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A COMPARISON OF THE ALL MOBILE TACTICAL AIR FORCE AND THE LOGISTICS COMPOSITE SIMULATION MODELS

THESIS

David P. Leonhardt, Captain, USAF

AFIT/GLM/LSM/91S-42

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A COMPARISON OF THE ALL MOBILE TACTICAL AIR FORCE AND THE LOGISTICS COMPOSITE SIMULATION MODELS

THESIS

Presented to the Faculty of the School of Systems and Logistics

of the Air Force Institute of Technology

Air University

In Partial Fulfillment of the

Requirements for the Degree of

Master of Science in Logistics Management

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September 1991

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Preface

The purpose of this study was to begin the process of comparing the AMTAF model to the LCOM model. In particular, this study was designed to compare the sortie generation portion of AMTAF with LCOM.

Results of the comparison showed that, statistically, there is no significant difference between selected output variables produced by each model when the initial inputs to the models are as identical as possible given the inherent logic differences between the two models.

In performing the thesis process, I am indebted to the support of many others. First, thanks to my faculty advisor, Major David Diener for steering me in the right direction when I would veer off-course. Second, sincere appreciation goes to Captain Gregg Clark and Michelle Judson of ASD/ALH for their part with helping me to understand LCOM and in making the LCOM runs; Eric Werkowitz, Tammy Logan, and the ASD/XR community for providing me with the computer facilities to develop the AMTAF database and run the simulations; and Mark Speed and Ball Systems Engineering Division for the time and effort put forth in preparing an AMTAF training session as well as time spent working with me in developing the AMTAF database. Finally, I wish to thank my family for supporting me over the last 15 months, especially my wife, Ila.

David P. Leonhardt

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Abstract

The sortie generation component of AMTAF was compared to LCOM with respect to the number of sorties generated and the number of maintenance manpower hours utilized during a 60-day scenario. The AMTAF database was developed from a F-36 LCOM database used in previous LCOM comparisons with other models with the intent of each model having identical databases. A 2^n factorial experimental design was used for the study with an n-value equal to three. Three variables, the number of LRUs available in the supply pool, the number of personnel available for maintenance tasks, and the quantity of AGE available on the base, were allowed to take on either a constrained or unconstrained value in the study. A distribution of the differences in each output variable between the two models was developed and a confidence interval of the distribution mean was calculated using a 95% confidence factor. Results showed that there was no statistical difference in the number of sorties generated and the manpower hours utilized between the two models. Recommendations were made to continue the comparisons by adding more variability to the databases and enabling many of the functions in the models that were disabled for this study.

A COMPARISON OF THE ALL MOBILE TACTICAL AIR FORCE AND THE LOGISTICS COMPOSITE SIMULATION MODELS

I. INTRODUCTION

Issue

Does the All Mobile Tactical Air Force (AMTAF) model give forecasts of aircraft generation and maintenance data comparable to forecasts made by the Air Force's "standard" models, such as the Logistics Composite Model (LCOM)? This question is of interest to the Aeronautical Systems Division's Mission Area Planning Section (ASD/XRS), who believe that AMTAF has features that can make it useful as a standard Air Force sortie generation simulation model.

Background. Computer simulation is becoming (if not there already) the standard planning tool to project almost all aspects of Air Force operations. A couple of the most widely used models in aircraft generation and maintenance planning are LCOM and Theater Simulation of Air Base Resources (TSAR). Recently, ASD/XRS took delivery of AMTAF from Ball Corporation, who had been contracted to develop a simulation model sensitive to a wide-range of performance and support variables. ASD/XRS had let this contract to develop a simulation model with a broader base than many of the "standard" models being used.

Some of these models such as LCOM and TSAR are not considered "user-friendly" because of their complicated data input procedures and their tabular output formats. TSAR requires massive amount of data to satisfy its requirements and is lacking in pre- and post-processor capabilities (15:12). Similarly, data formatting and retrieval in LCOM is extremely complicated. In addition to the "ease of use" issue, XRS was interested in developing a model that integrated all of the logistics functions of a Main Operating Base (MOB) with those of Dispersed Operating Bases (DOB) and higher level maintenance facilities such as intermediate level maintenance facilities and depots. This integration would allow much more detailed studies of how the logistics and operations functions interrelate (22).

With this in mind, AMTAF was developed by taking many of the capabilities of TSAR and converting them to a more "user-friendly" form. These capabilities put AMTAF into the category of LCOM and TSAR as a model for use in forecasting resource needs, manpower requirements, and other items related to aircraft generation and maintenance planning. ASD/XRS has used AMTAF to evaluate Short Take-off/Vertical Landing (STOVL) aircraft versus conventional aircraft and believes that the model has tremendous potential for use Air Force-wide (22).

Justification for Model Comparison

According to David R. Noble, Air Force analysts are looking for an alternative to LCOM and TSAR because of limitations that each of the models possess (15:6). Noble states that LCOM has limitations in what situations it can model and that analysts are reluctant to use TSAR exclusively because of ". . . its ability to match the forecasting abilities and suitability of LCOM, in those areas where the two models duplicate capability, has yet to be proven (15:6)."

This dilemma has forced analysts to maintain both models resulting in duplication of effort. Since AMTAF has most (if not all) of the capabilities of TSAR, a case can be made that AMTAF could be used in place of the other two models as the single most reliable forecasting tool for aircraft resources, if it can be shown to be comparable to the forecasting abilities of LCOM.

Problem Statement

The purpose of this study is to determine whether the Sortie Generation (SORGEN) component of AMTAF produces acceptable forecasts compared to LCOM using the same data base. Acceptable AMTAF model forecasts are operationally defined as being statistically equivalent, within a specified confidence interval, to LCOM model forecasts.

Limitations

Both LCOM and AMTAF have the capability to simulate a wide range of activities within the aircraft generation and maintenance functions. To check every aspect of each model against each other, however, would be a monumental task requiring the evaluation of hundreds (if not thousands) of different variable combinations.

To narrow the scope of the study while still maintaining viable comparison characteristics, this research compares part of the SORGEN component of AMTAF with parts of the LCOM model. According to ASD/XRS, the AMTAF model cannot be validated if the SORGEN component does not compare favorably with LCOM since most of the other AMTAF components interact to a great extent with the SORGEN component (22).

Research Objectives

The purpose of this study is to evaluate and answer the following research questions:

1. What differences exist between LCOM and AMTAF? These differences can be separated into the following categories:
   a. Input variables and formats
   b. Output variable and formats
   c. Main forecasting emphasis (the main variables and areas that the models are used to analyze).

2. Are the simulation outputs of the two models statistically the same given common scenarios and databases?

Model Differences. There are a number structure and logic differences between the LCOM and AMTAF models. The main emphasis of research question number one is to: 1) identify these differences, 2) determine how important these differences are to the simulation outputs, and 3) determine if there is a way to reduce the impact of these differences so that a comparison of the forecasting outputs of the two models can be made.

Similarity of Results. In order to determine whether AMTAF and LCOM results are similar, the forecasting outputs of each model must be the same with some degree of statistical significance. Question number two deals with the comparison of specific sets of forecasted data generated by AMTAF with the corresponding sets of forecasted data generated by LCOM using the same variables, criteria, and database.

Experiment Hypothesis

The overall purpose of this study is to determine whether the AMTAF forecasting model is functionally the same as the widely-used LCOM forecasting model in the case of the number of sorties flown and the manhours utilized in a simulation given a common database. The research objectives provide the basis by which the comparison of the two models can be made. Because of the complexities of both models and the myriad of components and variables found in the simulations themselves, the actual hypothesis has been reduced to the following:

> The forecasted outputs of total sorties generated and manpower hours required for maintenance over the 60-day test period from the sortie generation components of AMTAF and LCOM are functionally the same when the input variables and database of each model are equivalent.

Scope

Because of the complexity of the two models, it is necessary to impose limits on the inputs to, and outputs from the simulations.

Input Limitations. The database used for the simulations is a training database found in the LCOM documentation that has gone through three different modifications and contains the necessary information needed to simulate all activities related to the generation of sorties such as maintenance, supply, manpower, etc. (6:16). Variables within each model will be set to simulate identical starting statuses. Because of the different random number generation and usage in the two models, 20 replications are run for each scenario to get a distribution of outputs for statistical analyses of the differences between the two models.

Other input limitations include: 1) the use of a peacetime scenario since LCOM's wartime scenario capabilities are limited, 2) the suppression of all variance in event durations (such as maintenance task times, sortie times, etc.) with the exception of the failure clocks for the Line Replaceable Units (LRU), 3) modeling of only one base with no outside facilities, and 4) allowing only one type of aircraft at the base.

Output Limitations. Only the SORGEN module of AMTAF is used in the comparison because LCOM does not address the problems that are addressed by the other three AMTAF modules. Only two output variables from the two models are considered for comparison, specifically, the number of sorties generated and the manpower hours required over a 60-day period.

Assumptions. There are no initial assumptions made other than those that are inherently built into the programming of each simulation model. No attempt is made to ascertain what those inherent assumptions are. Only the results of those assumptions, i.e., the forecasting outputs of each model, are evaluated and compared.

