the allocation factor stated in the cost element1.1.

2.0 12^{th} Airlift Base Material Consumption:

This is the cost of the all material consumed directly or indirectly on the operation and support of the C-130 aircraft. The optimistic, average and pessimistic allocations of this cost element revealed in Appendix B.

2.1 Fuel and Lubricants (POL), and Energy: This is the cost element that refers to the cost of fuel, oil and the energy required to operate the C-130 aircraft. The allocation factor and the rationale for finding the cost of that consumption will be addressed in the following subsections.

2.1.1 Fuel and Lubricants: This is the cost element that refers to the cost of the fuel and oil required for the unit flying operations. The unit level cost of fuel and the oil is found by multiplying the consumption of fuel and the oil per hour by the annual average flight hours and the cost of fuel and the oil prices per liter in Turkey. Since these substances are managed centrally by the Logistic Command the prices of these substances are the same all over Turkey. In the analysis, the flight hour is taken as a representative data, and sensitivity analysis is applied. The fuel consumption of the Turkish C-130s (4500 lb. per hour, or 692.5 gallons per hour) is similar to the US C-130E fuel consumption of 715 gallons per hour. The Turkish data was utilized across the analysis.

2.1.2 Electricity: The annual base electricity consumption for the year 2000 has been received. These costs are allocated among the supported aircraft in the flight squadron. The allocation factor for the cost of electricity for the C-130 aircraft is as stated in the cost element 1.3**.** After getting the share of the C-130, it is allocated between C-130E and B by using the allocation factor stated in cost element 1.1.

2.2 Consumable Material: This is the cost element that refers to the cost of consumable materials in the operation and support of the C-130 aircraft.

2.2.1 Maintenance Material: This is the cost element that refers to the cost of repair and consumable materials expended during maintenance. This includes the capacitors, transistors, fuses and other bit-and-piece material. The data for consumable materials for each type of aircraft and their usage is kept by the AGSO (Aircraft and Ground Systems Office). Based on that information, every quarter the new consumable material list is prepared. The cost of consumable material for the C-130s will be taken directly from AGSO, which are revealed in Appendix C. On the other hand, the reparable material expenditure is not kept, therefore the representative data from the supply squadron is used for the reparable material consumption and sensitivity analysis is applied.

2.2.2 Mission Support Supplies: This is the cost element that refers to the cost of material to support the mission personnel. This includes the cost of material such as cleaning and office supplies, charts, and computer consumables. The supply squadron centrally manages these materials and their records are kept for each of the squadrons. The value for this cost element was obtained from the Supply Squadron for the 222nd flight squadron was allocated between the C-130 types by using the allocation factor stated in the cost element 1.1.

2.3 Other Unit Level Consumption: This is the cost element that refers to unit level consumption costs that are not included in previous items. This includes the cost of water, telephone, and sewage. Since there is no specific allocation for these costs, the allocation factor will be the ratio of 222nd flight squadron personnel to the total number of personnel in the 12th Airlift Base. Thus, the cost of unit level consumption of these will be the multiplication of the grand total cost of these services by that allocation factor. After finding the total cost of the consumption, the cost allocation stated in the cost element 1.1 is used to find the share of each type of C-130 aircraft.

3.0 Intermediate Maintenance (External to Unit):

12th Airlift Base performs both unit and intermediate level maintenance of the C-130 aircraft, therefore, intermediate level maintenance cost has already been included. Therefore these costs are set at “0” across all alternatives.

4.0 Depot Maintenance:

This is the cost element that refers to the cost of material, personnel and the overhead incurred in performing the depot-level maintenance of the C-130 aircraft, their components, and the ground support equipments. The optimistic, average and pessimistic allocations of this cost element are revealed in Appendix D.

4.1 Overhaul: This is the cost element that refers to the cost of material and the labor costs for overhaul or rework of aircraft returned to a centralized depot facility. Since this cost is not specified for each type of the aircraft, the representative data for C-130E and B from supply squadron is used. The C-130J is the newest aircraft. According to the bathtub curve, the reliability of an aircraft drops as the age of the aircraft increases. Since the overhaul cost of the C-130J aircraft could not be specifically found, it is anticipated to fall between $250,000 and $750,000. Sensitivity analysis is applied for each type of the aircraft to assess impacts of the differences on the results.

4.2 Other: This is the cost element that refers to any significant cost of material and labor that is not included in the previous item. This may include the cost of activities such as supply, administrative services, maintenance and transportation. In this cost element there are two factors (direct and indirect) for the personnel salaries. The allocation factor for the direct personnel is just for the allocation between C-130E and B types as stated in the cost element 1.1. On the other hand, while allocating the indirect personnel support in depot maintenance, we have to consider the other types of aircraft. In this case, the first allocation factor is the C-130E/B quantities divided by the total number of aircraft stationed in the 12th Airlift Base as stated in the cost element 1.3. It is allocated between the C-130E and B by using the allocation factor stated in the cost element 1.1.

5.0 Contractor Support:

This is the cost element that refers to the cost of material, and the labor provided by a contractor to support the logistics required by the C-130 aircraft system. Since, the military personnel in the 12th Airlift Base service all the logistics supports, this cost is set at “0” across all alternatives.

6.0 Sustaining Support:

This is the cost element that refers to the cost of material, and the personnel costs incurred in providing operational reliability, overcoming mission deficiencies, and ensuring system conformance with the specifications and the standards. The optimistic, average and pessimistic allocations of this cost element are revealed in Appendix E.

6.1 Support Equipment Replacement: This is the cost element that refers to the cost of support equipment material required for the operation and the support of C-130 aircraft, aircraft subsystems, training systems, and other associated support equipment, the total cost of this cost element is kept in the BEMO in the supply squadron. All that equipment is also being used by the other types of aircraft. The total cost of that equipment is allocated between the aircraft types by using the allocation factor stated in the cost element 1.3. After obtaining the share for the C-130 aircraft, it is allocated between C-130E and B by using the allocation factor stated in the cost element 1.1.

6.2 Modification Kit: This is the cost element that refers to the cost of procuring and installing modification kits and modification kit initial spares required for the aircraft, and associated support and training equipment. This data is kept by the maintenance operation office, but not specified across the aircraft types, that is why the representative data is utilized and sensitivity analysis is applied. The allocation factor between the C-130 types is as stated in the cost element 1.1.

6.3 Sustaining Engineering Support: This is the cost element that refers to the cost of material, and the personnel incurred in providing continued system engineering and program management oversight to determine the integrity of a system to provide the operational reliability, and to ensure system conformance with the specifications and the standards. This service is provided by the personnel of the 12th Airlift Base, so it is already included.

7.0 Indirect Support:

This is the cost element that refers to the cost of material, and the personnel that are not assigned directly to the operation and the support of the C-130 aircraft, but indirectly required activities for the operation and the support activities of C-130s. The allocations of this cost element are revealed in Appendix F.

7.1 Personnel Support: This is the cost element that refers to the cost of system specific and specialty training of the military personnel. Most of this cost element has already been accounted for in the cost element 1.3 (Appendix A).

7.1.1 Specialty Training: This is the cost element that refers to the cost of material, and the personnel for system specific training and specialty training. There is no specialty training. Pilots receive their training while performing the missions, while the other officers and NCOs are being trained while performing their daily tasks.

7.1.2 Medical Support: This is the cost element that refers to the cost of material, and the personnel needed to support the 222nd flight squadron. The pay and allowances of the medical personnel times the number of medical people will result in the personnel cost. This cost has already been accounted for in the cost element 1.3. In addition, the medical supply unit keeps the medicines cost. The base is operating three types of flight squadrons, and the number of the people in the flight squadrons are the same by regulations, and the rest of the personnel are assigned there to support those three types of aircraft. The allocation factor is therefore as stated in the cost element 1.3 for the medical expenses that belong to the operation and the support of C-130 aircraft. Medical expenditures have to be allocated between the C-130 types by using the allocation factor stated in the cost element 1.1. While estimating the share for the C-130J, the numbers of the operating personnel will have to be considered, since there are no flight engineers and navigators on the C-130J.

7.2 Installation Support: This is the cost element that refers to the cost of material and the personnel assigned to the construction, maintenance, and engineering support of the real properties related to the 222nd flight squadron and the 222 flight line. The data related to these activities are kept by the Civil Engineering Squadron, and then they are refunded by the Supply Squadron. Since this cost element is not specified for each squadron, it is allocated between the flight squadrons considering their aircraft numbers, so the allocation factor is as stated in the cost element 1.3. After obtaining the share of C-130 squadron, it is allocated between the C-130 types by using the allocation factor stated in the cost element 1.1. After performing the analysis, the cost summary and the percentage of each cost element to the total O&S became as it is seen in the Table IV.3.

Table IV.3. Summary of Costs per Aircraft (Average)

	C-130E	C-130B	C-130J	C-130E	C-130B	C-130J
1.0 Mission personnel:						
1.1 Operations:	$137.333,33	$137.333,33	$64.053,00	3,97%	3,97%	2,89%
1.2 Maintenance:	$43.336,94	$43.336,94	$43.336,94	1,25%	1,25%	1,95%
1.3 12th Airlift Base:	$67.686,49	$67.686,49	$67.686,49	1,96%	1,96%	3,05%
2.0 12th Airlift Base Material	**Consumption:**					
2.1 Fuel Oil and Lubricants (POL), and Energy:						
2.1.1 Fuel and Oil:	$1.350.135,00	$1.350.135,00	$1.003.680,00	39,06%	39,02%	45,21%
2.1.2 Electricity:	$6.682,59	$6.682,59	$6.682,59	0,19%	0,19%	0,30%
2.2 Maintenance Material:						
2.2.1 Consumable Material:	$6.710,10	$9.914,58	$3.250,32	0,19%	0,29%	0,15%
2.2.2 Reparable Material:	$852.428,57	$852.428,57	$310.173,32	24,66%	24,64%	13,97%
2.2.2 Mission Sup. Supplies:	$2.564,10	$2.564,10	$2.564,10	0,07%	0,07%	0,12%
2.3 Other Unit Level Consumption:	$4.955,99	$4.955,99	$4.955,99	0,14%	0,14%	0,22%
3.0 Intermediate Maintenance						
4.0 Depot Maintenance:						
4.1 Overhaul:	$750.000,00	$750.000,00	$500.000,00	21,70%	21,68%	22,52%
4.2 Other:	$54.570,62	$54.570,62	$54.570,62	1,58%	1,58%	2,46%
5.0 Contractor Support:						
6.0 Sustaining Support:						
6.1 Support Equipment Replacement:	$122.801,82	$122.801,82	$122.801,82	3,55%	3,55%	5,53%
6.2 Modification Kit:	$35.000,00	$35.000,00	$15.000,00	1,01%	1,01%	0,68%
7.0 Indirect Support:						
7.1 Personnel Support:						
7.1.1 Specialty Training:						
7.1.2 Medical Support:	$3.045,02	$3.045,02	$1.827,01	0,09%	0,09%	0,08%
7.2 Installation Support:	$19.594,59	$19.594,59	$19.594,59	0,57%	0,57%	0,88%
TOTAL	$3.456.845,16	$3.460.049,65	$2.220.176,79	1	1	1

As seen from Table IV.3 the major cost elements are reparable material, overhaul and fuel cost. The C-130J has the lowest O&S cost. Since it is the newest aircraft it has the lowest maintenance cost, as it was discussed by referring the bathtub curve before. In addition, due to its improved propulsion system, it uses 15% less fuel than the other types of C-130 aircraft, so its fuel cost is the lowest.

Sensitivity Analysis

Sensitivity analysis is required when some of the data are representative in order to reach a better assessment about the alternatives. In this case, overhaul costs, reparable material costs, flying hours, and modification kit costs for each type of the aircraft and C-

130J procurement cost are representative. Sensitivity analysis is applied to those costs, as well as the inflation rate of the USA, so the O&S cost of each type of aircraft take their shape according to optimistic, average, and pessimistic approaches. Some data are gotten as an interval. The lower bound of the interval was called “optimistic’, while the upper bound of the interval “pessimistic”, the average of the upper and the lower bounds of the interval was called “average” data. The sensitivity analysis for C-130J procurement cost, and inflation are applied in the breakeven analysis. The “optimistic” approach results are given in the Table IV.4 below.

Table IV.4. Summary of Costs per Aircraft (Optimistic)

	C-130E	C-130B	C-130J	C-130E	C-130B	C-130J
1.0 Mission personnel:						
1.1 Operations:	$137.333,33	$137.333,33	$64.053,00	5,12%	5,11%	3,93%
1.2 Maintenance:	$43.336,94	$43.336,94	$43.336,94	1,62%	1,61%	2,66%
1.3 12th Airlift Base:	$67.686,49	$67.686,49	$67.686,49	2,52%	2,52%	4,15%
2.0 12th Airlift Base Material	**Consumption:**					
2.1 Fuel Oil and Lubricants (POL), and Energy:						
2.1.1 Fuel and Oil:	$900.090,00	$900.090,00	$669.180,00	33,54%	33,46%	41,04%
2.1.2 Electricity:	$6.682,59	$6.682,59	$6.682,59	0,25%	0,25%	0,41%
2.2 Maintenance Material:						
2.2.1 Consumable Material:	$6.710,10	$9.914,58	$3.250,32	0,25%	0,37%	0,20%
2.2.2 Reparable Material:	$783.924,39	$787.128,58	$310.173,32	29,21%	29,26%	19,02%
2.2.2 Mission Sup. Supplies:	$2.564,10	$2.564,10	$2.564,10	0,10%	0,10%	0,16%
2.3 Other Unit Level Consumption:	$4.955,99	$4.955,99	$4.955,99	0,18%	0,18%	0,30%
3.0 Intermediate Maintenance						
4.0 Depot Maintenance:						
4.1 Overhaul:	$500.000,00	$500.000,00	$250.000,00	18,63%	18,59%	15,33%
4.2 Other:	$54.570,62	$54.570,62	$54.570,62	2,03%	2,03%	3,35%
5.0 Contractor Support:						
6.0 Sustaining Support:						
6.1 Support Equipment Replacement:	$122.801,82	$122.801,82	$122.801,82	4,58%	4,57%	7,53%
6.2 Modification Kit:	$30.000,00	$30.000,00	$10.000,00	1,12%	1,12%	0,61%
7.0 Indirect Support:						
7.1 Personnel Support:						
7.1.1 Specialty Training:						
7.1.2 Medical Support:	$3.045,02	$3.045,02	$1.827,01	0,11%	0,11%	0,11%
7.2 Installation Support:	$19.594,59	$19.594,59	$19.594,59	0,73%	0,73%	1,20%
TOTAL	$2.683.295,98	$2.689.704,66	$1.630.676,79	1	1	1

In this case, C-130J has still the lowest O&S cost, the overhaul cost, reparable material and the fuel cost are the major cost drivers. The optimistic, average and pessimistic data were utilized in order to see the cost change in terms of “optimistic” (the lower bound of the interval), and “pessimistic” (the upper bound of the interval), also, the average cost data were utilized to reach an accurate O&S cost figures. The results of applying the pessimistic approach are shown in the Table IV.5:

Table IV.5. Summary of Costs per Aircraft (Pessimistic)

	C-130E	C-130B	C-130J	C-130E	C-130B	C-130J
1.0 Mission personnel:						
1.1 Operations:	$137.333,33	$137.333,33	$64.053,00	3,24%	3,24%	2,28%
1.2 Maintenance:	$43.336,94	$43.336,94	$43.336,94	1,02%	1,02%	1,54%
1.3 12th Airlift Base:	$67.686,49	$67.686,49	$67.686,49	1,60%	1,60%	2,41%
2.0 12th Airlift Base Material	**Consumption:**					
2.1 Fuel Oil and Lubricants (POL), and Energy:						
2.1.1 Fuel and Oil:	$1.800.180,00	$1.800.180,00	$1.338.180,00	42,49%	42,45%	47,68%
2.1.2 Electricity:	$6.682,59	$6.682,59	$6.682,59	0,16%	0,16%	0,24%
2.2 Maintenance Material:						
2.2.1 Consumable Material:	$6.710,10	$9.914,58	$3.250,32	0,16%	0,23%	0,12%
2.2.2 Reparable Material:	$927.642,86	$927.642,86	$306.923,00	21,89%	21,88%	10,94%
2.2.2 Mission Sup. Supplies:	$2.564,10	$2.564,10	$2.564,10	0,06%	0,06%	0,09%
2.3 Other Unit Level Consumption:	$4.955,99	$4.955,99	$4.955,99	0,12%	0,12%	0,18%
3.0 Intermediate Maintenance						
4.0 Depot Maintenance:						
4.1 Overhaul:	$1.000.000,00	$1.000.000,00	$750.000,00	23,60%	23,58%	26,72%
4.2 Other:	$54.570,62	$54.570,62	$54.570,62	1,29%	1,29%	1,94%
5.0 Contractor Support:						
6.0 Sustaining Support:						
6.1 Support Equipment Replacement:	$122.801,82	$122.801,82	$122.801,82	2,90%	2,90%	4,38%
6.2 Modification Kit:	$40.000,00	$40.000,00	$20.000,00	0,94%	0,94%	0,71%
7.0 Indirect Support:						
7.1 Personnel Support:						
7.1.1 Specialty Training:						
7.1.2 Medical Support:	$3.045,02	$3.045,02	$1.827,01	0,07%	0,07%	0,07%
7.2 Installation Support:	$19.594,59	$19.594,59	$19.594,59	0,46%	0,46%	0,70%
TOTAL	$4.237.104,45	$4.240.308,93	$2.806.426,47	1	1	1

Sensitivity Analysis was applied to the major cost elements of overhaul cost, reparable material cost, flying hours, and modification kit cost. When the sensitivity analysis was applied, it was seen that in both instances, C-130J has the lowest O&S cost.

Breakeven Analysis

Breakeven Analysis is important for keep-or-buy decisions. In this research, the operation and support costs of C-130E, C-130B and C-130J models were investigated. According to the analysis, C-130J has the lowest O&S cost in each case (optimistic-pessimistic), when the inflation rate of the USA is held constant at 2.3% over 40 years. (as can be seen from the Figure IV.1). The TUAF already has the other types of aircraft, and in this case the decision makers would want to know how long would it take to reach a break-even if C-130J is procured. The breakeven analysis covered the next 40 years (from year 2000) in the sensitivity analysis for inflation rate.

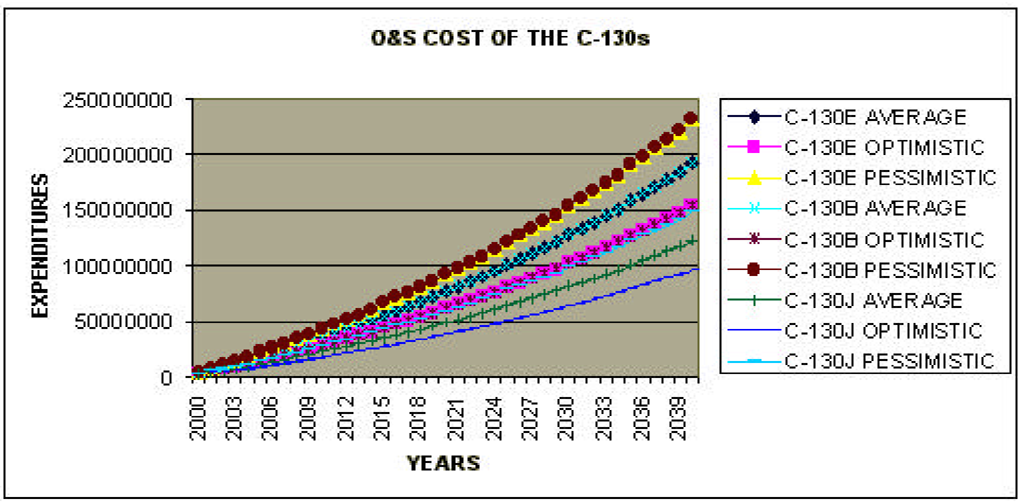

Figure IV.1. O&S Costs of Each Type of Aircraft over 40 Years with 2.3% Inflation Rate

Sensitivity Analysis for Inflation Rate

While performing breakeven analysis, the other variable that has to be considered is the inflation rate. While performing the analysis, the 2001 inflation rate of USA was determined to be 2.3%. By taking this inflation rate as a stand point, future inflation rates can be estimated. In this research the lowest inflation rate for USA for next 39 years was assumed as 1.8% for optimistic approach, 2.3% for average, 3.3%, and 5% for pessimistic. The computation of the constant rates of the inflation for the next 39 years for optimistic, constant and pessimistic approaches is revealed in Appendix G.

When the sensitivity analysis is applied to the inflation rate, while holding the other representative data average across 40 years, the breakeven point changes according to the inflation rate. Figure IV.2 shows the breakeven point when the inflation rate is 1.8% from the year 2002 through 2040.

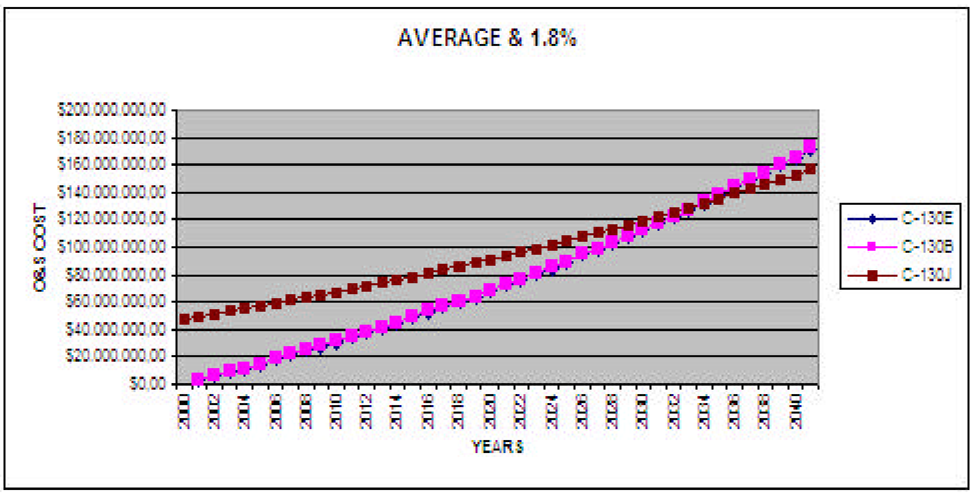

Figure IV.2. Sensitivity Analysis to the Average Data with 1.8% Inflation Rate

As it is shown in Figure IV.2, when the representative data and the procurement cost of the C-130J is taken average, while the inflation rate 1.8% from the year 2002 to 2040, then the breakeven point would be somewhere between the years 2032 and 2033.

The sensitivity analysis is applied to the inflation rate while the cost data is held at average to see the inflation affect on the breakeven point, it would be useful to look at additional inflation figures effects.

If the inflation rate of the USA is assumed to stay 2.3% over 40 years, then the breakeven point would be as seen from Figure IV.3. The breakeven point would be somewhere between the years 2030 and 2031.

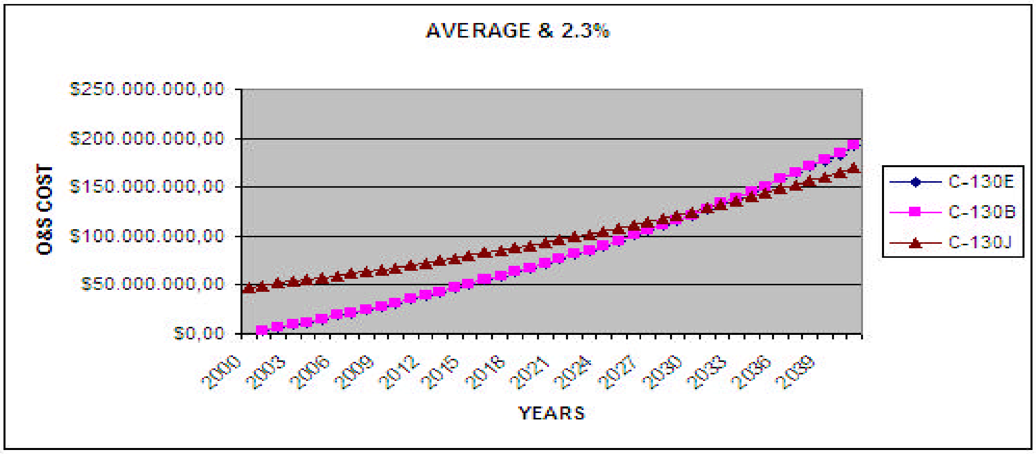

Figure IV.3. Sensitivity Analysis to Average Data with 2.3% Inflation Rate

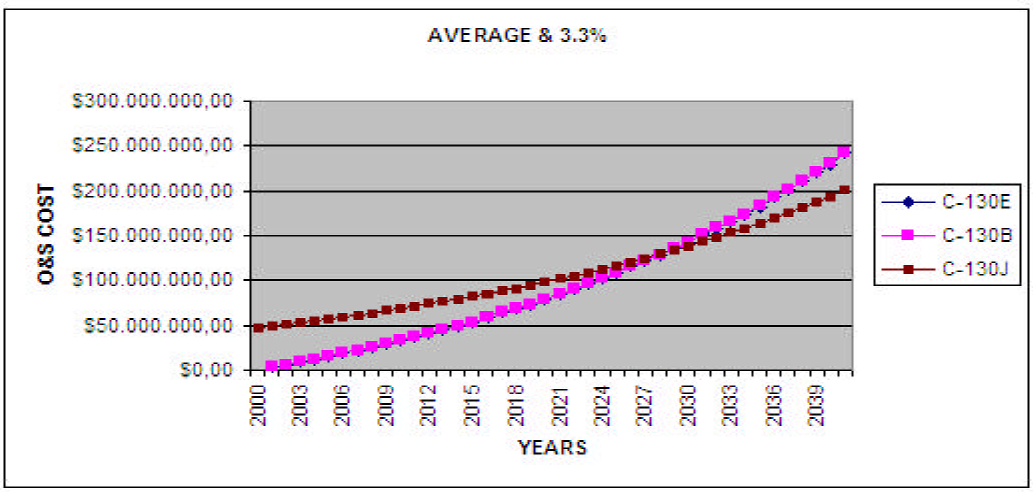

Figure IV.4. Sensitivity Analysis to Average Data with 3.3% Inflation Rate

When the representative data and the procurement cost of C-130J are held constant, and the inflation rate of the USA is 3.3%, then the breakeven point would be some where between the years 2027 and 2028.

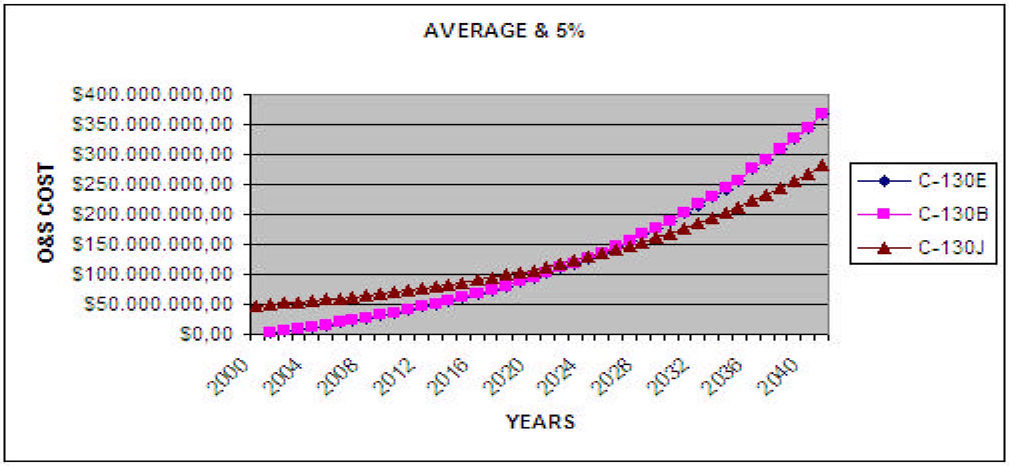

Figure IV.5. Sensitivity Analysis to Average Data with 5% Inflation Rate

As it can be seen from Figure IV.5 the breakeven point would be somewhere between the years 2023 and 2024, when the inflation rate is held at 5%.

As the analysis showed, when the procurement cost of C-130J is taken at the average estimate ($47,500,000), and the representative O&S cost data averages are used, it reaches breakeven point somewhere between years 2023 and 2033. The actual procurement cost of C-130J in the year 2000 was $55,000,000. However, if TUAF decides to buy the C-130J, it is quite likely that some other air forces will want to buy. In this case, the price could drop. The representative data are also subject to change. Sensitivity analysis, has to be applied in order to reach a better assessment. The procurement cost of C-130J was taken as $40,000,000 optimistically in the analysis.

The effect of the inflation should also be investigated on the optimistic data for thorough analysis. The section below shows the effect of the inflation figure on the breakeven point with the optimistic data. Figure IV.6 shows the breakeven point with the optimistic data and 1.8% inflation rate.

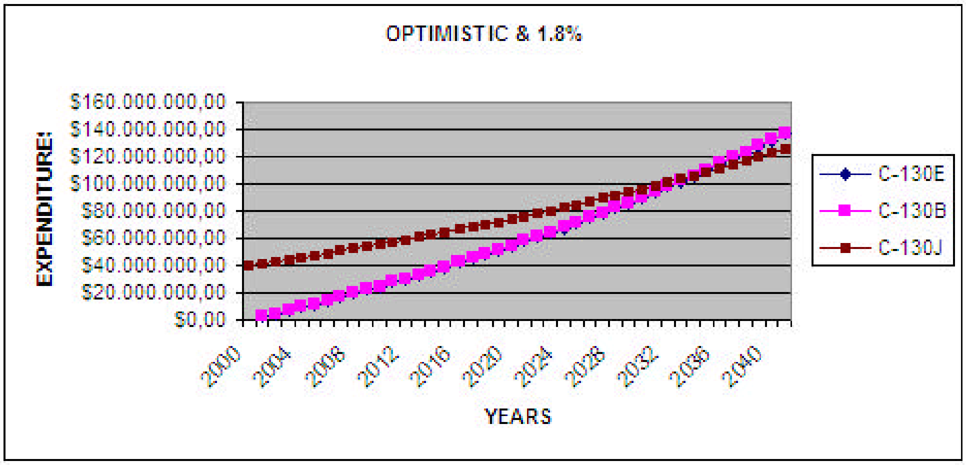

Figure IV.6. Sensitivity Analysis to Optimistic Data with 1.8% Inflation Rate

When the representative data and the procurement cost of C-130J is taken optimistically with 1.8% inflation rate, then the breakeven point would be somewhere between the years 2033 and 2034.

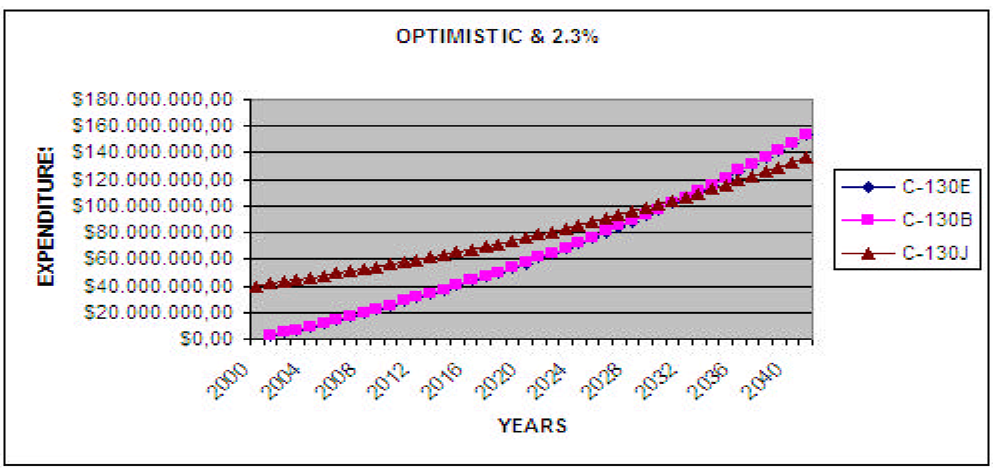

Figure IV.7. Sensitivity Analysis to Optimistic Data with 2.3% Inflation Rate

When the representative data and the procurement cost of C-130J are taken optimistically with the 2.3% inflation rate, then the breakeven point would be somewhere between the years 2031 and 2032.

When the representative data and the procurement cost of C-130J are taken optimistically with the 3.3% inflation rate, then the breakeven point would be somewhere between the years 2027 and 2028.