Summary

Rationale for this study comes from previous theses done by David R. Noble (15) and Gregg A. Clark (6). The justification is provided mainly by ASD/XRS, who wishes to validate AMTAF.

The AMTAF model may be a powerful tool to forecast sortie generation and maintenance requirements in the planning phase of an aircraft system. If it can be shown to be a valid model, AMTAF could replace other current models such as LCOM and TSAR because it incorporates most of the functions of TSAR into a more user-friendly format (5) and provides the same forecasting information as LCOM (the focus of this study). The basis of this study is to test whether AMTAF and LCOM produce essentially the same values for corresponding output variables given similar databases and initial values of the input variables. Given a failure to reject the hypothesis of this study, it will be left to others to show that AMTAF outputs indeed do not differ from LCOM output (under identical initial conditions) by doing more detailed research on the databases used in this study.

Definitions

Aircraft Ground Equipment (AGE)- Equipment used by maintenance personnel on the flightline to service aircraft.

Air Force Specialty Code (AFSC)- an identifier given Air Force personnel to distinguish the type of work that they are trained for.

Cannibalization- the practice of removing a good part from a plane that is down for unrelated maintenance and installing it on a plane needing that part in order to avoid waiting for a new part to come from Supply.

Discrete Event Simulation- a simulation in which the state of a model (or of a system being modeled) changes at only a discrete, but possibly random, set of time points, known as event times (17:16).

Dispersed Operating Base (DOB) - a designated location where a squadron or wing will deploy. In many cases there are very few facilities existing at the DOB location before the unit arrives, requiring the unit to bring what it needs to function. A Main Operating Base will provide many services that the unit itself cannot provide due to lack of facilities, manpower, or other limitations.

European Scenario- A scenario pitting Warsaw Pact forces led by the Soviet Union against NATO forces led by the United States in Europe along boundaries and under political realities that were prevalent in the mid 1980s.

Line Replaceable Unit- an aircraft component that can be repaired while still on the aircraft or removed and replaced if it cannot be repaired on the aircraft. If removed, it is replaced by an identical part that is functioning properly and taken to a maintenance shop for repair. Once repaired, it is returned to the supply pool for use.

Main Operating Base- an established air base which supports one or more DOBs with a resupply function, maintenance facilities and capabilities, and/or personnel that the DOB is in need of.

Monte Carlo Simulation- the commonly used name to describe discrete-event simulation.

Network- A sequence of events that take place for a given function consisting of one or more tasks that must be completed. Tasks are accomplished either deterministically (meaning that the individual task is always completed if the network is being accomplished or always completed when certain preconditions are met) or probabilistically (meaning that they occur as mutually exclusive or non-mutually exclusive random events with a certain probability of occurrence). Each task can branch out into sub-tasks which must be completed before the next task in the network can be accomplished. The network is completed when the final task in the network chain is accomplished.

Off-Equipment Task- A maintenance task performed on a piece of equipment or component after it has been removed from the aircraft.

On-line- a term used to describe a situation where a computer user can make input changes to a program by bringing up the required data on the computer screen, making the changes on the screen, and returning the changed data back to the program.

On-Equipment Task- a maintenance task that is performed on a piece of equipment or component that is still installed on the aircraft.

Probability Distribution- a function that relates a probability to the values a random variable can take on (8:807).

Scenario- the overall attributes of a system that is being simulated, such as the location and number of facilities, types and numbers of personnel utilized, types and number of parts and equipment used, sortie rates, etc.

Simulation- a descriptive technique that involves developing a model of some real phenomenon and then performing experiments on that model (8:587). In this study, the real phenomenon is an air base with all its characteristics and activities.

Sortie- the actual flying of the mission by the aircraft. In this study, a sortie is defined as the actual takeoff of the aircraft since there is no possibility of aborting the mission.

User-Friendly- a term used to describe a computer program that is relatively simple for a novice to learn how to use and allows easy data manipulation.

Variable- a condition existing in the scenario that is allowed to change to measure the effect it has on the overall system.

II. BACKGROUND

Introduction

This chapter gives background information on both LCOM and AMTAF and summarizes results from a preliminary comparison of the capabilities of AMTAF to those of LCOM and other models. The chapter then concludes by showing the results of two recent studies comparing LCOM with the Theater Simulation of Air Base Resources (TSAR) model. These two comparisons are mentioned because of the similarities to this study and because the same LCOM database used in one of the studies was used (with some modifications) in this research.

Both LCOM and AMTAF are Monte Carlo, discrete-event simulation models (15:1), and both are designed to model the interaction between operations and logistics factors. In addition, AMTAF can also be run in the expected-value mode (22). The models simulate the possible operational results of given scenarios by processing a series of identified tasks and task networks that correspond to the tasks performed on the actual weapons system. Tasks can be divided into two basic categories, deterministic and probabilistic.

Deterministic tasks are those tasks which occur every time a certain situation arises. For example, before an aircraft can take off, a pre-flight check must be accomplished. This task happens before every sortie, regardless of the situation. Deterministic tasks, however, do not necessarily occur between every sortie. Some maintenance tasks, for instance, will be performed after the aircraft has logged so many flight-hours since the last time the task was performed. A probabilistic task is a task that occurs only as a result of some random event. Maintenance data have shown that some parts will fail along some probabilistic distribution and it is necessary for the models to be able to simulate this probabilistic distribution. To illustrate how this occurs, fictitious maintenance data show that for a particular radar part, 10 percent will fail after 100 flight-hours. The simulations model this probability using random number generators. In this case, a random number between zero and one could be generated using the failure-rate distribution of the part. If the number is .100 or below, the part fails and a maintenance task is performed (in this case the part is removed and replaced). If the number is higher than .100, the model skips to the next possible task. Both LCOM and AMTAF use random number generators, though the use of particular streams of random numbers varies between models.

Both models simulate facilities such as aircraft shelters, taxiways, runways, and repair shops and each model has its own way of keeping track of the data unique to these facilities as well as the resources required to run them. The purpose of each model is to determine what happens to facilities, resources, etc., when scenario tasking is placed on the flying unit simulated in the models. Some common output measures that are studied by running such models with given parameters are the number of sorties flown, man-hours required (normally maintenance man-hours), equipment usage, support resources utilized, and personnel required. A description of and the background behind each of the models compared in this study follows, as well as some information on similar comparison studies that have been done using LCOM and TSAR.

The Logistics Composite Model (LCOM)

Background. LCOM was developed by the Rand Corporation and the Air Force Logistics Command in the late 1960s. It was adopted by the Tactical Air Command manpower community in 1971 and in 1974, approved by HQ USAF for use in determining aircraft maintenance manpower requirements. Since that time, it has been upgraded many times and has been used by various Department of Defense agencies and contractors. The model is now continuously updated and maintained by the Headquarters, Air Force, manpower community, specifically HQ AFMEA (1). The users manual is maintained as an Air Force publication (9).

The validity of LCOM has been demonstrated on many occasions by using actual data to compare with the simulated output given by the model (15:4). Because of its longevity, the validated results, its wide use within the Air Force, and the fact that it is maintained by the AF manpower community, LCOM has become a commonly accepted tool for resource (mainly manpower) determination.

Purpose. LCOM models generation of sorties from a single air base given constraints. It can be used to analyze the interaction between operations and logistics factors to identify tradeoffs and can be used to determine logistics resource requirements for existing and emerging weapon systems. It can also be used to assess the impact of how policy/program changes affect the performance of the weapon system and its support structure.

Characteristics. LCOM consists of three main parts: the input module, the main module, and the post-processor module.

Input Module. Data needed to run the simulation can be introduced into the input module in one of two ways, 1) it can be done on-line or 2) LCOM has the capability of building data base parameters using raw maintenance and resource data (7). The input module has a pre-processor which then reformats these data into a form usable by the simulation module (15:3).

Databases formatted in this module fall in one of two categories, scenario development or database development. Scenario development is concerned with the following databases: 1) maintenance parameters to include maintenance concepts, maintenance policy, maintenance organization, Air Force Specialty Code (AFSC) structure, maintenance rates, and task information; 2) supply parameters to include not-mission-capable rates, resupply times, and spares levels; and 3) operational parameters to include sortie data, mission data, alert posture, aircraft configuration, weather minimums, and abort rate. Database development is concerned mainly with the maintenance functions such as the flightline network (the sequence and routing of maintenance tasks on the flightline), the on-equipment unscheduled maintenance network, and the off-equipment unscheduled maintenance network.

Simulation Module. This module is where the actual simulation of the air base operation is done using the databases that are found in the input module. Figure 1, which is reproduced from an Aeronautical Systems Division (ASD) Technical Report, shows a simplified diagram of how the simulation uses these inputs to simulate a sequence of maintenance activities that would take place in an operational unit flying a specified schedule (16:4).

The simulation follows a predetermined flying schedule. When the schedule calls for a mission, aircraft are assigned and configured using resources from the pool that has already been established in the model and keeps track of the utilization and/or expenditure of each resource throughout the simulation. Once the mission has been flown, the aircraft return and maintenance is performed as required.

The simulation maintains a failure clock for each subsystem which draws random numbers according to a pre-established probability distribution (usually exponential)

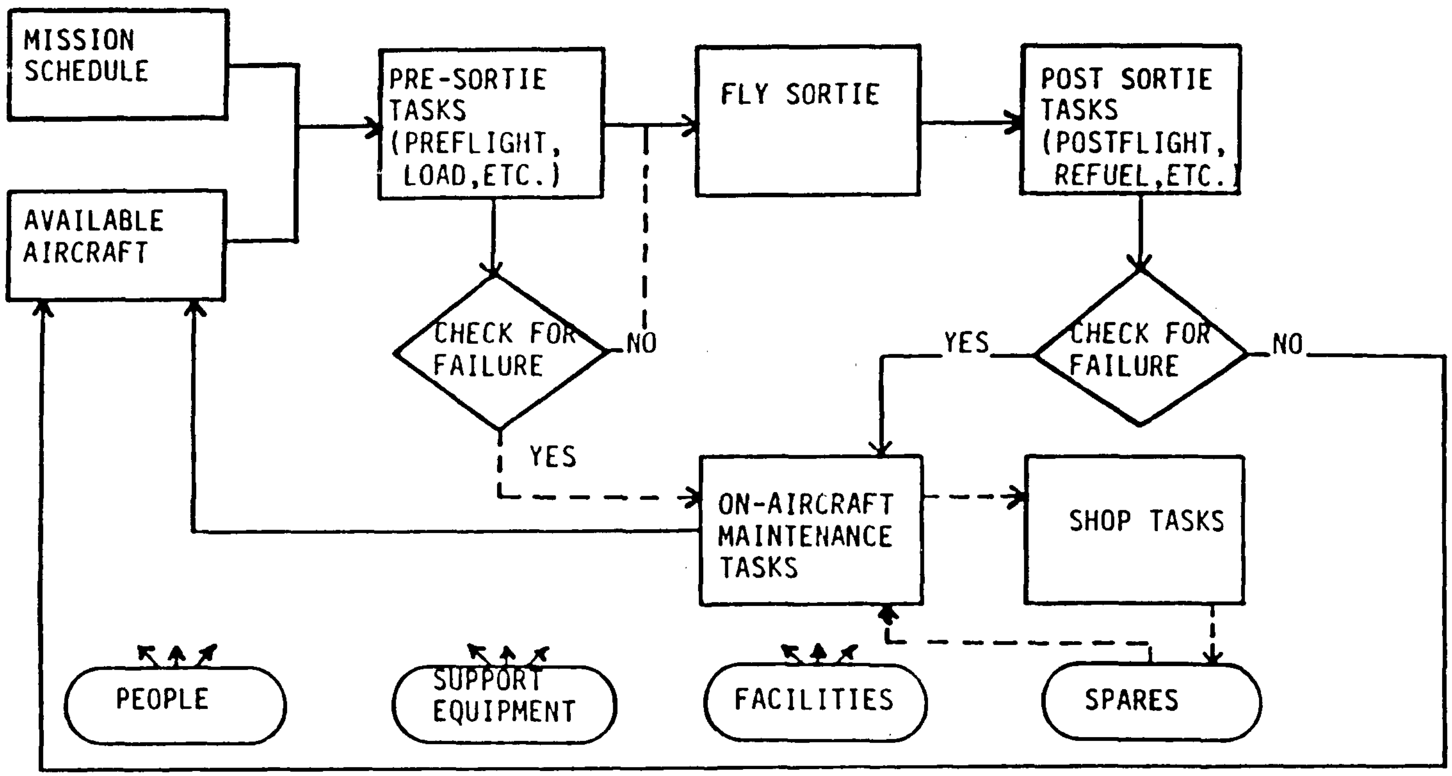

Figure 1. LCOM Simulation Logic Structure

to determine whether the subsystem has failed or not. If failure occurs, maintenance is performed according to the pre-established maintenance networks for that particular system. Once all post-flight maintenance has been performed, the aircraft is prepared for another mission (16:5).

Post-Processor Module. This module provides the results of the simulation. During the simulation, reports are produced showing operational effectiveness, spares requirements, stock level performance, and a variety of resource utilization and performance data. Most of these data can be found in the primary simulation output report, the Performance Summary Report. The post-processor also produces other time-oriented snapshot reports with similar data. Not all reports, however, can be accomplished during the simulation. To accomplish other reports, detailed simulation data are stored and can be retrieved using one of the following post processors in the module: programs, decoder, matrix, graph, parts, display, mission, and support equipment (9:2-2).

Limitations. LCOM has three major limitations. First, it is not a "user-friendly" simulation model. In order for the model to be useful, the person using the model must take the time to learn all aspects of the model (some of which are quite complicated). ASD estimates that personnel require 12 months of training on the model and should have systems engineering skills and first hand knowledge of aircraft maintenance procedures as prerequisites (1).

Second, many critics have pointed to the long run-times required to run a complete model and the long lead times required to initially build a data base. In one such critique Francis Hoeber states that LCOM is ". . . huge and cumbersome. . . and one-half to two hours of CPU time are required for one LCOM run (12:116)." ASD estimates that it takes from 1-12 months to build a suitable data base for the model (1).

Third, LCOM is written in SIMSCRIPT II.5. According to Clark, the major problem with SIMSCRIPT II.5 is that even though SIMSCRIPT II.5 is a very good simulation language, ". . . SIMSCRIPT II.5 compilers are not widely available and are quite expensive to develop and buy (6:11)." This limits the portability of LCOM.

LCOM Applications. LCOM is used by most of the major commands primarily for manpower forecasting (21). It is maintained for that purpose by the manpower community, specifically HQ MEA as mentioned above. LCOM, however, has been and continues to be used for other purposes. Some of its users and uses have included: 1) Air Force Systems Command/Human Resources Lab to study developmental aircraft manpower requirements, 2) Air Force Test and Evaluation Center assessing the performance of weapons systems and the study of space shuttle availability, 3) U.S. Navy for analyzing the SH-2D helicopter with respect to carrier operations, 4) Air Force Communication Command studying the utilization of ground communication equipment, 5) the Air Force Logistics Command for use in analyzing spares, and 6) Air Force Tactical Air Command for engine pipeline studies (1, 6:9, 21).

In addition to the applications mentioned above, ASD has given LCOM support to the following program offices: F-15, F-16, E-3A, E-4, EF-111A, and KC-10 (1). Even though it is still primarily a model used for manpower forecasting and planning, the wide use of LCOM in other types of studies has entrenched it as a one of the Air Force's most trusted simulation models.

The All Mobile Tactical Air Force Model

Background. According to the AMTAF Users Manual, "The All Mobile Tactical Air Force (AMTAF) suite of models was developed as a balanced weapon systems evaluation model to enable an analyst to measure and prioritize the many activities associated with deploying and supporting weapon systems" (4:1-1).

The motivation for AMTAF can be expressed in the following:

- USAF realization that logistics is a key driver for overall mission effectiveness evaluation.

- There is a need to understand how reliability, maintainability, logistics, and combat effectiveness play together.

- There is no existing single tool or resource that fully integrates all factors affecting sortie generation (5).

The concept of developing a model to meet the above-stated objectives originated around 1984 (5). In 1985, Verac, Inc. was commissioned by ASD/XRS to develop such a model to use with its STOVL program. The tasking was to develop a model that would incorporate many of the characteristics of existing models into one, more "user-friendly" model. Shortly thereafter, Verac was acquired by Ball Corporation and hence Ball Systems Engineering Division continued the contract to develop the model. The finished model was delivered in 1990. This is the first study to compare the output results of this model with any other established model such as LCOM.

Characteristics. AMTAF was developed with the European scenario of the mid-1980s in mind. It has the provisions to model a Main Operating Base (MOB) supporting one or more Dispersed Operating Bases (DOB) (20). Even though the European scenario is no long valid, AMTAF's MOB/DOB concept is a realistic concept and can be used effectively with current scenarios because most of the underlying principles of air base operations apply across the spectrum of peacetime or wartime scenarios.

AMTAF contains four interactive components: the Sortie Generation Model (SORGEN), the Logistics Model (LOGSIM), the Sortie Effectiveness Model or Mission Area Simulation to Evaluate Requirements (MASTER), and the TSAR Inputs Using AIDA (TSARINA) model (4). The first three models are designed to be interactive to the point that they can be run separately if an analyst wants to focus on a specific aspect of the simulation or run as a whole grand simulation. Each component has a set of databases, some of which are shared between components. The fourth component, TSARINA, interoperates with the SORGEN component and is used to simulate an attack on the air base with either conventional or chemical weapons. Figure 2 shows a representation of how the models interact.

SORGEN. This component is a detailed simulation of air base operations. The air base can be designated as a MOB with one or more DOBs or as a MOB alone. The primary measure of merit for this component is the number of sorties generated. Other outputs of interest generated by SORGEN are: resources causing delays; resources used, ordered, received or lost; aircraft turn times; and costs (although this is a weak part of the model) (5). SORGEN can be run interactively with the MASTER, LOGSIM, and/or TSARINA components or it can be run separately using its own databases which include: Control, Scenario, Base, Aircraft, Mission, Resource, Attacks, and Base Mods.