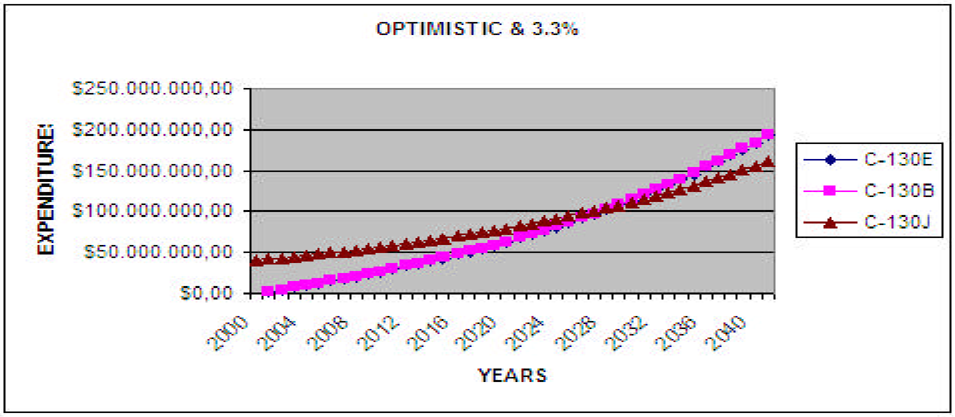

Figure IV.8. Sensitivity Analysis to Optimistic Data with 3.3% Inflation Rate

When the representative data and the procurement cost of C-130J are taken optimistically with the 5% inflation rate, then the breakeven point would be somewhere between the years 2023 and 2024 as it is seen in the Figure IV.9.

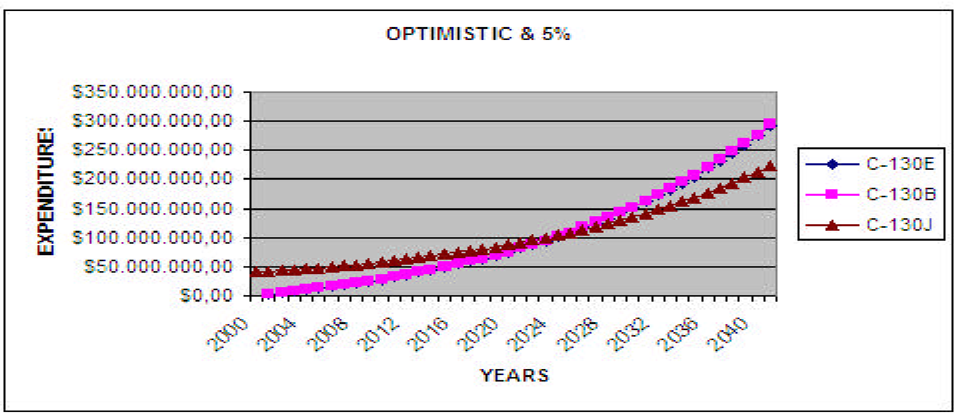

Figure IV.9. Sensitivity Analysis to Optimistic Data with 5% Inflation Rate

In this step, the effect of the inflation on the pessimistic data was investigated. The procurement cost of C-130J is taken as $55,000,000 based on the year 2000 values.

When the representative data and the procurement cost of C-130J are taken pessimistically with the 1.8% inflation rate, then the breakeven point would be somewhere between the years 2032 and 2033 as it is seen in the Figure IV.10.

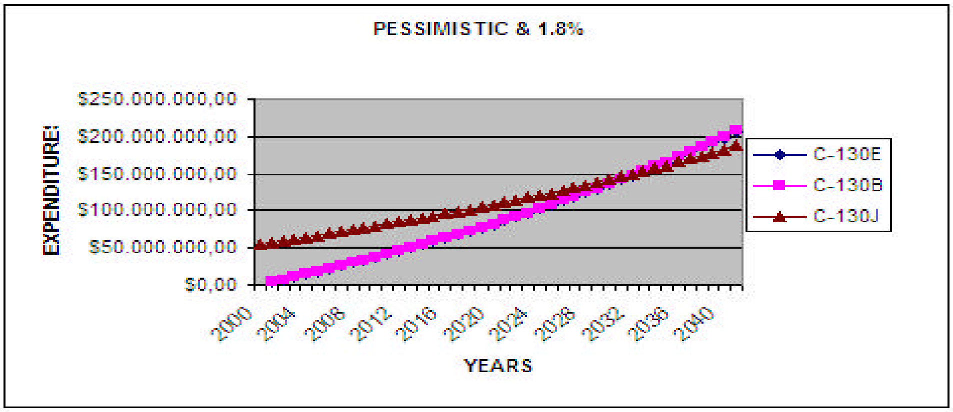

Figure IV.10. Sensitivity Analysis to Pessimistic Data with 1.8% Inflation Rate

When the representative data, and the procurement cost of the C-130J are taken pessimistically, while the inflation rate 2.3%, then the breakeven point would be somewhere between the years 2029 and 2030, as it seen from the Figure IV.11.

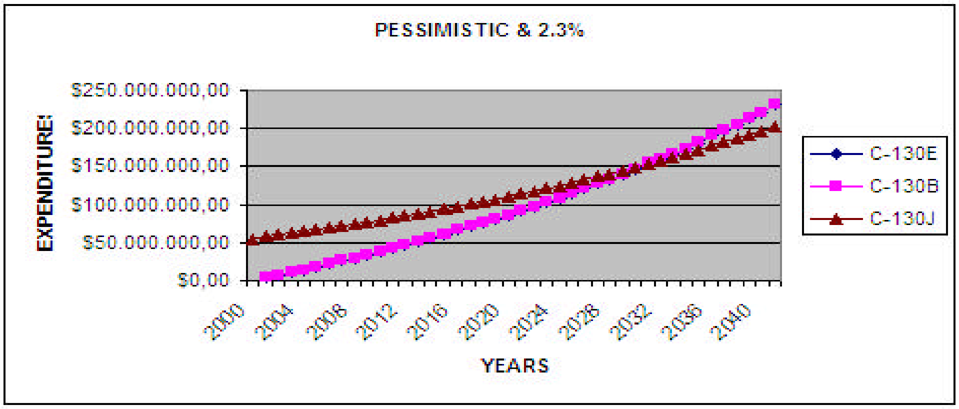

Figure IV.11. Sensitivity Analysis to the Pessimistic Data with 2.3% Inflation Rate

When the representative data, and the procurement cost of the C-130J are taken pessimistically, while the inflation rate 3.3%, then the breakeven point would be somewhere between the years 2026 and 2027, as it seen in Figure IV.12.

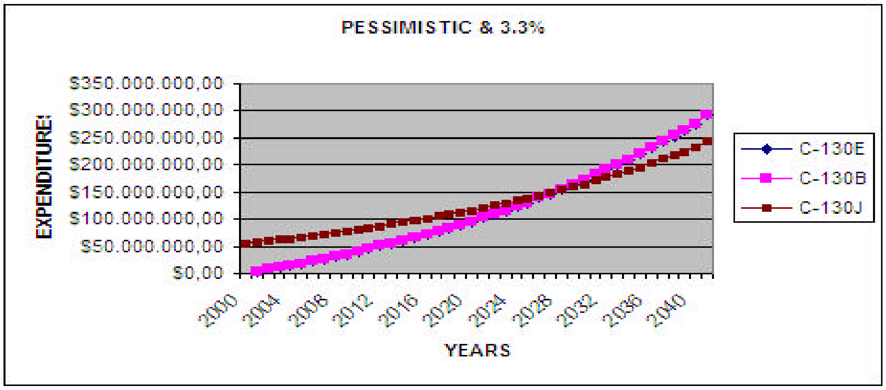

Figure IV.12. Sensitivity Analysis to the Pessimistic Data with 3.3% Inflation Rate

When the representative data and the procurement cost of the C-130J are taken pessimistically, while the inflation rate 5%, then the breakeven point would be somewhere between the years 2023 and 2024, as it seen from the Figure IV.13.

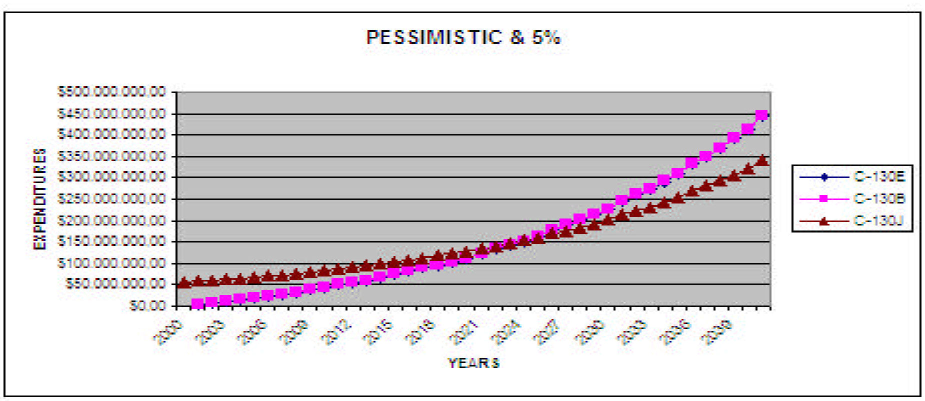

Figure IV.13. Sensitivity Analysis to the Pessimistic data with 5% Inflation Rate

In the last step, the reverse possibilities have to be considered, in this research, C-130E and C-130B were considered to have similar reliabilities, while the C-130J was considered more reliable because of its age and technology. The optimistic and pessimistic values of the aircraft might not be faced at the same time. In this step the reverse situations of C-130E/B and J models were analyzed.

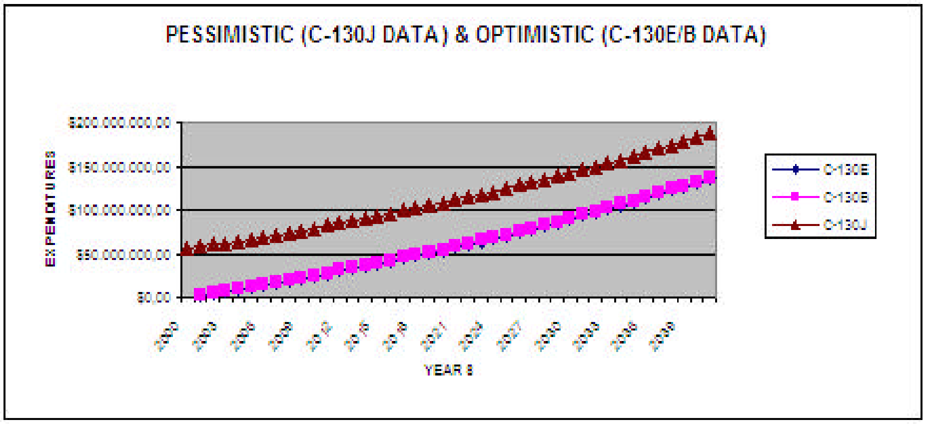

Figure IV.14. Sensitivity Analysis to the Pessimistic C-130J and Optimistic C-130E/B Data with 1.8% Inflation Rate

When the C-130E/B values are taken optimistically, while C-130J data pessimistically with 1.8% inflation rate, the breakeven point would be beyond next 40 years.

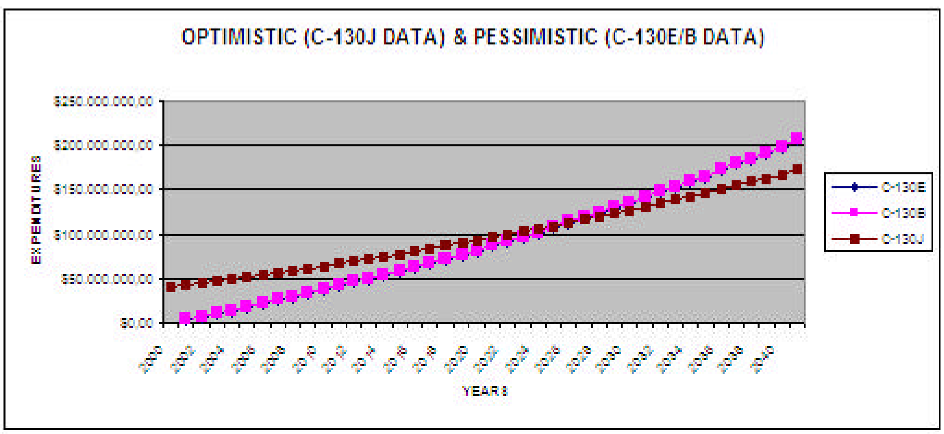

Figure IV.15. Sensitivity Analysis to the Optimistic C-130J and Pessimistic C-130E/B Data with 1.8% Inflation Rate

When the C-130E/B values are taken pessimistically, while C-130J data optimistically with 1.8% inflation rate, the breakeven point would be somewhere between the years 2024 and 2025 as it seen in the Figure IV.15.

When the C-130E/B values are taken optimistically, while C-130J data pessimistically with 2.3% inflation rate, the breakeven point would be beyond next 40 years.

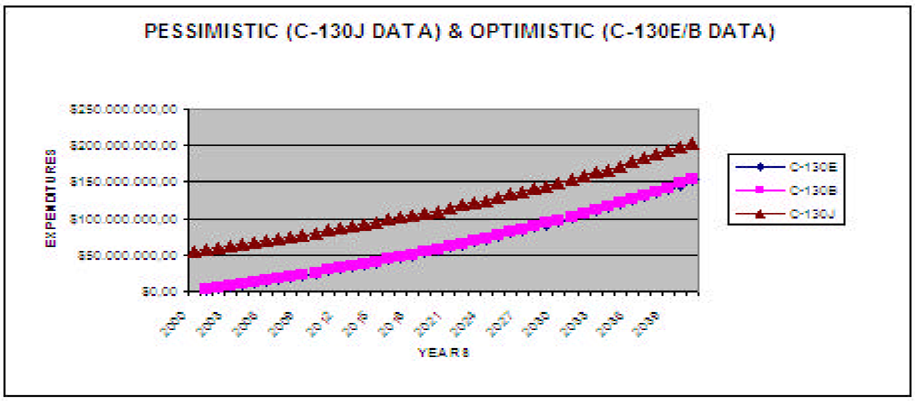

Figure IV.16. Sensitivity Analysis to the Pessimistic C-130J and Optimistic C-130E/B Data with 2.3% Inflation Rate

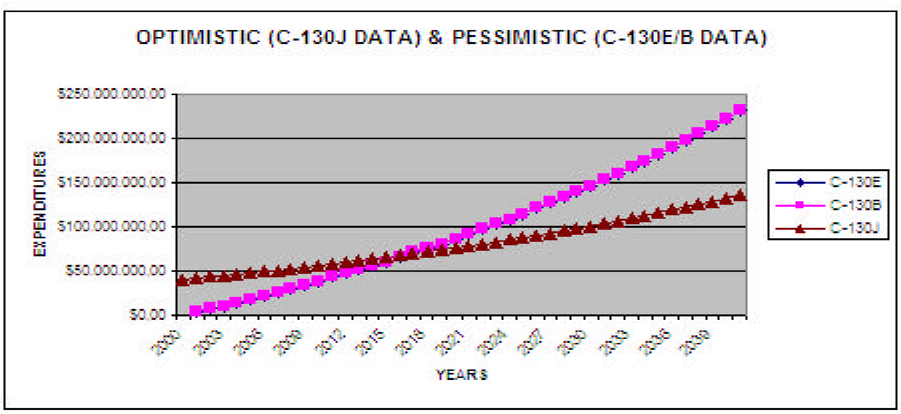

Figure IV.17. Sensitivity Analysis to the Optimistic C-130J and Pessimistic C-130E/B Data with 2.3% Inflation Rate

When the C-130E/B values are taken pessimistically, while C-130J data optimistically with 2.3% inflation rate, the breakeven point would be somewhere between the years 2015 and 2016 as it seen in the Figure IV.17.

When the C-130E/B values are taken optimistically, while C-130J data pessimistically with 3.3% inflation rate, the breakeven point would be beyond next 40 years.

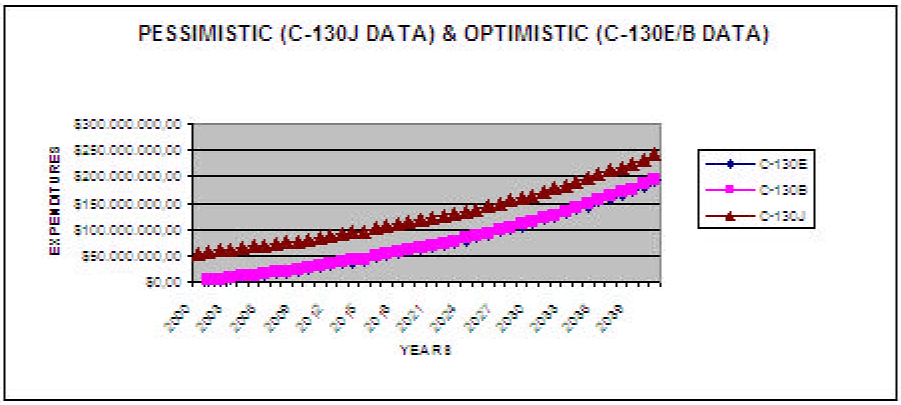

Figure IV.18. Sensitivity Analysis to the Pessimistic C-130J and Optimistic C-130E/B Data with 3.3% Inflation Rate

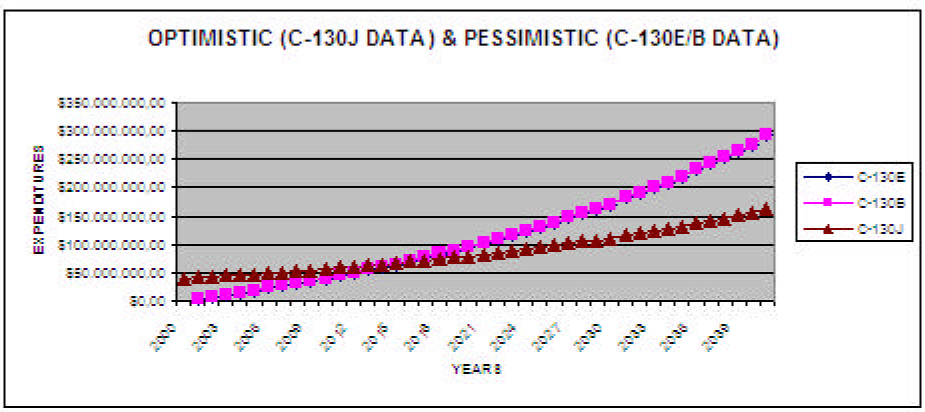

Figure IV.19. Sensitivity Analysis to the Optimistic C-130J and Pessimistic C-130E/B Data with 3.3% Inflation Rate

When the C-130E/B values are taken pessimistically, while C-130J data optimistically with 3.3% inflation rate, the breakeven point would be somewhere between the years 2014 and 2015 as it seen in the Figure IV.19.

When the C-130E/B values are taken optimistically, while C-130J data pessimistically with 5% inflation rate, the breakeven point would be beyond next 40 years.

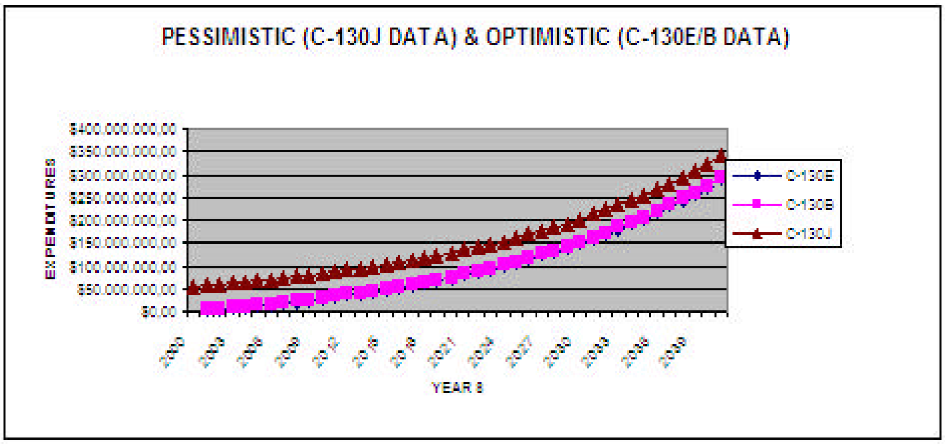

Figure IV.20. Sensitivity Analysis to the Pessimistic C-130J and Optimistic C-130E/B Data with 5% Inflation Rate

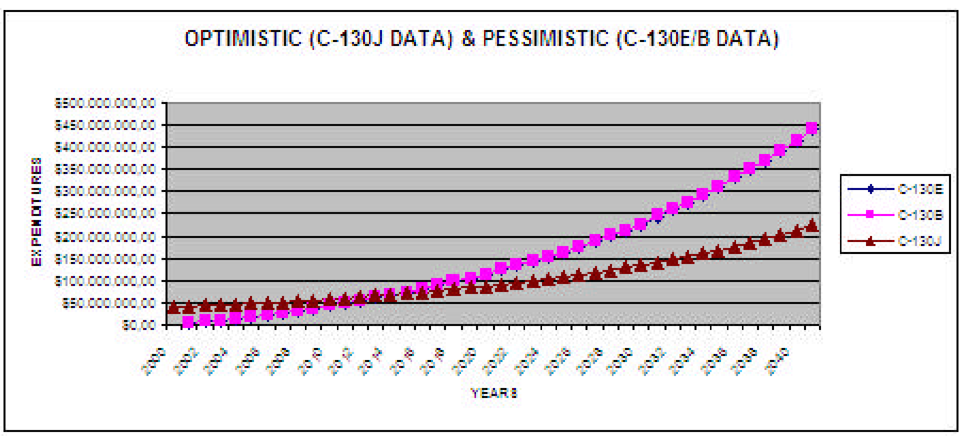

Figure IV.21. Sensitivity Analysis to the Optimistic C-130J and Pessimistic C-130E/B Data with 5% Inflation Rate

When the C-130E/B values are taken pessimistically, while C-130J data optimistically with 5% inflation rate, the breakeven point would be somewhere between the years 2013 and 2014 as it seen in the Figure IV.21.

While performing this analysis, it was considered that the inflation rate can be optimistic, while the rest of the representative data are pessimistic or vice versa. The sensitivity analysis for the inflation rate for pessimistic, average and optimistic representative data was applied.

When comparing the alternatives based on the cost figures, at first one of them may appear favorable, therefore it would be useful to see positions of the costs in the future in order to make a better decision. In this specific case, as it seen from the analysis, when the C-130J procurement cost is included into the sensitivity analysis, the breakeven point would change. Decision makers have to make their decisions about keeping the existing C-130 types, or buying C-130J considering the actual age of the existing C-130s, their reliabilities, technologies, and the air force vision.

Summary

In this chapter, the cost break down structure of O&S cost for C-130 aircraft was developed. All cost elements in the cost breakdown structure were defined and their allocation rationales ware discussed. Most of the data related with the C-130E and C-130B are kept without discriminating the type of the aircraft that is why they were allocated between those types of aircraft based on their total numbers in the 222nd flight squadron.

Their O&S costs in the year 2000 were found, and shown in the Table IV.3. Based on the data, C-130J, which the data revealed in the Appendix J, has the lowest O&S cost, and C-130E is coming after it. Significant cost elements were fuel cost, overhaul cost, and reparable material cost.

Then sensitivity analysis was applied to the representative data which are overhaul costs, reparable material costs, flying hours, and modification kit costs for each type of the aircraft, so the O&S cost of each type of aircraft take their shape according to optimistic, pessimistic approach. In all cases, C-130J had the lowest O&S cost.

When, comparing the alternatives the breakeven analysis was required to make a better analysis about the future position of the cost figures, and the procurement cost of C-130J had to be included, as well as the sensitivity analysis of inflation rate. Considering the market situations, and the discounts according to the amount bought, the sensitivity analysis was applied to all cost, and inflation figures. The summary of the breakeven points according to sensitivity analysis applied to the inflation rate and the optimistic, average, and pessimistic cost figures was shown in the Table IV.6.

Table IV.6. Summary of Breakeven Points

	Optimistic	Average	Pessimistic
1.8%	2033-2034	2032-2033	2032-2033
2.3%	2031-2032	2030-2031	2029-2030
3.3%	2027-2028	2027-2028	2026-2027
5%	2023-2024	2023-2024	2023-2024

In addition to this, the reverse possibilities were also considered, in this research, C-130E and C-130B were considered to have similar reliabilities, while the C-130J was considered more reliable because of its age and technology. The optimistic and pessimistic values of the aircraft might not be faced at the same time. The summary of the breakeven point for the reverse situations was shown in the Table IV.7.

Table IV.7. Summary of Breakeven Points for Reverse Situations

	Optimistic C-130J Data with Pessimistic C-130E/B Data	Optimistic C-130E/B Data with Pessimistic C-130J Data
1.8%	2024-2025	Beyond 40 Years
2.3%	2015-2016	Beyond 40 Years
3.3%	2014-2015	Beyond 40 Years
5%	2013-2014	Beyond 40 Years

The next chapter will present the conclusions of this study and the recommendations of the researcher.

V. Conclusions and Recommendations

Chapter Overview

There were six investigative questions presented in Chapter I, and four of them were already answered along with the analysis. In this chapter, the questions and their answers will be presented one more time. The last two questions will be answered here along with the conclusions and recommendation for future research.

Investigative Questions

1. What are the relevant costs to compare?

It was mentioned that the procurement costs of the C-130 E/B aircraft are considered to be sunk, since TUAF has already been operating C-130E and C-130Bs. The O&S cost was therefore the most significant cost in system or product life cycle. That is why O&S cost (labor costs of operating and maintenance personnel, fuel and power cost, operating and maintenance supply costs, spare and repair part costs, and related overhead costs) was considered to be valid for the cost aspect of this comparison. This question and operating and support cost breakdown structure (CBS) of C-130 aircraft that includes all relevant costs and their definitions along with the allocation rationale were presented in Chapter IV.

2. What is the best way to compare these costs?

The C-130 types were evaluated over 40 years in order to give a better idea to the decision makers to make their decision more accurate over long run. The cost elements were analyzed over 40 years by taking the year 2000 as a base year. Sensitivity analysis was applied to representative data, C-130J procurement cost, and the inflation rate, in order to perform breakeven analysis. The analysis and the results were presented in Chapter IV.

3. What data would be needed to perform the comparison?

The main steps of CBS for O&S costs of the C-130 aircraft are presented in the "Operating and Support Cost Estimating Guide" issued by Office of the Secretary of Defense Cost Analysis Improvement Group (21:C-1). This was presented in Chapter IV. The CBS of the C-130 aircraft includes labor costs of operating and support personnel, fuel and power cost, operating and maintenance supply costs, spare and repair part costs. All data required was provided by the TUAF related to C-130E and C-130B aircraft, while the data, which were unique for C-130J, were obtained from the US sources. The data for C-130E and B gathered from the TUAF were revealed in the Appendix I, while C-130J data revealed in Appendix J.

4. What additional non-O&S cost factors would need to be considered?

Since the USA is one of the most important allied countries for Turkey, political factors were considered to be irrelevant for this thesis. Because of the declining budget and the major role of the TUAF on the region and the peacekeeping missions, the performance and the cost are deemed to be the relevant factors that would be considered. The cost factor appear to favor the C-130J for O&S cost. The technology is speeding, and the obsolete technology has to be replaced by the modern technologies sooner or later. In this specific case, capacity, speed, range, and landing range were appeared to be the non-cost factors as well as efficiency. The capacities of the aircraft are the same, while all other factors were favorable to the C-130J.

5. What recommendation should be made to the TUAF?

After analyzing the alternatives in terms of performance and cost, the most suitable alternative appeared to be C-130J. It should not be forgotten that LCC analysis would not be the final result for the decision makers. This would be one of the most important inputs for the decision makers while reaching the conclusion about the alternatives. Even after adding the procurement cost of C-130J, it reaches breakeven in 30 years averagely, relative to inflation rate and C-130J procurement cost.

6. What trade-offs exist in the decision?

After the analysis, it can be concluded that C-130J has the lowest O&S cost comparing to C-130E and C-130B. On the other hand since the TUAF already has C-130E and C-130B, the main consideration would be the procurement cost of C-130J. However, this should be considered in every replacement decision, in keep or buy decision, the decision makers have to consider the strategy of the TUAF, the missions, the reliability and the performance such as speed, range, and landing range.

Efficiency versus effectiveness would be the main consideration in this case. By keeping the existing C-130s, the TUAF can be efficient for short term when we consider the life of the aircraft over 40 years, in addition to this, it should not be forgotten that the existing aircraft have been serving for more than 40 years. So, it would not be realistic to expect them to serve for another 40 years. This would make decision makers consider the replacement of the existing C-130s. In this case, the procurement cost would be unavoidable.

Conclusions

Several important issues were identified during this research. They are not only related to the result of analysis, but also, the LCC process itself. The research showed that LCC analysis is vital for evaluating the alternatives in decision-making.

Conclusion 1

LCC Analysis showed that operating with existing C-130s is not feasible comparing to the C-130J model's O&S cost. This also showed that using LCC is useful to evaluate the cost aspect of the competing alternative systems, as well as replacing the existing systems. It also shows the inefficient areas that need to be improved in the operating and supporting activities. During the analysis, the cost figures and the percentage of those in the total O&S cost shows the analyst the important issues that have to be pointed to decision makers and the operators to improve the service.

Conclusion 2

After the analysis, it can be concluded that the newest version of C-130 aircraft (C-130J) has the lowest O&S cost when we compare it with C-130E and C-130B. When optimistic, average, and pessimistic data were utilized, it was seen that C-130J with its new propulsion systems, gives high efficiency in the operations. It also requires fewer crewmembers. So, the operation and support cost figure of C-130 J is smaller.

Conclusion 3

When the sensitivity analysis is applied to those cost figures, including the procurement cost of C-130J, it amortizes itself in the lifetime of the cargo airplane if everything is *ceteris paribus*.

Recommendation

In the analysis some data are representative, and more accurate and complete cost figures are needed. This can be achieved by implementing activity based costing. Activity based costs are based on assigning the cost figures to the systems in terms of the spent sources by those systems. Since there are a lot of allocation between the aircraft types and C-130 types, those cost data do not represent exact cost figures for the resources consumed those types of C-130 aircraft. If the organization wants to have more accurate O&S cost figure, it has to establish the database that keeps the resources consumed each type of aircraft. This will serve to evaluate the competing systems, in addition to this; will show the areas that are inefficient.

Recommendation for Further Research

In this research, the cost figures related to the O&S cost are investigated. The further research might be related to the cost benefit analysis of the systems. In this case, the performance of the systems will also be investigated as well as the cost figures. This will help to make trade-offs between the systems.

In addition to this, the economical life of the systems can be investigated. In ideal conditions, once the system is produced and operations begin, it is expected to be useful forever. This is not true in reality. Because of the deterioration and obsolescence of the systems or products, their useful life is limited. There might be increasing trends in O&S cost, and the economic life of the system can be a research subject.

Moreover, this research was aircraft to aircraft, without adjusting for any increased payload or effectiveness. Operators might be able hypothesize that the payload of current air force can be carried by less C-130J, and might offer another approach to be more efficient and effective.

Finally, in this research, keep or buy decision was investigated. However, refurbishing existing C-130s have to be considered and then new suggestions can be given to the decision makers. Because of the high acquisition cost of C-130J is the negative side of the buying C-130J, if refurbishing existing C-130s is good enough to accomplish the targeted efficiency and effectiveness, then that decision has to be considered.