LOGSIM. LOGSIM is a multi-echelon logistics simulation. The emphasis in this component is the demand placed on the logistics support system given simulated aircraft missions. According to the AMTAF Users Manual,

> . . . LOGSIM models the demands that are placed on a logistics support system to supply parts, munitions, support equipment, and POL needed to perform tactical aircraft sorties at operational air bases. LOGSIM explicitly represents the movement of transports

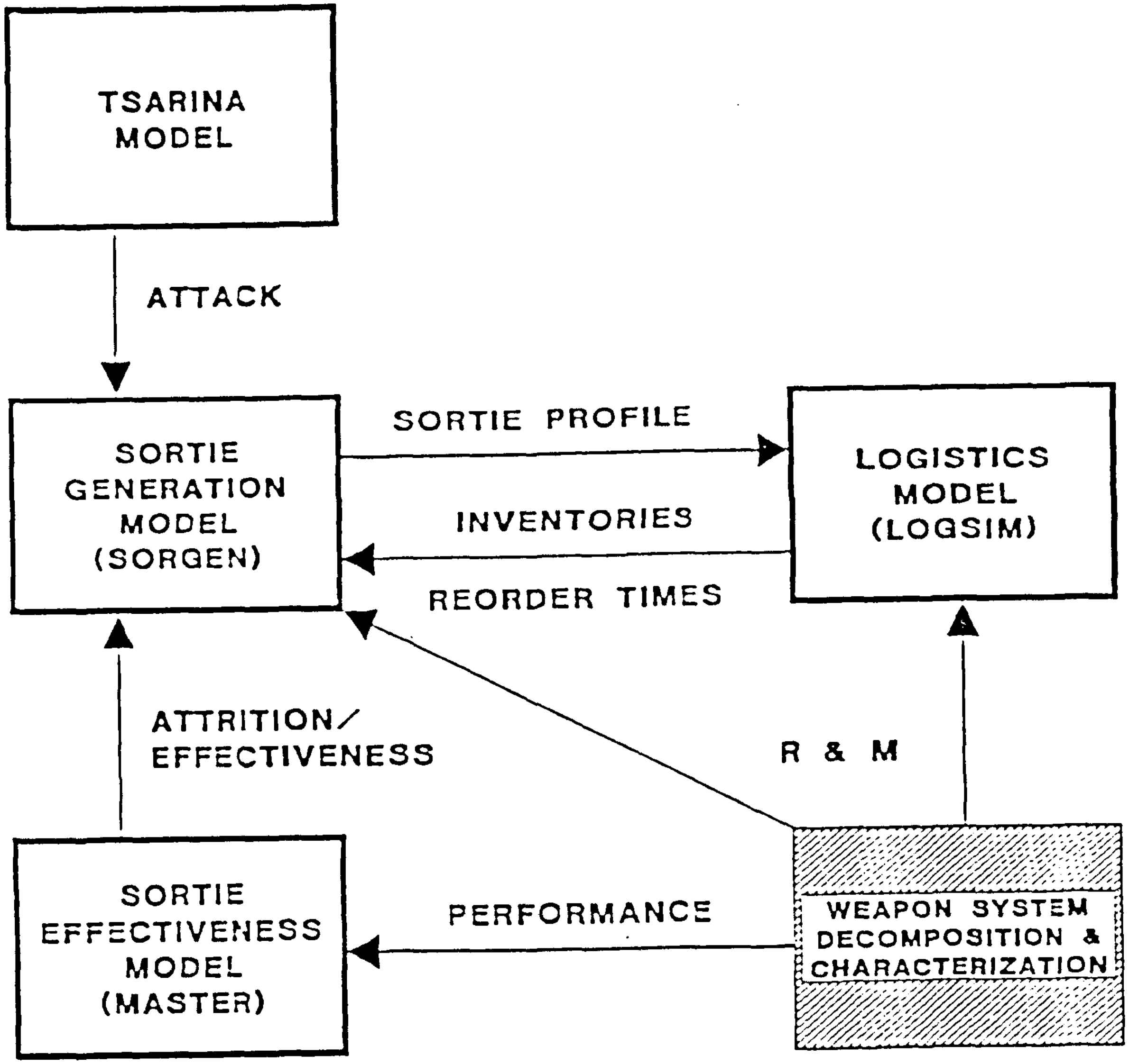

Figure 2. AMTAF Model Components

between bases and the repair of all non-flightline aircraft parts and support equipment (4:6-1).

AMTAF has the capability of modeling a two-tier (MOB and Depot) or a three-tier (MOB, Intermediate Maintenance Facility, Depot) maintenance support structure. The primary measures of merit in LOGSIM are inventory levels, reorder delays, transport utilization, and sortie generation. The component can be run interactively with SORGEN and MASTER, in which case, LOGSIM uses mission demand inputs from SORGEN and mission effectiveness inputs from MASTER to calculate the lead times that will occur to fulfill these demands, and provides this information to SORGEN; or it can be run separately using its own internal databases such as Control, Scenarios, Base, Resource, Aircraft Line Replaceable Unit (LRU) Specification, Base Modifications, Sortie Demands, and Mission Definitions.

MASTER. This component enables AMTAF to model sortie engagements. According to the AMTAF training manual, "The MASTER Model provides the detail necessary to simulate the engagements of many surface vehicles and aircraft each with multiple sensor and weapon capabilities. The object is to provide estimates of survivability and mission effectiveness (4:8-1)." MASTER is database compatible with SORGEN and LOGSIM. It provides mission success, mission survival, and resource utilization data to SORGEN and mission effectiveness data to LOGSIM. The databases peculiar to MASTER are: Control; Scenario;

Player; Environment; Vulnerability, Signature and Area; Sensors; Trajectory; Fire Control; Missiles; Guns; Lasers; Bombs; CM (chemical weapons); and CM Effects.

TSARINA. This component is a model that was developed by the Rand Corporation for use with TSAR, another sortie generation model. Because of its usefulness for air base attack simulation, it was incorporated in its entirety into AMTAF and designed to interface with SORGEN. The SORGEN/TSARINA interface is modeled directly after the TSAR/TSARINA interface (4:7-1). TSARINA simulates a conventional or chemical attack on the MOB (and/or DOBs) by transferring resource losses, facility damages and operating surface craters to SORGEN. Since the TSARINA interface is not a focus of this study, no further mention of this component will be necessary.

Data Management. Data are input, managed, manipulated, and retrieved through the Verac Information Control System (VICS). VICS is a relational database manager with an interactive batch and run-time interface. VICS is also menu-driven allowing the non-programming analysts and support personnel to manipulate the databases with minimal training (5).

Post-Processor. The AMTAF post-processor (AMTAFPLT) is a menu-driven post-processor providing high resolution color graphics. Once a simulation has been run, AMTAFPLT provides a large selection of SORGEN, LOGSIM, and TSARINA plots from which to choose. The analyst need only use the menus to choose the information required from the list and the information is shown in graphic form. Plots may also be created from user-defined data that can be entered at the keyboard or read from disk files. MASTER sortie scenario graphics are embedded in the MASTER Model (5).

AMTAF Advantages. AMTAF developers and ASD/XRS maintain that AMTAF has three distinct advantages over the simulation models currently in-use. The first major advantage is the user-friendly aspect of the model. Analysts can use the system with much less training than is required for models such as LCOM and TSAR. The menu system built into the model makes it easy to manipulate data within the model. This is particularly true in comparison to the complexities of data input into LCOM and the limited capabilities that TSAR has in manipulating the enormous amount of data used in the model (15:4).

The second major advantage is that AMTAF gives the analyst the choice of isolating the different aspects of effectiveness, sortie generation, and logistics; analyzing them separately or running simulations where the different components interact with each other. This means that it is not necessary to run a full blown model if the analyst is interested in the activities simulated in the SORGEN (air base activities) or LOGSIM (logistics) component models.

The third major advantage is the post-processing capabilities. The user-friendliness built into the system allows an analyst to pull down more information faster either on-line or otherwise. It is not necessary to decipher the output that many models produce to get to the heart of the simulation. AMTAFPLT displays the information in easy-to-understand high resolution graphics.

Preliminary Comparisons

While this is the first study to actually compare the output of AMTAF to that of another model given the same initial conditions and scenarios for each model, preliminary comparisons of the capabilities of AMTAF with other models have been made. At the Reliability and Maintainability Modeling Conference in February 1988 sponsored by the Air Force Logistics Command, the characteristics of several different models were compared and rated (2). Since at that time, AMTAF had not yet been finished, the rating of the model was based on what the developers and sponsors of AMTAF claimed it would do once delivered to ASD/XRS. The results of this comparison (see Table 1) show that AMTAF was the highest rated simulation model among those models rated. The rating for LCOM was just over half the total rating that AMTAF received. Once again, it should be stressed that these ratings were made based on the capabilities that each model was advertised to have, not on a comparison of the outputs of actual modeling simulations. One should also consider that different models have different focuses and it is questionable whether they should even be ranked (10).