APPENDIX A. COST ESTIMATION OF MISSION PERSONNEL

C-130 OPERATION AND SUPPORT COST ESTIMATION

	C-130E	7
All Turkish Lira values 1000	C-130B	6

Allocation factor of costs for C-130E is total number of C-130E/(no of C-130E+no of C-130B)

Allocation factor for C-130E = 0,538461538

Allocation factor for C-130B = 0,461538462

1.0 MISSION PERSONNEL

1 Dollar = 1500 1000 TL

1.1 OPERATION

	No Per.	Ann. Salary	Ann Salary ($)	TOTAL	C-130E	per C-130E	C-130B	per C-130B	per C-130J
Pilot									
2nd Lieutenant	1	7500000	5000	5000	2692,307692	384,6153846	2307,692308	384,6153846	385
1st Lieutenant	60	8500000	5666,666667	340000	183076,9231	26153,84615	156923,0769	26153,84615	26154
Captain	33	9500000	6333,333333	209000	112538,4615	16076,92308	96461,53846	16076,92308	16077
Major	8	10500000	7000	56000	30153,84615	4307,692308	25846,15385	4307,692308	4308
Navigator									
1st Lieutenant	55	7200000	4800	264000	142153,8462	20307,69231	121846,1538	20307,69231	0
Captain	32	8000000	5333,333333	170666,6667	91897,4359	13128,20513	78769,23077	13128,20513	0
Major	1	9000000	6000	6000	3230,769231	461,5384615	2769,230769	461,5384615	0
Flight engineer									
3rd Sergeant									
2nd Sergeant	48	7000000	4666,666667	224000	120615,3846	17230,76923	103384,6154	17230,76923	0
1st Sergeant	54	8000000	5333,333333	288000	155076,9231	22153,84615	132923,0769	22153,84615	0
Loadmaster									
3rd Sergeant									
2nd Sergeant	18	7000000	4666,666667	84000	45230,76923	6461,538462	38769,23077	6461,538462	6462
1st Sergeant	26	8000000	5333,333333	138666,6667	74666,66667	10666,66667	64000	10666,66667	10667
1.2 MAINTENANCE									
Officers									
2nd Lieutenant	1	5500000	3666,666667	1288,288288	693,6936937	99,0990991	594,5945946	99,0990991	99,0990991
1st Lieutenant	3	6000000	4000	4216,216216	2270,27027	324,3243243	1945,945946	324,3243243	324,324324
Captain	4	7500000	5000	7027,027027	3783,783784	540,5405405	3243,243243	540,5405405	540,540541
Major	2	8500000	5666,666667	3981,981982	2144,144144	306,3063063	1837,837838	306,3063063	306,306306
NCOs									
3rd Sergeant	171	4200000	2800	168227,027	90583,78378	12940,54054	77643,24324	12940,54054	12940,5405

2nd Sergeant	71	4800000	3200	79827,02703	42983,78378	6140,540541	36843,24324	6140,540541	6140,54054
1st Sergeant	172	7000000	4666,666667	282018,018	151855,8559	21693,69369	130162,1622	21693,69369	21693,6937
Civilian	7	3600000	2400	5902,702703	3178,378378	454,0540541	2724,324324	454,0540541	454,054054
	431								
Aircraft and Ground Systems Office									
Officer									
1st Lieutenant	2	7200000	4800	3372,972973	1816,216216	259,4594595	1556,756757	259,4594595	259,459459
NCOs									
2nd Sergeant	2	4800000	3200	2248,648649	1210,810811	172,972973	1037,837838	172,972973	172,972973
1st Sergeant	3	7500000	5000	5270,27027	2837,837838	405,4054054	2432,432432	405,4054054	405,405405
1.3 12th AIRLIFT BASE									
Total C-130 Aircraft	13								
Total C-160 Aircraft	12								
Total CN-235 Aircraft	12								
Allocation factor	0,3513514								
Officers									
2nd Lieutenant	5	6000000	4000	7027,027027	3783,783784	540,5405405	3243,243243	540,5405405	540,540541
1st Lieutenant	30	7000000	4666,666667	49189,18919	26486,48649	3783,783784	22702,7027	3783,783784	3783,78378
Captain	60	8000000	5333,333333	112432,4324	60540,54054	8648,648649	51891,89189	8648,648649	8648,64865
Major	10	8500000	5666,666667	19909,90991	10720,72072	1531,531532	9189,189189	1531,531532	1531,53153
Lt Col.	8	10000000	6666,666667	18738,73874	10090,09009	1441,441441	8648,648649	1441,441441	1441,44144
Col	2	12000000	8000	5621,621622	3027,027027	432,4324324	2594,594595	432,4324324	432,432432
General	1	15000000	10000	3513,513514	1891,891892	270,2702703	1621,621622	270,2702703	270,27027
NCOs									
3rd Sergeant	150	4200000	2800	147567,5676	79459,45946	11351,35135	68108,10811	11351,35135	11351,3514
2nd Sergeant	62	4800000	3200	69708,10811	37535,13514	5362,162162	32172,97297	5362,162162	5362,16216
1st Sergeant	140	7000000	4666,666667	229549,5495	123603,6036	17657,65766	105945,9459	17657,65766	17657,6577
Civilian	80	4000000	2666,666667	74954,95495	40360,36036	5765,765766	34594,59459	5765,765766	5765,76577
Enlisted	800	300000	200	56216,21622	30270,27027	4324,324324	25945,94595	4324,324324	4324,32432
Food per person daily	800	456250	304,1666667	85495,4955	46036,03604	6576,576577	39459,45946	6576,576577	6576,57658
					1662190,991	237455,8559	1424735,135	237455,8559	164175,523

APPENDIX B. COST ESTIMATION OF 12th AIRLIFT MATERIAL CONSUMPTION (OPTIMISTIC)

		C-130E 7						
All Turkish Lira values 1000		C-130B 6						
Allocation factor of costs for C-130E is total number of C-130E/(no of C-130E+no of C-130B)								
Allocation factor for C-130E =		0,53846154						
Allocation factor for C-130B =		0,46153846						
		1 Dollar = 1500 1000 TL						
2.0 12th AIRLIFT BASE MATERIAL CONSUMPTION								
2.1 Fuel Lubricants and Energy								
2.1.1 Fuel and Oil			TOTAL	C-130E	per C-130E	C-130B	per C-130B	per C-130J
		Cost						
Average flight hour	500							
Libre per C-130E/B flight hour	4500							
Libre per C-130J flight hour	3345							
Cost of fuel per libra	0,4							
Per C-130E/B aircraft/hr		900000	11700000	6300000	900000	5400000	900000	669000
Oil								
Galon per hour	1,2							
Cost of oil per galon	0,15							
Average flight hour	500							
Per aircraft/hr		90	1170	630	90	540	90	180
2.2.1 Maintenance Material								
Consumable Maintenance Material								
				46970,711	6710,10157	59487,502	9914,58366	3250,32
Reparable Maintenance Material			10075000	5440500	777214,286	4634500	777214	306923

2.1.2 Electricity								
Ann. base electric bill	370884000							
Total C-130 Aircraft	13							
Total C-160 Aircraft	12							
Total CN-235 Aircraft	12							
Allocation factor	0,351351351							
Allocated cost		86873,7297	247256	46778,1622	6682,59459	40095,5676	6682,59459	6682,59
2.2.2 Mission Support Supplies		33333,3333		17948,7179	2564,10256	15384,6154	2564,10256	2564,1
2.2.3 Other Unit Level Consumption		350000	64427,8607	34691,925	4955,98928	29735,9357	4955,98928	4955,99
222 Personnel	370							
Total Personnel	2010							
Allocation Factor For 222nd Fight Squadron	0,184079602							
TOTAL				11887519,5	1698217,07	10179743,6	1701421,27	993556

APPENDIX B (contd). COST ESTIMATION OF 12th AIRLIFT MATERIAL CONSUMPTION (AVERAGE)

		C-130E	7						
All Turkish Lira values 1000		C-130B	6						
Allocation factor of costs for C-130E is total number of C-130E/(no of C-130E+no of C-130B)									
Allocation factor for C-130E =		0,538461538							
Allocation factor for C-130B =		0,461538462							
		1 Dollar =	$1.500 1000 TL						
2.0 12th AIRLIFT BASE MATERIAL CONSUMPTION									
2.1 Fuel Lubricants and Energy									
2.1.1 Fuel and Oil				TOTAL	C-130E	per C-130E	C-130B	per C-130B	per C-130J
		Cost							
Average flight hour	$750,00								
Libre per C-130E/B flight hour	$4.500,00								
Libre per C-130J flight hour	$3.345,00								
Cost of fuel per libra	$0,40								
Per C-130E/B aircraft hr		$1.350.000		$17.550.000	$9.450.000	$1.350.000	$8.100.000	$1.350.000	$1.003.500
Oil									
Gallon per hour	$1,20								
Cost of oil per gallon	$0,15								
Average flight hour	$750,00								
Per aircraft hr		$135,00		$1.755,00	$945,00	$135,00	$810,00	$135,00	$180,00
2.2.1 Maintenance Material									
Consumable Maintenance Material					$46.970,71	$6.710,10	$59.487,50	$9.914,58	$3.250,32
Reparable Maintenance Material				11050000	5967000	852428,5714	5083000	852428,5714	306923

2.1.2 Electricity								
Ann. base electric bill	$370.884.000,00							
Total C-130 Aircraft	$13,00							
Total C-160 Aircraft	$12,00							
Total CN-235 Aircraft	$12,00							
Allocation factor	$0,35							
Allocated cost		$86.873,73	247256	46778,16216	6682,594595	40095,56757	6682,594595	6682,59
2.2.2 Mission Support Supplies		33333,33333		17948,71795	2564,102564	15384,61538	2564,102564	2564,1
2.2.3 Other Unit Level Consumption		350000	64427,8607	34691,92499	4955,989284	29735,93571	4955,989284	4955,99
222 Personnel	370							
Total Personnel	2010							
Allocation Factor For 222nd Flight Sq.	0,184079602							
TOTAL				15564334,52	2223476,359	13328513,62	2226680,842	1328056

APPENDIX B (contd). COST ESTIMATION OF 12th AIRLIFT MATERIAL CONSUMPTION (PESSIMISTIC)

		C-130E	7					
All Turkish Lira values 1000		C-130B	6					
Allocation factor of costs for C-130E is total number of C-130E/(no of C-130E+no of C-130B)								
Allocation factor for C-130E =		0,53846154						
Allocation factor for C-130B =		0,46153846						
		1 Dollar =	1500 1000 TL					
2.0 12th AIRLIFT BASE MATERIAL CONSUMPTION								
2.1 Fuel Lubricants and Energy								
2.1.1 Fuel and Oil			TOTAL	C-130E	per C-130E	C-130B	per C-130B	per C-130J
		Cost						
Average flight hour	1000							
Libre per C-130E/B flight hour	4500							
Libre per C-130J flight hour	3345							
Cost of fuel per libra	0,4							
Per C-130E/B aircraft/hr		1800000	23400000	12600000	1800000	10800000	1800000	1338000
Oil								
Galon per hour	1,2							
Cost of oil per galon	0,15							
Average flight hour	1000							
Per aircraft/hr		180	2340	1260	180	1080	180	180
2.2.1 Maintenance Material								
Consumable Maintenance Material								
				46970,711	6710,10157	59487,502	9914,58366	3250,32
Reparable Maintenance Material			12025000	6493500	927642,857	5531500	927642,857	306923

2.1.2 Electricity								
Ann. base electric bill	370884000							
Total C-130 Aircraft	13							
Total C-160 Aircraft	12							
Total CN-235 Aircraft	12							
Allocation factor	0,351351351							
Allocated cost		86873,7297	247256	46778,1622	6682,59459	40095,5676	6682,59459	6682,59
2.2.2 Mission Support Supplies		33333,3333		17948,7179	2564,10256	15384,6154	2564,10256	2564,1
2.2.3 Other Unit Level Consumption		350000	64427,8607	34691,925	4955,98928	29735,9357	4955,98928	4955,99
222 Personnel	370							
Total Personnel	2010							
Allocation Factor For 222nd Figh	0,184079602							
TOTAL				19241149,5	2748735,65	16477283,8	2751940,13	1662556

APPENDIX C. C-130 CONSUMABLE MATERIAL LIST

C-130E CONSUMABLE MATERIALS

S/N	STOCK NO	PRICE	QUARTERLY USAGE	ANNUAL USAGE	TOTAL PRICE
1	1560XXXXXXX00LG	0,00005	269	1076	0,012622915
2	1560XXXXXXX56LG	0,000151767	38	152	0,005767133
3	1650XXXXXX665	3	56	224	149,3333333
4	1650XXXXXX060	2,78	21	84	58,38
5	1650XXXXXX430	2,63	21	84	55,23
6	1650XXXXXXXX0LE	39,79	43	172	1710,97
7	1670XXXXXXXX1LG	0,000146667	14	56	0,002053333
8	2840XXXXXX709	30,05	27	108	811,35
9	2915XXXXXXX90	36,88	13	52	479,44
10	2915XXXXXXXX8RW	16,05	51	204	818,55
11	2940XXXXXXX58	3,8	30	120	114
12	2945XXXXXX384	21,82	12	48	261,84
13	4020XXXXXX334	10,07	2	8	20,14
14	4330XXXXXX593	2,51	4	16	10,04
15	4330XXXXXX274	2,42	16	64	38,72
16	4330XXXXXX013	37,96	22	88	835,12
17	4730XXXXXXXX7SX	166,1	11	44	1827,1
18	4935XXXXXX425	11	2	8	21,33333333
19	5305XXXXXX902	0,42	356	1424	149,52
20	5310XXXXXX406	2,8	20	80	56
21	5315XXXXXX873	9,25	84	336	777
22	5315XXXXXX359	2,02	500	2000	1010
23	5315XXXXXX274	0,14	191	764	26,74
24	5315XXXXXX566	0,68	55	220	37,4
25	5330XXXXXX759	0,00007616	139	556	0,01058624
26	5330XXXXXX790	0,667	50	200	33,33333333
27	5330XXXXXX032	322	12	48	3864
28	5330XXXXXX462	1,063333333	19	76	20,20333333
29	5330XXXXXX525	0,08	4	16	0,32
30	5330XXXXXX527	500	32	128	16000
31	5330XXXXXX006	35,29	5	20	176,45
32	5330XXXXXX345	47,5	28	112	1330
33	5330XXXXXX310	0,00038	5	20	0,0019
34	5330XXXXXX898	200	5	20	1000
35	5331XXXXXX331	61	14	56	854
36	5331XXXXXX174	15	5	20	75
37	5331XXXXXX278	50	16	64	800
38	5331XXXXXX607	0,0005	16	64	0,008
39	5331XXXXXX633	50	5	20	250
40	5331XXXXXX262	10,1	18	72	181,8
41	5340XXXXXXX90SX	0,1	488	1952	48,8
42	5340XXXXXXX31SX	0,11	744	2976	81,84
43	5342XXXXXXX68SX	4,23	9	36	38,07
44	5355XXXXXXX40SX	7,67	13	52	99,71
45	5355XXXXXX138	20,7	36	144	745,2
46	5930XXXXXXX67SX	559,44	14	56	7832,16
47	5930XXXXXX290	222,27	1	4	222,27
48	5930XXXXXXXX3SX	631,29	1	4	631,29
49	5935XXXXXX174	7,37	10	40	73,7
50	5940XXXXXX370	0,24	13	52	3,12

51	5975XXXXXX284	0,666666667	188	752	125,3333333
52	6220XXXXXX797	9,5	4	16	38
53	6220XXXXXX244	11,35	13	52	147,55
54	6240XXXXXX784	0,32	77	308	24,64
55	6240XXXXXX824	1,13	146	584	164,98
56	6240XXXXXX848	0,23	128	512	29,44
57	6240XXXXXX518	8,37	5	20	41,85
58	6240XXXXXX094	22,27	1	4	22,27
59	6240XXXXXXX48SX	4,66	39	156	181,74
60	6240XXXXXX757	1,342666667	12	48	16,112
61	6340XXXXXX289	188,84	1	4	188,84
62	6685XXXXXX564	328,61	1	4	328,61
63	6685XXXXXXX46NT	339,07	5	20	1695,35
64	6850XXXXXX188	17,83	16	64	285,28
65	9150XXXXXX860	0,000153333	9	36	0,00138
66	9505XXXXXX175	5,12	10	40	51,2
					46970,71098

C-130B CONSUMABLE MATERIALS

S/N	STOCK NO	PRICE	QUARTERLY USAGE	ANNUAL USAGE	TOTAL PRICE
1	1560XXXXXXX00LG	0,00005	371	1484	0,017409299
2	1560XXXXXXX56LG	0,000151767	57	228	0,0086507
3	1650XXXXXX665	3	65	260	173,3333333
4	1650XXXXXX060	2,78	32	128	88,96
5	1650XXXXXX430	2,63	35	140	92,05
6	1650XXXXXXXX0LE	39,79	87	348	3461,73
7	1670XXXXXXXX1LG	0,000146667	9	36	0,00132
8	2840XXXXXX709	30,05	34	136	1021,7
9	2915XXXXXXX90	36,88	19	76	700,72
10	2915XXXXXXXX8RW	16,05	58	232	930,9
11	2940XXXXXXX58	3,8	41	164	155,8
12	2945XXXXXX384	21,82	22	88	480,04
13	4020XXXXXX334	10,07	9	36	90,63
14	4330XXXXXX593	2,51	3	12	7,53
15	4330XXXXXX274	2,42	14	56	33,88
16	4330XXXXXX013	37,96	28	112	1062,88
17	4730XXXXXXXX7SX	166,1	14	56	2325,4
18	4935XXXXXX425	11	8	32	85,33333333
19	5305XXXXXX902	0,42	222	888	93,24
20	5310XXXXXX406	2,8	16	64	44,8
21	5315XXXXXX873	9,25	92	368	851
22	5315XXXXXX359	2,02	750	3000	1515
23	5315XXXXXX274	0,14	175	700	24,5
24	5315XXXXXX566	0,68	92	368	62,56
25	5330XXXXXX759	0,00007616	196	784	0,01492736
26	5330XXXXXX790	0,667	42	168	28
27	5330XXXXXX032	322	14	56	4508
28	5330XXXXXX462	1,063333333	28	112	29,77333333
29	5330XXXXXX525	0,08	9	36	0,72
30	5330XXXXXX527	500	45	180	22500
31	5330XXXXXX006	35,29	8	32	282,32
32	5330XXXXXX345	47,5	32	128	1520
33	5330XXXXXX310	0,00038	19	76	0,00722
34	5330XXXXXX898	200	4	16	800
35	5331XXXXXX331	61	17	68	1037
36	5331XXXXXX174	15	7	28	105
37	5331XXXXXX278	50	20	80	1000

38	5331XXXXXX607	0,0005	5	20	0,0025
39	5331XXXXXX633	50	7	28	350
40	5331XXXXXX262	10,1	14	56	141,4
41	5340XXXXXXX90SX	0,1	322	1288	32,2
42	5340XXXXXXX31SX	0,11	525	2100	57,75
43	5342XXXXXXX68SX	4,23	10	40	42,3
44	5355XXXXXXX40SX	7,67	16	64	122,72
45	5355XXXXXX138	20,7	31	124	641,7
46	5930XXXXXXX67SX	559,44	14	56	7832,16
47	5930XXXXXX290	222,27	0	0	0
48	5930XXXXXXXX3SX	631,29	2	8	1262,58
49	5935XXXXXX174	7,37	17	68	125,29
50	5940XXXXXX370	0,24	25	100	6
51	5975XXXXXX284	0,666666667	250	1000	166,6666667
52	6220XXXXXX797	9,5	3	12	28,5
53	6220XXXXXX244	11,35	16	64	181,6
54	6240XXXXXX784	0,32	58	232	18,56
55	6240XXXXXX824	1,13	122	488	137,86
56	6240XXXXXX848	0,23	138	552	31,74
57	6240XXXXXX518	8,37	7	28	58,59
58	6240XXXXXX094	22,27	3	12	66,81
59	6240XXXXXXX48SX	4,66	27	108	125,82
60	6240XXXXXX757	1,342666667	19	76	25,51066667
61	6340XXXXXX289	188,84	1	4	188,84
62	6685XXXXXX564	328,61	1	4	328,61
63	6685XXXXXXX46NT	339,07	6	24	2034,42
64	6850XXXXXX188	17,83	18	72	320,94
65	9150XXXXXX860	0,000153333	17	68	0,002606667
66	9505XXXXXX175	5,12	9	36	46,08
					59487,50197

Consumable Maintenance Material	**C-130E**	**per C-130E**
	$46.970,71	**$6.710,10**
	C-130B	**per C-130B**
	59487,50197	**9914,583661**

APPENDIX D. COST ESTIMATION OF DEPOT LEVEL MAINTENANCE (OPTIMISTIC)

		C-130E		7					
All Dollar values 1000		C-130B		6					
Allocation factor of costs for C-130E is total number of C-130E/(no of C-130E+no of C-130B)									
Allocation factor for C-130E =		0,538461538							
Allocation factor for C-130B =		0,461538462							
		1 Dollar =		1500	1000 TL				
4.0 Depot Level Maintenance					C-130E	per C-130E	C-130B	per C-130B	per C-130J
4.1 Overhaul					3500000	500000	3000000	500000	250000
4.2 Other									
Direct Personnel	No. Per.		Annual Salary($)	TOTAL					
Officer									
Major	1	8500000	5666,666667	5666,666667	3051,282051	435,8974359	2615,384615	435,8974359	435,9
Captain	1	8000000	5333,333333	5333,333333	2871,794872	410,2564103	2461,538462	410,2564103	410,2564103
1st Lt.	1	7000000	4666,666667	4666,666667	2512,820513	358,974359	2153,846154	358,974359	358,974359
NCO									
3rd Sergeant	4	4200000	2800	11200	6030,769231	861,5384615	5169,230769	861,5384615	861,5384615
2nd Sergeant	3	4800000	3200	9600	5169,230769	738,4615385	4430,769231	738,4615385	738,4615385
1st Sergeant	3	7000000	4666,666667	14000	7538,461538	1076,923077	6461,538462	1076,923077	1076,923077
Engineer	5	12000000	8000	40000	21538,46154	3076,923077	18461,53846	3076,923077	3076,923077
Technician	15	9600000	6400	96000	51692,30769	7384,615385	44307,69231	7384,615385	7384,615385
Civilian Labor	48	7800000	5200	249600	134400	19200	115200	19200	19200

Allocation Factor										
C-130E	0,538461538									
C-130B	0,461538462									
Indirect Personnel										
Officer										
Lt.Colonel	1	10000000	6666,666667	6666,666667	1261,261261	180,1801802	1081,081081	180,1801802	180,1801802
Major	2	8500000	5666,666667	11333,33333	2144,144144	306,3063063	1837,837838	306,3063063	306,3063063
Captain	2	8000000	5333,333333	10666,66667	2018,018018	288,2882883	1729,72973	288,2882883	288,2882883
1st Lt.	2	7000000	4666,666667	9333,333333	1765,765766	252,2522523	1513,513514	252,2522523	252,2522523
NCO									
3rd Sergeant	8	4200000	2800	22400	4237,837838	605,4054054	3632,432432	605,4054054	605,4054054
2nd Sergeant	7	4800000	3200	22400	4237,837838	605,4054054	3632,432432	605,4054054	605,4054054
1st Sergeant	6	7000000	4666,666667	28000	5297,297297	756,7567568	4540,540541	756,7567568	756,7567568
Engineer	10	12000000	8000	80000	15135,13514	2162,162162	12972,97297	2162,162162	2162,162162
Technician	30	9600000	6400	192000	36324,32432	5189,189189	31135,13514	5189,189189	5189,189189
Civilian Labor	76	7800000	5200	395200	74767,56757	10681,08108	64086,48649	10681,08108	10681,08108
Allocation factor	0,351351351								
C-130	13								
C-160	12								
CN-235	12								
TOTAL					3881994,317	554570,6168	3327423,701	554570,6168	304570,6193

APPENDIX D (contd). COST ESTIMATION OF DEPOT LEVEL MAINTENANCE (AVERAGE)

		C-130E		7					
All Dollar values 1000		C-130B		6					
Allocation factor of costs for C-130E is total number of C-130E/(no of C-130E+no of C-130B)									
Allocation factor for C-130E =		0,538461538							
Allocation factor for C-130B =		0,461538462							
		1 Dollar =		1500	1000 TL				
4.0 Depot Level Maintenance					C-130E	per C-130E	C-130B	per C-130B	per C-130J
4.1 Overhaul					5250000	750000	4500000	750000	500000
4.2 Other									
Direct Personnel	No.Per.		Annual Salary ($)	TOTAL					
Officer									
Major	1	8500000	5666,666667	5666,666667	3051,282051	435,8974359	2615,384615	435,8974359	435,9
Captain	1	8000000	5333,333333	5333,333333	2871,794872	410,2564103	2461,538462	410,2564103	410,2564103
1st Lt.	1	7000000	4666,666667	4666,666667	2512,820513	358,974359	2153,846154	358,974359	358,974359
NCO									
3rd Sergeant	4	4200000	2800	11200	6030,769231	861,5384615	5169,230769	861,5384615	861,5384615
2nd Sergeant	3	4800000	3200	9600	5169,230769	738,4615385	4430,769231	738,4615385	738,4615385
1st Sergeant	3	7000000	4666,666667	14000	7538,461538	1076,923077	6461,538462	1076,923077	1076,923077
Engineer	5	12000000	8000	40000	21538,46154	3076,923077	18461,53846	3076,923077	3076,923077
Technician	15	9600000	6400	96000	51692,30769	7384,615385	44307,69231	7384,615385	7384,615385
Civilian Labor	48	7800000	5200	249600	134400	19200	115200	19200	19200

Allocation Factor										
C-130 E	0,538461538									
C-130 B	0,461538462									
Indirect Personnel										
Officer										
Lt.Colonel	1	10000000	6666,666667	6666,666667	1261,261261	180,1801802	1081,081081	180,1801802	180,1801802
Major	2	8500000	5666,666667	11333,33333	2144,144144	306,3063063	1837,837838	306,3063063	306,3063063
Captain	2	8000000	5333,333333	10666,66667	2018,018018	288,2882883	1729,72973	288,2882883	288,2882883
1st Lt.	2	7000000	4666,666667	9333,333333	1765,765766	252,2522523	1513,513514	252,2522523	252,2522523
NCO									
3rd Sergeant	8	4200000	2800	22400	4237,837838	605,4054054	3632,432432	605,4054054	605,4054054
2nd Sergeant	7	4800000	3200	22400	4237,837838	605,4054054	3632,432432	605,4054054	605,4054054
1st Sergeant	6	7000000	4666,666667	28000	5297,297297	756,7567568	4540,540541	756,7567568	756,7567568
Engineer	10	12000000	8000	80000	15135,13514	2162,162162	12972,97297	2162,162162	2162,162162
Technician	30	9600000	6400	192000	36324,32432	5189,189189	31135,13514	5189,189189	5189,189189
Civilian Labor	76	7800000	5200	395200	74767,56757	10681,08108	64086,48649	10681,08108	10681,08108
Allocation factor	0,351351351								
C-130	13								
C-160	12								
CN-235	12								
TOTAL					5631994,317	804570,6168	4827423,701	804570,6168	554570,6193

APPENDIX D (contd). COST ESTIMATION OF DEPOT LEVEL MAINTENANCE (PESSIMISTIC)

		C-130E		7					
All Dollar values 1000		C-130B		6					
Allocation factor of costs for C-130E is total number of C-130E/(no of C-130E+no of C-130B)									
Allocation factor for C-130E =		0,53846154							
Allocation factor for C-130B =		0,46153846							
		1 Dollar =		1500 1000 TL					
4.0 Depot Level Maintenance					C-130E	per C-130E	C-130B	per C-130B	per C-130J
4.1 Overhaul					7000000	1000000	6000000	1000000	750000
4.2 Other									
Direct Personnel	No.Per.		Annual Salary($)	TOTAL					
Officer									
Major	1	8500000	5666,666667	5666,66667	3051,28205	435,897436	2615,38462	435,897436	435,9
Captain	1	8000000	5333,333333	5333,33333	2871,79487	410,25641	2461,53846	410,25641	410,25641
1st Lt.	1	7000000	4666,666667	4666,66667	2512,82051	358,974359	2153,84615	358,974359	358,974359
NCO									
3rd Sergeant	4	4200000	2800	11200	6030,76923	861,538462	5169,23077	861,538462	861,538462
2nd Sergeant	3	4800000	3200	9600	5169,23077	738,461538	4430,76923	738,461538	738,461538
1st Sergeant	3	7000000	4666,666667	14000	7538,46154	1076,92308	6461,53846	1076,92308	1076,92308
Engineer	5	12000000	8000	40000	21538,4615	3076,92308	18461,5385	3076,92308	3076,92308
Technician	15	9600000	6400	96000	51692,3077	7384,61538	44307,6923	7384,61538	7384,61538
Civilian Labor	48	7800000	5200	249600	134400	19200	115200	19200	19200

Allocation Factor									
C-130E	0,53846154								
C-130B	0,46153846								
Indirect Personnel									
Officer									
Lt.Colonel	1	10000000	6666,666667	6666,66667	1261,26126	180,18018	1081,08108	180,18018	180,18018
Major	2	8500000	5666,666667	11333,3333	2144,14414	306,306306	1837,83784	306,306306	306,306306
Captain	2	8000000	5333,333333	10666,6667	2018,01802	288,288288	1729,72973	288,288288	288,288288
1st Lt.	2	7000000	4666,666667	9333,33333	1765,76577	252,252252	1513,51351	252,252252	252,252252
NCO									
3rd Sergeant	8	4200000	2800	22400	4237,83784	605,405405	3632,43243	605,405405	605,405405
2nd Sergeant	7	4800000	3200	22400	4237,83784	605,405405	3632,43243	605,405405	605,405405
1st Sergeant	6	7000000	4666,666667	28000	5297,2973	756,756757	4540,54054	756,756757	756,756757
Engineer	10	12000000	8000	80000	15135,1351	2162,16216	12972,973	2162,16216	2162,16216
Technician	30	9600000	6400	192000	36324,3243	5189,18919	31135,1351	5189,18919	5189,18919
Civilian Labor	76	7800000	5200	395200	74767,5676	10681,0811	64086,4865	10681,0811	10681,0811
Allocation factor	0,35135135								
C-130	13								
C-160	12								
CN-235	12								
TOTAL					7381994,32	1054570,62	6327423,7	1054570,62	804570,619

APPENDIX E. COST ESTIMATION OF SUSTAINING SUPPORT(OPTIMISTIC)

		C-130E		7
All Dollar values 1000		C-130B		6
Allocation factor of costs for C-130E is total number of C-130E/(no of C-130E+no of C-130B)				
Allocation factor for C-130E =		0,53846154		
Allocation factor for C-130B =		0,46153846		
		1 Dollar =		1500 1000 TL

6.0 Sustaining Support

6.1 Support Equipment Replacement

C-130 AIRCRAFT EQUIPMENTS

S/N	STOCK NO	PRICE	No. Equip.	TOTAL
1	6115XXXXXX486	241643	10	2416430
2	1740XXXXXX287	32102	5	160510
3	1730XXXXXX439	3630	20	72600
4	2320XXXXXX709	269000	4	1076000
5	3655XXXXXX062	50719	4	202876
6	3655XXXXXX943	17506	4	70024
7	1650XXXXXX323	8500	5	42500
8	4910XXXXXX124	16727,4667	3	50182,4
9	1730XXXXXX969	40000	3	120000
10	6230XXXXXX804	6500	5	32500
11	4520XXXXXX789	1500,24	20	30004,8
12	1740XXXXXX561	50000	4	200000
13	4310XXXXXX653	3502	20	70040
				4543667,2

C-130	C-130E	per C-130E	C-130B	per C-130B	per C-130J
1596423,61	859612,714	122801,816	736810,897	122801,816	122801,82

Total C-130 Aircraft	13
Total C-160 Aircraft	12
Total CN-235 Aircraft	12
Allocation factor	0,35135135

6.2 Modification Kit

C-130	C-130E	per C-130E	C-130B	per C-130B	per C-130J
390000	210000	30000	180000	30000	10000

APPENDIX E (contd). COST ESTIMATION OF SUSTAINING SUPPORT (AVERAGE)

		C-130E	7	
All Dollar values 1000		C-130B	6	

Allocation factor of costs for C-130E is total number of C-130E /(no of C-130E +no of C-130B)

Allocation factor for C-130E =	0,53846154
Allocation factor for C-130B =	0,46153846
1 Dollar =	1500 1000 TL

6.0 Sustaining Support

6.1 Support Equipment Replacement

C-130 AIRCRAFT EQUIPMENTS

S/N	STOCK NO	PRICE	No. Equip.	TOTAL
1	6115XXXXXX486	241643	10	2416430
2	1740XXXXXX287	32102	5	160510
3	1730XXXXXX439	3630	20	72600
4	2320XXXXXX709	269000	4	1076000
5	3655XXXXXX062	50719	4	202876
6	3655XXXXXX943	17506	4	70024
7	1650XXXXXX323	8500	5	42500
8	4910XXXXXX124	16727,4667	3	50182,4
9	1730XXXXXX969	40000	3	120000
10	6230XXXXXX804	6500	5	32500
11	4520XXXXXX789	1500,24	20	30004,8
12	1740XXXXXX561	50000	4	200000
13	4310XXXXXX653	3502	20	70040
				4543667,2

C-130	C-130E	per C-130E	C-130B	per C-130B	per C-130J
1596423,61	859612,714	122801,816	736810,897	122801,816	122801,82

Total C-130 Aircraft	13
Total C-160 Aircraft	12
Total CN-235 Aircraft	12
Allocation factor	0,35135135

6.2 Modification Kit

455000	245000	35000	210000	35000	15000

APPENDIX E (contd). COST ESTIMATION OF SUSTAINING SUPPORT (PESSIMISTIC)

		C-130E	7	
All Dollar values 1000		C-130B	6	

Allocation factor of costs for C-130E is total number of C-130E/(no of C-130E+no of C-130B)

Allocation factor for C-130E =		0,53846154		
Allocation factor for C-130B =		0,46153846		
		1 Dollar =	1500	1000 TL

6.0 Sustaining Support

6.1 Support Equipment Replacement

C-130 AIRCRAFT EQUIPMENTS

S/N	STOCK NO	PRICE	No. Equip.	TOTAL
1	6115XXXXXX486	241643	10	2416430
2	1740XXXXXX287	32102	5	160510
3	1730XXXXXX439	3630	20	72600
4	2320XXXXXX709	269000	4	1076000
5	3655XXXXXX062	50719	4	202876
6	3655XXXXXX943	17506	4	70024
7	1650XXXXXX323	8500	5	42500
8	4910XXXXXX124	16727,4667	3	50182,4
9	1730XXXXXX969	40000	3	120000
10	6230XXXXXX804	6500	5	32500
11	4520XXXXXX789	1500,24	20	30004,8
12	1740XXXXXX561	50000	4	200000
13	4310XXXXXX653	3502	20	70040
				4543667,2