TABLE 1- MODEL RANKING MATRIX
(Supplied by Ball Corporation)

AREA	MODEL * NOTE: 5 is a Maximum Rating on a 0-5 Scale								
	MRM	NAIL	MARGI	SCOPE	TIGER	LAMP/ LAWS	LCOM/ SLAM	TSAR	AMTAF
Sortie Data Reliability Attrition Abort Munitions Selection Target Destruction	4	4	4.7	1	5	1	1	1	4.3
Turnaround Data Reliability Maintainability Resource Constraints	1	2	3	4	2	4	5	5	5
Other Policy Analysis Generality Efficiency Complexity	4	1	3	5	2	4	.3	1	2
Cost Data	1	4	2	3	1	4	1	1	2
TOTAL	10	11	12.7	13	10	13	7.3	8	13.3

Source: Air Force Logistics Command Reliability and Maintainability Conference, Wright-Patterson AFB OH, September 1988

Other Studies

In 1986 and 1987 respectively, two studies were done comparing LCOM outputs to TSAR outputs. The rationale behind these comparisons were similar to those for doing this study, namely to verify that a particular simulation model produced reliable output data using a well-established model such as LCOM as a comparison base. Both studies were theses by Air Force Institute of Technology graduate students, namely Captain David Noble and Captain Gregg Clark.

Noble's Conclusions. Captain Noble used a randomized block experimental design to make his comparison of the two models. An attempt was made to make the databases as compatible to each other as possible after which five 30-day runs at each of three different sortie levels (one, two, and three sorties per aircraft per day) were made. The average number of sorties and average total manhours required over the five runs at each level was then calculated for each model and the results were compared using a statistical test.

The results of Captain Noble's study were statistically inconclusive as to whether the outputs of the two models were similar. One reason offered for the lack of similarity between the two model outputs was that the databases used in each model were similar but not exactly the same. Further study was recommended because of the inconclusive results (15:44).

Clark's Conclusions. This study was done as a follow-on to Captain Noble's study. To begin his study, Captain Clark attempted to initialize each model with common databases ". . . having similar tasks, task probabilities, task sequence, resource requirements, and sortie requests (6:vii)." Captain Clark used the same experimental design as above with the exception that he made 10 replications of 60 days for each sortie level and he called his design a factorial experimental design. The main difference in this study from the Noble study is commonality of the two databases.

The results of the output comparison showed statistically significant differences in the number of sorties flown between the two models. The difference, however, was less than four percent and Captain Clark theorized that unique properties of the TSAR model could account for this discrepancy. No conclusion was reached as to which model was better. Captain Clark left the choice of model up to the preference of the individual analyst (6:59).

Summary

In this chapter, the background and capabilities of both LCOM and AMTAF were detailed. LCOM was developed in the late 1960s and gradually gained wide acceptance. It has been upgraded many times and is currently "owned and operated" by the Air Force manpower community. AMTAF, on the other hand, is a brand new model developed by the

Systems Engineering Division of Ball Corporation for ASD/XRS. The model was designed to incorporate the characteristics of many of the current models into one user-friendly model.

Recent comparisons of AMTAF characteristics to the characteristics of other models at an AFLC-sponsored modeling conference rated AMTAF as the favorite among those making the comparisons. These ratings were made based on the characteristics that ASD/XRS and Ball Corporation were claiming that AMTAF would possess since the model had not yet been completely developed at the time the ratings were made.

Model comparison studies of LCOM and TSAR in 1986 and 1987 were inconclusive as to whether one model was more advantageous to use over the other. The methodology of the studies showed that the best way to compare two such simulation models is to use common databases. For that reason, common databases will be used in this study.

III. Methodology

Introduction

To compare AMTAF with LCOM, it is necessary to statistically compare the outputs of the two models. If the outputs are similar with statistical significance, then the outputs can be considered the same with some level of confidence. This chapter explains the process used to make this comparison by, 1) giving some detail on the database used for the comparison, 2) introducing the variables that are the focus of this comparison, 3) listing the differences encountered between the two models and detailing how these differences are compensated for, 4) describing the experimental design used to facilitate the comparison of the two models, 5) detailing the statistical tests used to compare the outputs of the two models, 6) introducing the hypothesis that this study is to test, and 7) explaining the criteria upon which an analysis is to be made.

The Database

The database used in this study is a revision of a database used by Captain Clark in his thesis comparing TSAR and LCOM (6:62). The database was originally developed by Simulation Modeling Consultants (SMC) from the F-36 Training Problem database found in the LCOM documentation, also for the purpose of making a comparison study between TSAR and LCOM (6:16). In his thesis, Captain Clark revised the basic database developed by SMC by adding actual F-16 data and networks to the database (7).

Much of the data in this database is taken from actual F-16 data and represents actual resources and maintenance networks used by a base with F-16 aircraft. Other parts of the database are generic to fighter aircraft. No attempt is made in this study to create a database that exactly mirrors actual operations at a fighter base. The purpose of this study is to compare the results of two models given identical databases (whether the data are factual for a specific item, generic, or fictitious) that have the basic characteristics of a base with fighter aircraft assigned to it.

Database Scenarios. The database used in this study simulates only the activities of one Main Operating Base (MOB). The base has 72 F-36 aircraft assigned to it which are in an initial configuration where neither Tanks, Racks, Adaptors, and Pylons (TRAP) nor munitions are attached or loaded on the them. Table 2 lists the type of equipment, parts, and personnel that are available at the base as well as other pertinent base data.

The aircraft at the base fly three different missions: Close Air Support (CLSPT), Bombing (SMTBM), and Ferry missions. For a CLSPT mission the aircraft is fitted with TRAP and then prepared for the mission (munitions are not loaded for this mission). Configuration for a SMTBM mission requires the attachment of TRAP and the loading of four

TABLE 2- DATABASE RESOURCES

Base

Base Type: MOB   Base Name: Wueschheim

Aircraft

Type: F36   Number: 72   Initial Configuration: Ferry

Personnel (by AFSC)

325X0	328X1	423X3	423X4	431X1
432L4	462X0	462X1	326S4	326S5
326X6	326X7	326X8	423X0	423X1

LRUs On the Aircraft

LRU	ABBREVIATION
Landing Gear	LANDGEAR
Electrical Power Supply	PSUPPLY
Air Data System	DATA
Built-in Test Display Group	TESTER
Tactical Air Navigation Set	TANS
Lead Computing Gyro System	GYRO
Avionics System	AVIONICS
Radar	RADAR
Hydraulics System	HYDRO

Aircraft Ground Equipment

UNIT	ABBREVIATION
Air-conditioning Unit	ARCON
Maintenance Stand	B-4
Power Generator	MD3
Tail Jack	TJACK
Ground Cart	GCART
Hydraulics Cart	HCART
Munitions Jammer	MJ2

TRAP	MUNITIONS
Racks	Bombs
Pylons	Missiles

Missions

Lead Time for Selection:	4.0 hours
Mission Duration:	1.5 hours
Min. # of planes required:	1
Max. # of planes required:	2
Mission Window:	2.0 hours

bombs onto the aircraft. The Ferry mission requires neither the loading of munitions nor the attachment of TRAP to the aircraft.

For the purpose of this study, two different flying schedules were developed, the first where each aircraft is scheduled to fly two sorties per day and the second where each aircraft is scheduled to fly three sorties per day. Flying windows open every morning at 0530 and close shortly after the last mission has been scheduled to fly depending on which flying schedule is used. Personnel required to meet these flying schedules are scheduled on the basis of two twelve-hour shifts per day. The particular flying scenario used is run for a 30-day period.

Database Constraints. For the purpose of this study it is necessary to further revise this database to match the characteristics of AMTAF. In an effort to minimize differences that could be caused due to different random number flows in each model, all network task times are held constant. The only part of each of the models where variance is allowed is in the task network failure clocks. These failure clocks determine when each individual LRU fails and requires maintenance. The clocks draw random numbers from an exponential distribution using Mean Sorties Between Failure (MSBF) values assigned to each of the LRUs as the distribution mean.

To further simplify the comparison, pre-flight ground abort probabilities are zero, no attrition due to enemy activity occurs (LCOM does not possess such a function), cannibalization of parts is not allowed (AMTAF does not possess this capability), and no deferment of maintenance tasks is allowed (even though both models have this capability). The effort in this study is to compare just the results obtained from the task networks using MSBF values with all other interaction factors held constant for the particular simulation run.

Variables

Because of the very high number of variables in the models, the scope of the study will be limited to allowing only three input variables to change, and to comparing two output variables of the sortie generation components of each model using a predetermined experimental design over a simulated timeframe of 60 days. If these components compare statistically with significance, then further research into finding the similarity of other parts of the two models will be justified.

Input Variables. In order to study how the two models compare under varying but identical conditions, it is necessary to allow specific input variables to change value between different runs to evaluate whether the changes effect the output of both models in the same manner. The variables allowed to vary in the different simulation runs are listed below:

1) Parts- These parts are the replacement LRUs for all the LRUs found on the aircraft. LRUs on the aircraft fail according to the parameters of the time clocks designated to the particular LRUs and are replaced from a supply of spare parts on the base. A list of these LRUs is found in Table 2.

2) Personnel- The only personnel modeled in the databases are maintenance personnel, by AFSC, directly associated with the generation (pre-flight) and recovery (post-flight) of aircraft. Table 2 gives a listing of the 15 different AFSCs entered in the databases.

3) AGE- This equipment is used in generation, recovery, and maintenance task networks. There are seven types of equipment utilized in these task networks which are also listed in Table 2.

Input Variable Values. Each of these three variables has an unconstrained value and a constrained value associated with it for each of the two different flying scenarios developed for the study. Before any runs are made, a sensitivity analysis is done using LCOM to determine the constrained values that the variables would take on. This analysis is nothing more than an informal look at what values are needed for each flying scenario to constrain the model.

Model constraint in this study is defined as a scenario where sorties are canceled because of lack of resources. In doing this sensitivity analysis, a sortie cancellation rate of 10% is deemed by this researcher as enough of a constraint and the constraint values of the variable are chosen from studying what is need to constrain the model to this point. The actual constraint values used in this study are found in Appendix A. Different output data are generated by using different value combinations of these input variables in each of the two flying scenarios according to an experimental design described later in this chapter.

Output Variables. The output variables compared in this study are the total number of sorties flown and the manpower hours required for maintenance that each model generates under identical initial conditions. When input variables are changed in order to generate a different set of values for the two output variables being compared, the changes made in one model will be echoed exactly in the other model.

Model Differences

Making a comparison of the output variables of two models requires that both models run under identical conditions. As mentioned above, the database used for this study is an LCOM database. Before any comparison study can be done, it is necessary to convert this LCOM database into an identical AMTAF format. In making this conversion several fundamental model differences must be compensated for. The model differences compensated for in this study are detailed below.

Aircraft Selection. A major difference between the models is the way in which aircraft are selected for specific missions and the way the models keep track of the aircraft's configuration after a mission has been flown.

AMTAF. AMTAF does not keep track of an aircraft's configuration. Any TRAP or munitions that had been installed and loaded onto the plane "miraculously" disappear after the sortie has been flown. Once all required post-flight maintenance is performed, the aircraft is returned in a stripped-down configuration to the Ready Pool from which it can be selected for a mission. If the particular mission requires TRAP and munitions, the TRAP is once again installed and the munitions loaded.

LCOM. In contrast, LCOM does keep track of an aircraft's configuration. If an aircraft flies a mission with munitions, it will return with munitions unless the model has a network to expend (subtract) the munitions. Like munitions, if the aircraft has any TRAP installed, that aircraft is then flagged as having TRAP installed. Once post-flight maintenance has been performed, the aircraft returns to the ready pool as "available" but still flagged as to which configuration it is in.

When an aircraft is selected for a mission and begins pre-flight configuration, if the mission is canceled, the aircraft continues to perform pre-flight network taskings as if the aircraft were still going to fly the mission instead of returning it to the Ready Pool (16:15). An aircraft that has gone through this process is flagged by LCOM as being "cocked", meaning all preparations for the sortie have been made. It is as if the aircraft were sitting on the end of the runway waiting for a mission to fly (7).

When selecting an aircraft for a mission, LCOM first looks in the Ready Pool for 1) a cocked or 2) an available aircraft in the proper configuration with respect to TRAP and munitions for the mission to be flown. If it cannot find such an aircraft, it will then search for a cocked or available aircraft having a different configuration following a pre-established search pattern. If an aircraft is selected that has a different configuration than the one required for the mission, a task network is initiated to download any munitions and TRAP currently on the aircraft that do not match those required for the upcoming mission and configure the aircraft for the selected mission.

Reconciling the Two Models. The task here is to equalize the manpower and equipment usage between the two models given the differences in the way the models select and configure aircraft for three possible missions. The Ferry mission requires no TRAP or munitions to be loaded, therefore the configuration time for the AMTAF model should be zero given that all aircraft in the Ready Pool are already in that configuration. Even though the aircraft initially begin the first day of the simulation in a Ferry configuration, after one day almost all of the available aircraft in LCOM's Ready Pool are aircraft with TRAP attached since TRAP is required in 91.7 percent of all the missions flown. With this being the case, it is almost certain that whenever a Ferry mission is scheduled in LCOM, the aircraft selected will be one with TRAP that will have to be removed. This tasking takes one hour and requires four manhours to complete. To compensate for this, Ferry configuration time in AMTAF is set at one hour to match what would be happening with the same aircraft in LCOM even though no manpower resources are assigned to the configuration task. This decision (not to include manhours in the AMTAF configuration tasking of the Ferry mission) was made early on in the development of the AMTAF database. In hindsight, the manhours should have been included and the manpower obligated to this task in order to match what would be happening to the aircraft in LCOM. This omission should have little effect on the overall manpower totals since the percentage of Ferry missions flown is such a small percentage of the overall missions flown.

The CLSPT mission in LCOM requires only that racks be installed on the aircraft (for some reason, when the LCOM database was used in previous studies, munitions were not included as part of the CLSPT mission configuration). Since most of the aircraft in the Ready Pool would be in that configuration at any given time, no extra configuration time would be needed. The AMTAF data base is given a configuration time of 0.5 hours to compensate for any time incurred by LCOM in taking down cocked aircraft. This time is only charged to the time required to configure the aircraft and no resources or manhours are obligated to this task.

For this mission (CLSPT), the AMTAF database requires pylons and missiles. This is only to distinguish it from the SMTBM mission and facilitate the running of the simulation on AMTAF. No resources of time are utilized in installing the missiles. It is as if it happened instantaneously. In both of the databases, TRAP and munitions are not a constraint. The base stocks are designed that there will always be an ample supply of either when they are used to configure an aircraft. The main concern is that in both models, the CLSPT mission requires some kind of TRAP, be it pylons or racks. The AMTAF database simply added munitions (with no effect on time or resources) to make the CLSPT mission more realistic.

The SMTBM mission in LCOM requires that TRAP be installed and bombs loaded onto the aircraft. Once again, for the reason stated above, most if not all available aircraft in the Ready Pool will already have the TRAP installed. This leaves only the task of loading the bombs which takes one hour to perform, tying up two pieces of AGE and four maintenance personnel. The AMTAF database reflects exactly the time and resources that it would take to load the bombs as stated above. Rack installation is also a part of this configuration but it is considered to be part of the overall process and no extra time or resources are committed to them since they would not be committed and accounted for in LCOM. The availability of TRAP and munitions can be modeled as a constraint in both LCOM and AMTAF. In the database used in this research however, the time and manpower needed to install the TRAP and munitions is accounted for but the database is built so that there is always TRAP and munitions available at the aircraft when needed.

Base Aircraft Maintenance Network. There is a specific sequence of maintenance tasks that always occurs when an aircraft is generated for a sortie and when an aircraft has just returned from a sortie. In this study, that sequence of events is referred to as the Base Aircraft Maintenance Network (BAMN). LCOM and AMTAF treat the BAMN differently. LCOM allows a BAMN to be established for each individual type of mission. AMTAF will allow more than one type of aircraft to be assigned to each base (as does LCOM) but unlike LCOM allows only one BAMN per aircraft instead of a BAMN for each mission. Figure 3a. shows two of the three BAMNs for the LCOM database and Figure 3b. shows the other LCOM BAMN as well as the BAMN for the AMTAF database. The following subsections will describe each individual segment of the BAMN and describe how the two models' BAMNs are reconciled.