	C-130	C-130E	per C-130E	C-130B	per C-130B	per C-130J
6.1	1596423,61	859612,714	122801,8162	736810,8973	122801,816	122801,82
6.2 Modification Kit	520000	280000	40000	240000	40000	20000

Total C-130 Aircraft	13
Total C-160 Aircraft	12
Total CN-235 Aircraft	12
Allocation factor	0,35135135

6.2 Modification Kit

APPENDIX F. COST ESTIMATION OF INDIRECT SUPPORT

		C-130E	7						
All Dollar values 1000		C-130B	6						
Allocation factor of costs for C-130E is total number of C-130E/(no of C-130E+no of C-130B)									
Allocation factor for C-130E =		0,53846154							
Allocation factor for C-130B =		0,46153846							
		1 Dollar =	1500	1000 TL					
7.0 Indirect Support									
7.1 Personnel support									
7.1.1 Specialty Training									
7.1.2 Medical Support			12th Airlift Ba	C-130	C-130E	per C-130E	C-130B	per C-130B	per C-130J
			250000	39585,2969	21315,1599	3045,02284	18270,137	3045,02284	1827,0137
C-130E	7								
C-130B	6								
Allocation factor C-130E	0,53846154								
Allocation factor C-130B	0,46153846								
	C-130E/B								
222 flight Squad.	336								
12th Airlift Base	2122								
7.2 Installation Support			725000	254729,73	137162,162	19594,5946	117567,568	19594,5946	19594,5946
Total C-130 Aircraft	13								
Total C-160 Aircraft	12								
Total CN-235 Aircraft	12								
Allocation factor	0,35135135								
C-130E	7								
C-130B	6								
Allocation factor C-130E	0,53846154								
Allocation factor C-130B	0,46153846								

APPENDIX G. THE COMPUTATION OF CONSTANT YEAR DOLLARS

CONSTANT INFLATION			OPTIMISTIC INFLATION		PESSIMISTIC INFLATION		PESSIMISTIC INFLATION	
INF. RATE FOR 2001		0,023	INF. RATE FOR 2002-2030	0,018	INF. RATE FOR 2002-2030	0,033	INF. RATE FOR 2002-2030	0,05
YEAR	i	CONSTANT YEAR DOLLAR	CONSTANT YEAR DOLLAR		CONSTANT YEAR DOLLAR		CONSTANT YEAR DOLLAR	
2000		1						
2001	1	1,023	1,023		1,023		1,023	
2002	2	1,047	1,036		1,067		1,103	
2003	3	1,071	1,055		1,102		1,158	
2004	4	1,095	1,074		1,139		1,216	
2005	5	1,120	1,093		1,176		1,276	
2006	6	1,146	1,113		1,215		1,340	
2007	7	1,173	1,133		1,255		1,407	
2008	8	1,200	1,153		1,297		1,477	
2009	9	1,227	1,174		1,339		1,551	
2010	10	1,255	1,195		1,384		1,629	
2011	11	1,284	1,217		1,429		1,710	
2012	12	1,314	1,239		1,476		1,796	
2013	13	1,344	1,261		1,525		1,886	
2014	14	1,375	1,284		1,575		1,980	
2015	15	1,406	1,307		1,627		2,079	
2016	16	1,439	1,330		1,681		2,183	
2017	17	1,472	1,354		1,737		2,292	
2018	18	1,506	1,379		1,794		2,407	
2019	19	1,540	1,403		1,853		2,527	
2020	20	1,576	1,429		1,914		2,653	
2021	21	1,612	1,454		1,977		2,786	
2022	22	1,649	1,481		2,043		2,925	
2023	23	1,687	1,507		2,110		3,072	
2024	24	1,726	1,534		2,180		3,225	
2025	25	1,766	1,562		2,252		3,386	
2026	26	1,806	1,590		2,326		3,556	
2027	27	1,848	1,619		2,403		3,733	
2028	28	1,890	1,648		2,482		3,920	
2029	29	1,934	1,678		2,564		4,116	
2030	30	1,978	1,708		2,649		4,322	
2031	31	2,024	1,739		2,736		4,538	
2032	32	2,070	1,770		2,826		4,765	
2033	33	2,118	1,802		2,920		5,003	
2034	34	2,167	1,834		3,016		5,253	
2035	35	2,216	1,867		3,115		5,516	
2036	36	2,267	1,901		3,218		5,792	
2037	37	2,320	1,935		3,324		6,081	
2038	38	2,373	1,970		3,434		6,385	
2039	39	2,427	2,005		3,547		6,705	
2040	40	2,483	2,041		3,664		7,040	

FORMULA: F=P*(1+I)^n

APPENDIX H. TURKCE ORJINAL DATA

Toplam C-130	13
Toplam C-160	12
Toplam CN-235	12
C-130E Sayisi	7
C-130B Sayisi	6

222NCI FILO KOMUTANLIGI

	Sayilari	Yillik Maas
Pilot		
Tegmen	1	7.500.000
Usttegmen	60	8.500.000
Yuzbasi	33	9.500.000
Binbasi	8	10.500.000
Yarbay		
Navigator		
Usttegmen	55	7.200.000
Yuzbasi	32	8.000.000
Binbasi	1	9.000.000
Flight engineer		
Cavus		
Ustcavus	48	7.000.000
Bascavus	54	8.000.000
Loadmaster		
Cavus		
Ustcavus	18	7.000.000
Bascavus	26	8.000.000

BAKIM KOMUTANLIGI

Subaylar	Sayilari	Yillik Maas
Tegmen	1	5.500.000
Usttegmen	3	6.000.000
Yuzbasi	4	7.500.000
Binbasi	2	8.500.000
Astsubaylar	171	4.200.000
Cavus	71	4.800.000
Ustcavus	172	7.000.000
Bascavus		
Sivil	7	3.600.000

Ucak Yer Sistemleri

Subay	Sayilari	Yillik Maas
Usttegmen	2	7200000
Astsubaylar		
Cavus		
Ustcavus	2	4.800.000
Bascavus	3	7.500.000

Us Toplam Mevcut

Yer siniflari ve onceden belirtilmemis olanlar icin ortalama

Subay	Sayilari	Yillik Maas
Tegmen	5	6.000.000
Usttegmen	30	7.000.000
Yuzbasi	60	8.000.000
Binbasi	10	8.500.000
Yarbay	8	10.000.000
Albay	2	12.000.000
Tuggeneral	1	15.000.000
Astsubay		
Cavus	150	4.200.000
Ustcavus	62	4.800.000
Bascavus	140	7.000.000
Sivil Memur	80	4.000.000
Asker	800	300000

2.0 12th AIRLIFT BASE MATERIAL CONSUMPTION

2.1 Yaki yag enerji

Ortalama yillik ucus	500-1000
Saatte lb. Yakit sarf	4500
Lb. Fiyati (Turkiye)	0,4

YAG

Saatte yag sarf.	1,2
Yag galon fiyat	0,15

2.1.2 Elektrik

Us yil.elek.tuk.	370884000	247256

2.2.1 Bakim Malzemeleri

C-130E SARF MALZEMELER

S/N	STOCK NO	FIYAT	DONEMLIK	YILLIK
1	1560XXXXXXX00LG	4,69253E-05	269	1076
2	1560XXXXXXX56LG	0,000151767	38	152
3	1650XXXXXX665	2,666666667	56	224
4	1650XXXXXX060	2,78	21	84
5	1650XXXXXX430	2,63	21	84
6	1650XXXXXXXX0LE	39,79	43	172
7	1670XXXXXXXX1LG	0,000146667	14	56
8	2840XXXXXX709	30,05	27	108
9	2915XXXXXXX90	36,88	13	52

10	2915XXXXXXXX8RW	16,05	51	204
11	2940XXXXXXX58	3,8	30	120
12	2945XXXXXX384	21,82	12	48
13	4020XXXXXX334	10,07	2	8
14	4330XXXXXX593	2,51	4	16
15	4330XXXXXX274	2,42	16	64
16	4330XXXXXX013	37,96	22	88
17	4730XXXXXXXX7SX	166,1	11	44
18	4935XXXXXX425	10,66666667	2	8
19	5305XXXXXX902	0,42	356	1424
20	5310XXXXXX406	2,8	20	80
21	5315XXXXXX873	9,25	84	336
22	5315XXXXXX359	2,02	500	2000
23	5315XXXXXX274	0,14	191	764
24	5315XXXXXX566	0,68	55	220
25	5330XXXXXX759	0,00007616	139	556
26	5330XXXXXX790	0,666666667	50	200
27	5330XXXXXX032	322	12	48
28	5330XXXXXX462	1,063333333	19	76
29	5330XXXXXX525	0,08	4	16
30	5330XXXXXX527	500	32	128
31	5330XXXXXX006	35,29	5	20
32	5330XXXXXX345	47,5	28	112
33	5330XXXXXX310	0,00038	5	20
34	5330XXXXXX898	200	5	20
35	5331XXXXXX331	61	14	56
36	5331XXXXXX174	15	5	20
37	5331XXXXXX278	50	16	64
38	5331XXXXXX607	0,0005	16	64
39	5331XXXXXX633	50	5	20
40	5331XXXXXX262	10,1	18	72
41	5340XXXXXXX90SX	0,1	488	1952
42	5340XXXXXXX31SX	0,11	744	2976
43	5342XXXXXXX68SX	4,23	9	36
44	5355XXXXXXX40SX	7,67	13	52
45	5355XXXXXX138	20,7	36	144
46	5930XXXXXXX67SX	559,44	14	56
47	5930XXXXXX290	222,27	1	4
48	5930XXXXXXXX3SX	631,29	1	4
49	5935XXXXXX174	7,37	10	40
50	5940XXXXXX370	0,24	13	52
51	5975XXXXXX284	0,666666667	188	752
52	6220XXXXXX797	9,5	4	16
53	6220XXXXXX244	11,35	13	52
54	6240XXXXXX784	0,32	77	308
55	6240XXXXXX824	1,13	146	584
56	6240XXXXXX848	0,23	128	512
57	6240XXXXXX518	8,37	5	20
58	6240XXXXXX094	22,27	1	4
59	6240XXXXXXX48SX	4,66	39	156
60	6240XXXXXX757	1,342666667	12	48
61	6340XXXXXX289	188,84	1	4
62	6685XXXXXX564	328,61	1	4
63	6685XXXXXXX46NT	339,07	5	20
64	6850XXXXXX188	17,83	16	64
65	9150XXXXXX860	0,000153333	9	36
66	9505XXXXXX175	5,12	10	40

C-130 B SARF MALZEMELERI

S/N	STOCK NO	FIYAT	DONEMLIK	YILLIK
1	1560XXXXXXX00LG	4,69253E-05	371	1484
2	1560XXXXXXX56LG	0,000151767	57	228
3	1650XXXXXX665	2,666666667	65	260
4	1650XXXXXX060	2,78	32	128
5	1650XXXXXX430	2,63	35	140
6	1650XXXXXXXX0LE	39,79	87	348
7	1670XXXXXXXX1LG	0,000146667	9	36
8	2840XXXXXX709	30,05	34	136
9	2915XXXXXXX90	36,88	19	76
10	2915XXXXXXXX8RW	16,05	58	232
11	2940XXXXXXX58	3,8	41	164
12	2945XXXXXX384	21,82	22	88
13	4020XXXXXX334	10,07	9	36
14	4330XXXXXX593	2,51	3	12
15	4330XXXXXX274	2,42	14	56
16	4330XXXXXX013	37,96	28	112
17	4730XXXXXXXX7SX	166,1	14	56
18	4935XXXXXX425	10,66666667	8	32
19	5305XXXXXX902	0,42	222	888
20	5310XXXXXX406	2,8	16	64
21	5315XXXXXX873	9,25	92	368
22	5315XXXXXX359	2,02	750	3000
23	5315XXXXXX274	0,14	175	700
24	5315XXXXXX566	0,68	92	368
25	5330XXXXXX759	0,00007616	196	784
26	5330XXXXXX790	0,666666667	42	168
27	5330XXXXXX032	322	14	56
28	5330XXXXXX462	1,063333333	28	112
29	5330XXXXXX525	0,08	9	36
30	5330XXXXXX527	500	45	180
31	5330XXXXXX006	35,29	8	32
32	5330XXXXXX345	47,5	32	128
33	5330XXXXXX310	0,00038	19	76
34	5330XXXXXX898	200	4	16
35	5331XXXXXX331	61	17	68
36	5331XXXXXX174	15	7	28
37	5331XXXXXX278	50	20	80
38	5331XXXXXX607	0,0005	5	20
39	5331XXXXXX633	50	7	28
40	5331XXXXXX262	10,1	14	56
41	5340XXXXXXX90SX	0,1	322	1288
42	5340XXXXXXX31SX	0,11	525	2100
43	5342XXXXXXX68SX	4,23	10	40
44	5355XXXXXXX40SX	7,67	16	64
45	5355XXXXXX138	20,7	31	124
46	5930XXXXXXX67SX	559,44	14	56
47	5930XXXXXX290	222,27	0	0
48	5930XXXXXXXX3SX	631,29	2	8
49	5935XXXXXX174	7,37	17	68
50	5940XXXXXX370	0,24	25	100
51	5975XXXXXX284	0,666666667	250	1000
52	6220XXXXXX797	9,5	3	12
53	6220XXXXXX244	11,35	16	64
54	6240XXXXXX784	0,32	58	232
55	6240XXXXXX824	1,13	122	488
56	6240XXXXXX848	0,23	138	552

57	6240XXXXXX518	8,37	7	28
58	6240XXXXXX094	22,27	3	12
59	6240XXXXXXX48SX	4,66	27	108
60	6240XXXXXX757	1,342666667	19	76
61	6340XXXXXX289	188,84	1	4
62	6685XXXXXX564	328,61	1	4
63	6685XXXXXXX46NT	339,07	6	24
64	6850XXXXXX188	17,83	18	72
65	9150XXXXXX860	0,000153333	17	68
66	9505XXXXXX175	5,12	9	36

	iyimser	kotumser
Tamirlik Malzeme	$10.075,00	$12.025,00

2.2.2 Gorev destek malzemeleri	$33.333,33
2.2.3 Diger birlik sarf malzemeleri	$333.333,33

4.0 Depo seviyesi bakim

	Iyimser	kotumser
4.1 Overhaul	$500.000,00	$1.000.000,00

4.2 Diger

Asil personel	Sayilari	Yillik maas
Subay		
Binbasi	1	8500000
Yuzbasi	1	8000000
Usttegmen	1	7000000
Astsubaylar		
Cavus	4	4200000
Ustcavus	3	4800000
Bascavus	3	7000000
Muhendis	5	12000000
Teknisyen	15	9600000
Sivil Isci	48	7800000
Diger personel		
Subay		
Yarbay	1	10000000
Binbasi	2	8500000
Yuzbasi	2	8000000
Usttegmen	2	7000000
Astsubay		
Cavus	8	4200000
Ustcavus	7	4800000
Bascavus	6	7000000
Muhendis	10	12000000
Teknisyen	30	9600000
Sivil Isci	76	7800000

5.0 Kontraktor destegi YOK

6.1 techizat tipi malzeme destegi

C-130 UCAK TECHIZATLARI

S/N	STOCK NO	Fiyat	Sayilari
1	6115XXXXXX486	241643	10
2	1740XXXXXX287	32102	5
3	1730XXXXXX439	3630	20
4	2320XXXXXX709	269000	4
5	3655XXXXXX062	50719	4
6	3655XXXXXX943	17506	4
7	1650XXXXXX323	8500	5
8	4910XXXXXX124	16727,46667	3
9	1730XXXXXX969	40000	3
10	6230XXXXXX804	6500	5
11	4520XXXXXX789	1500,24	20
12	1740XXXXXX561	50000	4
13	4310XXXXXX653	3502	20

	Iyimser	Kotumser
6.2 Modifikasyon kiti	$390.000,00	$520.000

7.1.2 Medical Support 250000

7.2 Bina bakim giderleri 725000

APPENDIX I. ORIGINAL DATA FOR C-130E&B IN ENGLISH

Total C-130 Aircraft		13
Total C-160 Aircraft		12
Total CN-235 Aircraft		12
Number of C-130E		7
Number of C-130B		6

1.0 MISSION PERSONNEL
1.1 OPERATION

	No Per.	Ann. Salary
Pilot		
2nd Lieutenant	1	7.500.000
1st Lieutenant	60	8.500.000
Captain	33	9.500.000
Major	8	10.500.000
Navigator		
1st Lieutenant	55	7.200.000
Captain	32	8.000.000
Major	1	9.000.000
Flight engineer		
3rd Sergeant		
2nd Sergeant	48	7.000.000
1st Sergeant	54	8.000.000
Loadmaster		
3rd Sergeant		
2nd Sergeant	18	7.000.000
1st Sergeant	26	8.000.000
Total	224	