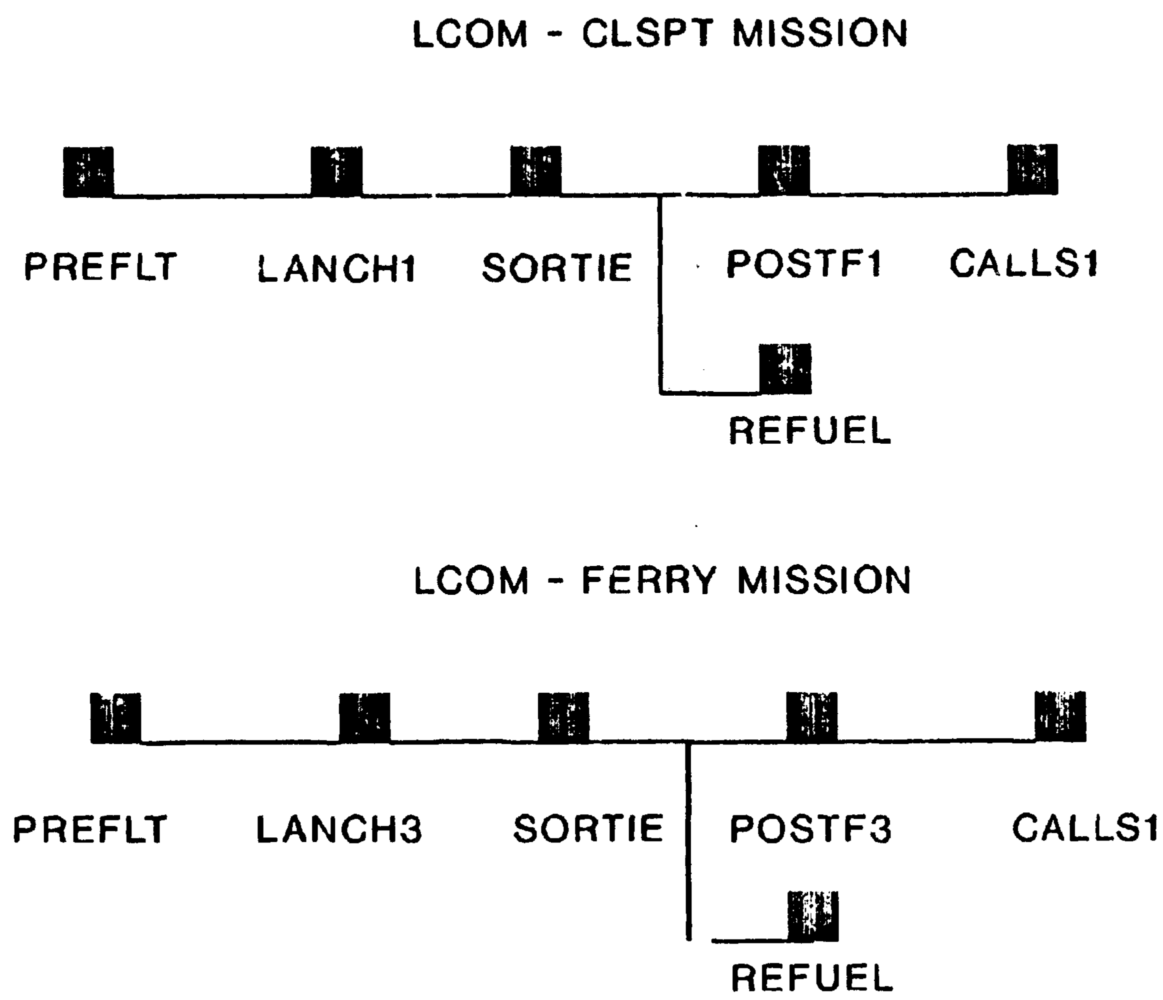

Figure 3a. Base Aircraft Maintenance Networks

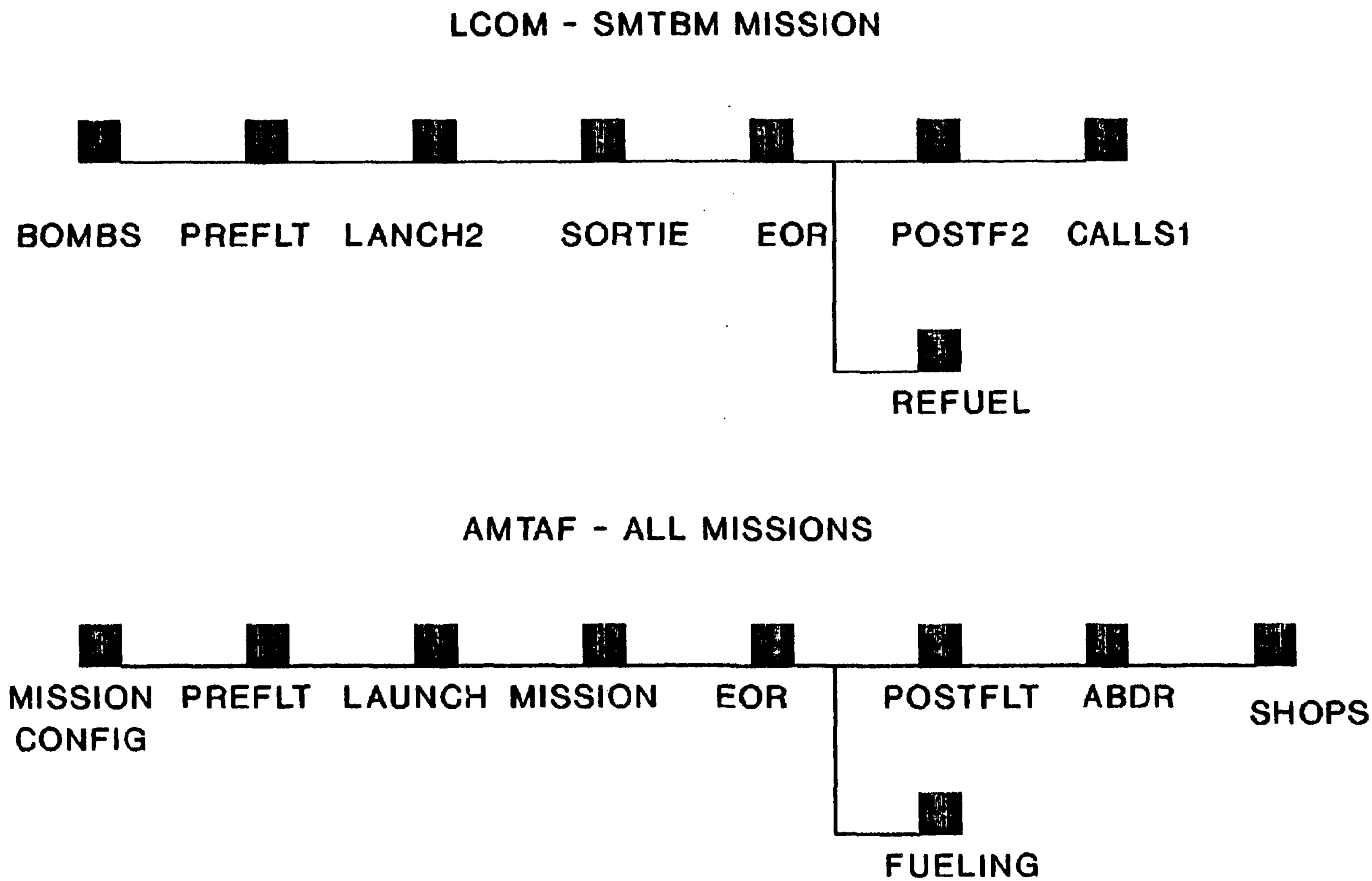

Figure 3b. Base Aircraft Maintenance Networks

Pre-flight Maintenance. In the LCOM database, each of the three BAMNs refer to a pre-flight maintenance task (PREFLT). This task consists of two sub-tasks, routine pre-flight maintenance (MPREFLT) and servicing of the hydraulics system (SERVHY). Each of the three BAMNs uses PREFLT for its pre-flight maintenance task so therefore the resources required for this task are the same regardless of which mission is flown. The PREFLT task in AMTAF reflects the same task times and resource requirements as the PREFLT task in LCOM.

Pre-launch Activities. The three BAMNs in LCOM each have a separate task for this activity (LANCH1, LANCH2,and LANCH3 respectively) but all require the same time for task completion and obligate the same amount of resources. The AMTAF LAUNCH task therefore reflects these same time and resource requirements.

Sorties. This task, SORTIE in LCOM and MISSION in AMTAF, is the same in both databases. No resources are utilized and only the mission duration time is used by the models.

End of Runway Check. In LCOM, this task (EOR) is only required in the SMTBM BAMN. SMTBM missions are flown approximately 42% of the time. Since in AMTAF there is no way of identifying which type of mission an aircraft has just flown, an EOR task was inserted into the BAMN with a probability of occurrence of 0.42. In other words, to reflect the task times and resource utilization of the EOR task in LCOM, 42 out of every 100 aircraft flying sorties will have this task performed on them with the same task times and resource requirements as the LCOM EOR task regardless of the mission type they have just flown.

Post-flight Activities. In LCOM this activity requires the same amount of time for task completion and the same quantity and type of AGE, but has different manpower requirements depending on which mission is flown. Depending on which BAMN the model is running (POSTF1, POSTF2, or POSTF3), there are requirements for one, two, or three maintenance personnel. To echo the requirements of LCOM's post-flight activities, AMTAF's POSTFLT task utilizes two maintenance personnel. To reconcile the manpower hours with LCOM, the total number of manhours required to fly all scheduled sorties of one of the two flying scenarios was calculated using the respective number of maintenance personnel with the proper mission. The same calculation was then done using two maintenance personnel regardless of the mission. The first calculation resulted in a 4% higher number of manhours used as the second calculation. To compensate for this, the AMTAF POSTFLT task time set at a level 4% higher than the LCOM POSTFLT task time.

Refueling. Refueling and resource utilization in LCOM are constant over the three BAMNs therefore the AMTAF refueling task reflected these same times and requirements.

Aircraft Battle Damage Repair. This task is required in the AMTAF BAMN to successfully run the model even if the probability of sustaining battle damage is zero as it is in this study. In this case the task is included to satisfy model run requirements but no time nor resources are obligated to it.

Unscheduled Maintenance. The rest of the BAMNs for each model are concerned with unscheduled maintenance. In AMTAF, each LRU with a failure clock assigned to it has its own dedicated shop. When the LRU fails, the networks for that particular shop are initiated. The CALLS1 task in the LCOM BAMNs is essentially the same function. All LRU failure networks are sub-taskings of this function.