1.2 MAINTENANCE

Officers		
2nd Lieutenant	1	5.500.000
1st Lieutenant	3	6.000.000
Captain	4	7.500.000
Major	2	8.500.000
NCOs		
3rd Sergeant	171	4.200.000
2nd Sergeant	71	4.800.000
1st Sergeant	172	7.000.000
Civilian	7	3.600.000
Aircraft and Ground Systems Office		
Officer		
1st Lieutenant	2	7.200.000
NCOs		
3rd Sergeant	2	4.800.000
1st Sergeant	3	7.500.000

1.3 12th AIRLIFT BASE

Officers		
2nd Lieutenant	5	6.000.000
1st Lieutenant	30	7.000.000
Captain	60	8.000.000
Major	10	8.500.000
Lt Col.	8	10.000.000
Col	2	12.000.000
General	1	15.000.000
NCOs		
3rd Sergeant	150	4.200.000
2nd Sergeant	62	4.800.000
1st Sergeant	140	7.000.000
Civilian	80	4.000.000
Enlisted	800	300.000

2.0 12th AIRLIFT BASE MATERIAL CONSUMPTION

2.1 Fuel Lubricants and Energy

2.1.1 Fuel and Lubricants

			Cost
Average flight hour	500-1000		
Libre per hour		4500	
Cost of fuel per libre		0,4	
Oil			
Galon per hour		1,2	
Cost of oil per galon		0,15	

2.1.2 Electricity

Ann. base electric bill	370884000	$247.256

2.2 Consumable Material

2.2.1 Maintenance Material

C-130E CONSUMABLE MATERIALS

S/N	STOCK NO	PRICE	QUARTERLY USAGE	ANNUAL USAGE
1	1560XXXXXXX00LG	0,00005	269	1076
2	1560XXXXXXX56LG	0,000151767	38	152
3	1650XXXXXX665	3	56	224
4	1650XXXXXX060	2,78	21	84
5	1650XXXXXX430	2,63	21	84
6	1650XXXXXXXX0LE	39,79	43	172
7	1670XXXXXXXX1LG	0,000146667	14	56
8	2840XXXXXX709	30,05	27	108
9	2915XXXXXXX90	36,88	13	52
10	2915XXXXXXXX8RW	16,05	51	204
11	2940XXXXXXX58	3,8	30	120

12	2945XXXXXX384	21,82	12	48
13	4020XXXXXX334	10,07	2	8
14	4330XXXXXX593	2,51	4	16
15	4330XXXXXX274	2,42	16	64
16	4330XXXXXX013	37,96	22	88
17	4730XXXXXXXX7SX	166,1	11	44
18	4935XXXXXX425	11	2	8
19	5305XXXXXX902	0,42	356	1424
20	5310XXXXXX406	2,8	20	80
21	5315XXXXXX873	9,25	84	336
22	5315XXXXXX359	2,02	500	2000
23	5315XXXXXX274	0,14	191	764
24	5315XXXXXX566	0,68	55	220
25	5330XXXXXX759	0,00007616	139	556
26	5330XXXXXX790	0,667	50	200
27	5330XXXXXX032	322	12	48
28	5330XXXXXX462	1,063333333	19	76
29	5330XXXXXX525	0,08	4	16
30	5330XXXXXX527	500	32	128
31	5330XXXXXX006	35,29	5	20
32	5330XXXXXX345	47,5	28	112
33	5330XXXXXX310	0,00038	5	20
34	5330XXXXXX898	200	5	20
35	5331XXXXXX331	61	14	56
36	5331XXXXXX174	15	5	20
37	5331XXXXXX278	50	16	64
38	5331XXXXXX607	0,0005	16	64
39	5331XXXXXX633	50	5	20
40	5331XXXXXX262	10,1	18	72
41	5340XXXXXXX90SX	0,1	488	1952
42	5340XXXXXXX31SX	0,11	744	2976
43	5342XXXXXXX68SX	4,23	9	36
44	5355XXXXXXX40SX	7,67	13	52
45	5355XXXXXX138	20,7	36	144
46	5930XXXXXXX67SX	559,44	14	56
47	5930XXXXXX290	222,27	1	4
48	5930XXXXXXXX3SX	631,29	1	4
49	5935XXXXXX174	7,37	10	40
50	5940XXXXXX370	0,24	13	52
51	5975XXXXXX284	0,666666667	188	752
52	6220XXXXXX797	9,5	4	16
53	6220XXXXXX244	11,35	13	52
54	6240XXXXXX784	0,32	77	308
55	6240XXXXXX824	1,13	146	584
56	6240XXXXXX848	0,23	128	512
57	6240XXXXXX518	8,37	5	20
58	6240XXXXXX094	22,27	1	4
59	6240XXXXXXX48SX	4,66	39	156
60	6240XXXXXX757	1,342666667	12	48
61	6340XXXXXX289	188,84	1	4
62	6685XXXXXX564	328,61	1	4
63	6685XXXXXXX46NT	339,07	5	20
64	6850XXXXXX188	17,83	16	64
65	9150XXXXXX860	0,000153333	9	36
66	9505XXXXXX175	5,12	10	40

C-130 B CONSUMABLE MATERIALS

S/N	STOCK NO	PRICE	QUARTERLY USAGE	ANNUAL USAGE
1	1560XXXXXXX00LG	0,00005	371	1484
2	1560XXXXXXX56LG	0,000151767	57	228
3	1650XXXXXX665	3	65	260
4	1650XXXXXX060	2,78	32	128
5	1650XXXXXX430	2,63	35	140
6	1650XXXXXXXX0LE	39,79	87	348
7	1670XXXXXXXX1LG	0,000146667	9	36
8	2840XXXXXX709	30,05	34	136
9	2915XXXXXXX90	36,88	19	76
10	2915XXXXXXXX8RW	16,05	58	232
11	2940XXXXXXX58	3,8	41	164
12	2945XXXXXX384	21,82	22	88
13	4020XXXXXX334	10,07	9	36
14	4330XXXXXX593	2,51	3	12
15	4330XXXXXX274	2,42	14	56
16	4330XXXXXX013	37,96	28	112
17	4730XXXXXXXX7SX	166,1	14	56
18	4935XXXXXX425	11	8	32
19	5305XXXXXX902	0,42	222	888
20	5310XXXXXX406	2,8	16	64
21	5315XXXXXX873	9,25	92	368
22	5315XXXXXX359	2,02	750	3000
23	5315XXXXXX274	0,14	175	700
24	5315XXXXXX566	0,68	92	368
25	5330XXXXXX759	0,00007616	196	784
26	5330XXXXXX790	0,667	42	168
27	5330XXXXXX032	322	14	56
28	5330XXXXXX462	1,063333333	28	112
29	5330XXXXXX525	0,08	9	36
30	5330XXXXXX527	500	45	180
31	5330XXXXXX006	35,29	8	32
32	5330XXXXXX345	47,5	32	128
33	5330XXXXXX310	0,00038	19	76
34	5330XXXXXX898	200	4	16
35	5331XXXXXX331	61	17	68
36	5331XXXXXX174	15	7	28
37	5331XXXXXX278	50	20	80
38	5331XXXXXX607	0,0005	5	20
39	5331XXXXXX633	50	7	28
40	5331XXXXXX262	10,1	14	56
41	5340XXXXXXX90SX	0,1	322	1288
42	5340XXXXXXX31SX	0,11	525	2100
43	5342XXXXXXX68SX	4,23	10	40
44	5355XXXXXXX40SX	7,67	16	64
45	5355XXXXXX138	20,7	31	124
46	5930XXXXXXX67SX	559,44	14	56
47	5930XXXXXX290	222,27	0	0
48	5930XXXXXXXX3SX	631,29	2	8
49	5935XXXXXX174	7,37	17	68
50	5940XXXXXX370	0,24	25	100
51	5975XXXXXX284	0,666666667	250	1000
52	6220XXXXXX797	9,5	3	12
53	6220XXXXXX244	11,35	16	64

54	6240XXXXXX784	0,32	58	232
55	6240XXXXXX824	1,13	122	488
56	6240XXXXXX848	0,23	138	552
57	6240XXXXXX518	8,37	7	28
58	6240XXXXXX094	22,27	3	12
59	6240XXXXXXX48SX	4,66	27	108
60	6240XXXXXX757	1,342666667	19	76
61	6340XXXXXX289	188,84	1	4
62	6685XXXXXX564	328,61	1	4
63	6685XXXXXXX46NT	339,07	6	24
64	6850XXXXXX188	17,83	18	72
65	9150XXXXXX860	0,000153333	17	68
66	9505XXXXXX175	5,12	9	36

Maintenance Material

2.2.2 Mission Support Supplies

2.2.3 Other Unit Level Consumption

3.0 Intermediate Maintenance

4.0 Depot Level Maintenance

		Optimistic	Pessimistic
4.1 Overhaul		$500.000,00	$1.000.000,00

4.2 Other

Direct Personnel	No.Per.	
Officer		
Major	1	8.500.000,00
Captain	1	8.000.000,00
1st Lt.	1	7.000.000,00
NCO		
3rd Sergeant	4	4.200.000
2nd Sergeant	3	4.800.000
1st Sergeant	3	7.000.000
Engineer	5	12.000.000
Technician	15	9.600.000
Civilian Labor	48	7.800.000

Indirect Personnel		
Officer		
Lt.Colonel	1	10.000.000,00
Major	2	8.500.000,00
Captain	2	8.000.000,00
1st Lt.	2	7.000.000,00
NCO		
3rd Sergeant	8	4.200.000
2nd Sergeant	7	4.800.000
1st Sergeant	6	7.000.000
Engineer	10	12.000.000
Technician	30	9.600.000
Civilian Labor	76	7.800.000

5.0 Contractor Support NO!

6.0 Sustaining Support

6.1 Support Equipment Replacement

C-130 AIRCRAFT EQUIPMENTS

S/N	STOCK NO	PRICE	No. Equip.
1	6115XXXXXX486	$241.643	10
2	1740XXXXXX287	$32.102	5
3	1730XXXXXX439	$3.630	20
4	2320XXXXXX709	$269.000	4
5	3655XXXXXX062	$50.719	4
6	3655XXXXXX943	$17.506	4
7	1650XXXXXX323	$8.500	5
8	4910XXXXXX124	$16.727	3
9	1730XXXXXX969	$40.000	3
10	6230XXXXXX804	$6.500	5
11	4520XXXXXX789	$1.500	20
12	1740XXXXXX561	$50.000	4
13	4310XXXXXX653	$3.502	20

	Optimistic	Pessimistic
6.2 Modification Kit	$390.000,00	$520.000,00
7.1.2 Medical Support	$250.000,00	
7.2 Installation Support	$725.000,00	

APPENDIX J. ORIGINAL DATA FOR 10 C-130J

	OPERATIONS	OTHER SUPP/INDIRECT SUPP	FUEL	**PARTS**
FY 99	$1.566.434	$5.733.333	$2.533.333	$3.069.231
FY 00	$3.289.510	$11.466.667	$5.066.667	$6.322.615
FY 01	$4.934.266	$17.200.000	$7.600.000	$9.483.923
FY 02	$6.579.021	$22.933.333	$10.133.333	$12.645.231
FY 03	$8.223.776	$28.666.667	$12.666.667	$15.806.538
FY 04	$9.868.531	$34.400.000	$15.200.000	$18.967.846
FY 05	$11.513.287	$40.133.333	$17.733.333	$22.129.154
FY 06	$13.158.042	$45.866.667	$20.266.667	$25.290.462
FY 07	$14.802.797	$51.600.000	$22.800.000	$28.451.769
FY 08	$16.447.552	$57.333.333	$25.333.333	$31.613.077
FY 09	$18.092.308	$63.066.667	$27.866.667	$34.774.385
FY 10	$19.737.063	$68.800.000	$30.400.000	$37.935.692
FY 11	$21.381.818	$74.533.333	$32.933.333	$41.097.000
FY 12	$23.026.573	$80.266.667	$35.466.667	$47.419.615
FY 13	$24.671.329	$86.000.000	$38.000.000	$47.419.615
FY 14	$25.904.895	$86.860.000	$38.000.000	$48.842.204
FY 15	$27.200.140	$87.728.600	$38.000.000	$50.307.470
FY 16	$28.560.147	$88.605.886	$38.000.000	$51.816.694
FY 17	$29.988.154	$89.491.945	$38.000.000	$53.371.195
FY 18	$31.487.562	$90.386.864	$38.000.000	$54.972.331
FY 19	$33.061.940	$91.290.733	$38.000.000	$56.621.501
FY 20	$34.715.037	$92.203.640	$38.000.000	$58.320.146
FY 21	$36.450.789	$93.125.677	$38.000.000	$60.069.750
FY 22	$38.273.328	$94.056.933	$38.000.000	$61.871.843
FY 23	$40.186.995	$94.997.503	$38.000.000	$63.727.998
FY 24	$42.196.344	$95.947.478	$38.000.000	$65.639.838
FY 25	$42.618.308	$96.906.953	$38.000.000	$67.609.033
FY 26	$43.044.491	$97.876.022	$38.000.000	$69.637.304
FY 27	$43.474.936	$98.854.782	$38.000.000	$71.726.423
FY 28	$43.909.685	$99.843.330	$38.000.000	$73.878.216
FY 29	$44.348.782	$100.841.763	$38.000.000	$76.094.562
FY 30	$44.792.270	$101.850.181	$38.000.000	$78.377.399
FY 31	$45.240.193	$102.868.683	$38.000.000	$80.728.721
FY 32	$45.692.595	$103.897.370	$38.000.000	$83.150.583
FY 33	$46.149.520	$104.936.343	$38.000.000	$85.645.100
FY 34	$46.611.016	$105.985.707	$38.000.000	$88.214.453
FY 35	$47.077.126	$107.045.564	$38.000.000	$90.860.887
FY 36	$47.547.897	$108.116.020	$38.000.000	$93.586.713
FY 37	$48.023.376	$109.197.180	$38.000.000	$96.394.315
FY 38	$48.503.610	$110.289.152	$38.000.000	$99.286.144
FY 39	$48.988.646	$111.392.043	$38.000.000	$102.264.728
FY 40	$49.478.532	$112.505.964	$38.000.000	$105.332.670
FY 41	$49.973.318	$113.631.023	$38.000.000	$108.492.650
FY 42	$50.473.051	$114.767.333	$38.000.000	$111.747.430
FY 43	$50.977.781	$115.915.007	$38.000.000	$115.099.853
FY 44	$51.487.559	$117.074.157	$38.000.000	$118.552.848
FY 45	$52.002.435	$118.244.898	$38.000.000	$122.109.434
FY 46	$52.522.459	$119.427.347	$38.000.000	$125.772.717
FY 47	$53.047.684	$120.621.621	$38.000.000	$129.545.898
FY 48	$53.578.161	$121.827.837	$38.000.000	$133.432.275
FY 49	$54.113.942	$123.046.115	$38.000.000	$137.435.244
FY 50	$54.655.082	$124.276.577	$38.000.000	$141.558.301
	$1.823.650.092,63	$4.553.934.230,82	$1.710.000.000,00	$3.614.521.023,18

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Vita

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14. ABSTRACT

This study addresses the operation and support cost differences between the TUAF C-130E & C-130B, and the USAF C-130J aircraft. The TUAF C-130s have been being used for more than 30 years and changing world situations give armed forces different roles, and Turkey participates in all peacekeeping missions that are assigned by NATO (North Atlantic Treaty Organization) and the United Nations. While performing these roles, the importance of air mobility and the importance of reliability became widely appreciated. Moreover, the coming retiring age of the existing C-130s in the TUAF forced the TUAF to look for ways to improve its air mobility.

Under these conditions the TUAF is trying to find a way to decrease these interruptions in the missions and to increase the capability of carrying more personnel and materials so as to increase the effectiveness of Air Lift missions. There are two ways to accomplish this target: (1) Refurbish the existing C-130s and increasing its reliability, and (2) Buy the newest version of C-130 Hercules, the C-130J

This study investigates the O&S cost difference among the aircraft by establishing a model to assess the O&S cost that can be used to evaluate the competing alternatives as well as the replacement decision for the existing systems. Cost Oriented Resource Estimation (CORE) model utilized in establishing the model. Sensitivity Analysis, and Breakeven Analysis are applied to the cost figures over 40 years. The analysis showed that C-130J amortizes itself in the lifetime of the cargo aircraft. In addition to that improved avionic, and propulsion systems increase the efficiency and effectiveness of the air mobility.

15. SUBJECT TERMS
Life Cycle Cost, Operating and Support Cost

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