Shop Repair. In the LCOM database, once a part is removed from an aircraft for reason of failure and brought to the shop, one of three different events can happen: 1) shop personnel can determine that the base does not have the capability to repair the part, in which case it is given the code Not Repairable This Station (NRTS), 2) shop personnel will not be able to duplicate the fault (CND) in the LRU and therefore return the part back to the resource pool, or 3) the LRU is repaired and returned to the resource pool. Each of these occurrences has a different mutually exclusive probability assigned to it (so that only one of the three tasks will be selected) and each occurrence has its own time and resource requirements.

AMTAF has only the possibility of two events occurring once a part is brought into the shop: 1) it is declared NRTS, or 2) it is repaired and returned to the supply stocks. When a part is declared NRTS, no accounting is made of the time required to examine the part and determine its status as NRTS nor of the manhours required to perform the task. In order to reconcile the two databases, the LCOM CND task is deactivated by giving it a probability of occurrence of zero. The probability that the repair task would be accomplished is then changed to the sum of what the CND and repair tasks had originally been. The probability, task-duration time, and resource requirements of the AMTAF repair tasks reflect those of the LCOM repair branch with its new probability of occurrence.

In LCOM, when an LRU is declared NRTS, the time and resources required to perform that task are accounted for. The part is then "shipped" to the depot where it is repaired and "returns" to the resource pool after a specified time period. AMTAF does not have the capability to account for base time and resources utilized in the NRTS process nor does SORGEN have a way of returning NRTS parts from the depot once they are repaired. To get these parts back, they must be ordered through the supply system. In this study, there is no way to tie up and account for the resources in the AMTAF NRTS process that are tied up and accounted for in the LCOM NRTS process. Manpower hours are therefore lost in AMTAF that are counted in LCOM. The time required for the depot to repair and return the part as well as the time that the part spends in the base repair shop is simulated in this study in AMTAF by adding these times onto the delivery time that the part has in the supply system. In this case, the only parts that are ever reordered are parts classified as NRTS. The reorder times for these individual parts are stipulated in the RES_ORDER database.

Other Differences. In addition to the model differences mentioned above, several other differences are reconciled between the models by either not activating the functions in the models or by creating dummy tasks to duplicate the function found in the other model.

Cannibalization. AMTAF does not have the capability to model this function so it is disabled in LCOM.

Wartime Capabilities. LCOM does not have any capabilities to simulate wartime attrition of aircraft and base resource attrition due to enemy attacks. The TSARINA component of AMTAF is therefore not used and all attrition rates are given a zero probability of occurrence.

Shifts. AMTAF utilizes personnel based on two 12-hour shifts per day. This of course is a war-time scenario. LCOM has the capability of modelling three 8-hour shifts. To reconcile the two databases, the LCOM database is run with 12-hour shifts.

Menu Restrictions. The menu format that AMTAF uses for data entry is definitely a much quicker and easier way to manipulate and enter data but it does have some restrictions. Some of the tasks in the networks require more than one type of AGE. LCOM has no problem handling this requirement. AMTAF menus, however, allow for the entry of only one type of AGE. In order to account for the other AGE equipment used in the task, it is necessary to make a parallel dummy task that has the same task time but utilizes no other resource other than one of the extra types of AGE required to perform the task.

Level of Maintenance. AMTAF has the capability of breaking the LRUs into SRU components, creating a much more complicated repair network. LCOM addresses only significant LRUs (1). This study deals, therefore, only on the LRU level.

Mission Schedules. When defining a mission flying schedule in LCOM, it is necessary to specify the time of day each mission window will open and the number of missions to be flown at that time. It is a cumbersome process to create this flying schedule but the process allows for irregular mission scheduling and multiple missions for a particular mission type.

AMTAF schedules missions on a regular basis. The menu simply asks for the time that the daily flying window opens, the first take-off time in the simulation, the reschedule interval, the daily flying window closing time, and the time during the simulation when the last take-off occurs. This allows for only regular mission intervals and only one mission of a particular type can be flown at a time. To schedule irregular missions or multiple missions, the user must create other missions in the MISSIONS database (even though these are the same missions) and then figure out the intervals required to meet the irregular flying schedule.

In this study, the LCOM flying schedule was changed to accommodate the limitations of the AMTAF flying schedules. Missions are scheduled in AMTAF in regular intervals and the LCOM flying schedule is modified to echo the AMTAF schedule.

Experimental Design

Emory defines the Experimental Design as the manipulation of some variable(s) in a setting and the observation of how these variables affect the output (11:114). Because this study entails using control variables to obtain outputs that will then be statistically compared, experimentation was chosen as the most appropriate method to use.

In this study there is no need to collect and measure new input data for the simulation models. A database that has already been assembled and used with LCOM is modified so that its networks are compatible with the capabilities of AMTAF. A database for AMTAF is then built using the LCOM database networks and values. This study is mainly concerned with controlling the input variables within the two models and comparing the results.

Explanation of Experimental Design. The experimental design used in this study is a 2^3 factorial design with n = 3. This method allows the "examination of the effects and interactions of many variables (n factors) simultaneously on a dependent variable (3:225)." The factorial design requires two levels of analysis for each independent variable and allows the effect of different variables on the selected outputs of the two models to be compared (18:372). If the models are the same, the different "treatments" will change the value of the output variables, but output variables of each model should change in the same direction and magnitude within statistical confidence levels.

The input variables allowed to change values in this study are the number of LRU replacement parts available on the base, the quantity of AGE equipment available for use in maintenance tasks, and the number of maintenance personnel available to perform the maintenance tasks. Each of these variables has one of two possible values: a constrained value and an unconstrained value. The unconstrained value is a number large enough that there is always enough of the resource available to accomplish the task networks in the model. The constrained value on the other hand is a value low enough that tasks must compete against one another for resources and at times some tasks are placed in a queue awaiting the availability of resources to complete the task.

In a 2^3 factorial design, there are eight possible treatment combinations. These eight combinations are run for each of the two flying scenarios giving 16 different values to compare between models for both the number of sorties flown and the number of manhours used during the 60-

day scenario. Table 3 shows the factorial design used in this study with the different treatment combinations.

Explanation of Experimental Process

The experimental process used in this study is described in the following three steps.

1. Run simulations according to a specified experimental design with both LCOM and AMTAF using databases that are as identical as feasible.

2. Compare the results of the model runs to determine statistically whether the results correlate with each other or whether they differ significantly. It is necessary to run several replications of each model and compare the means.

3. Change the control variables in both models according to the specified experimental design and repeat the previous two steps.

Running the Simulations. To obtain output data to compare, it is first necessary to convert the LCOM database into a form compatible with AMTAF and run the simulation using a 2^n factorial experimental design. Because of the inability to control the random number generation of the two models, 20 replications are run for each scenario and the average over the 20 replications is computed for the output variables being compared. Thirty or more replications is desirable in order to invoke the Central Limit Theorem and assume that the distribution created from the replications is normally distributed (13:321). Computer resource limitation was the constraining factor in deciding to limit

TABLE 3 - 2^3 FACTORIAL EXPERIMENTAL DESIGN

Treatments

SORTIE RATE TWO	Parts (U) Manpower (U) AGE (U)	Parts (C) Manpower (U) AGE (U)	Parts (U) Manpower (C) AGE (U)	Parts (U) Manpower (U) AGE (C)	Parts (C) Manpower (C) AGE (U)	Parts (C) Manpower (U) AGE (C)	Parts (U) Manpower (C) AGE (C)	Parts (C) Manpower (C) AGE (C)
MANPOWER HRS	A/L	A/L	A/L	A/L	A/L	A/L	A/L	A/L
SORTIES FLOWN	A/L	A/L	A/L	A/L	A/L	A/L	A/L	A/L
SORTIE RATE THREE	Parts (U) Manpower (U) AGE (U)	Parts (C) Manpower (U) AGE (U)	Parts (U) Manpower (C) AGE (U)	Parts (U) Manpower (U) AGE (C)	Parts (C) Manpower (C) AGE (U)	Parts (C) Manpower (U) AGE (C)	Parts (U) Manpower (C) AGE (C)	Parts (C) Manpower (C) AGE (C)
MANPOWER HRS	A/L	A/L	A/L	A/L	A/L	A/L	A/L	A/L
SORTIES FLOWN	A/L	A/L	A/L	A/L	A/L	A/L	A/L	A/L

(C) - The variable in the treatment is given the constrained value
(U) - The variable in the treatment is given the unconstrained value
A/L - The values for this output variable are obtained for both AMTAF and LCOM

this study to 20 replications and assume a normal distribution.

Results Comparison. Separate complete runs are made with the two models, changing the treatment each time to get a clear picture of whether or not the output data of the two models are similar. This process is repeated until all possible treatment combinations are run. Each run will produce the number of sorties flown and the number of manhours used during the scenario for each model's run. These are the two values to be compared between the two models.

Because of the different random number generation characteristics of each model, the models will give different outputs even though the inputs may have been exactly the same. To control this difference, 20 replications of each treatment are run. A mean of each output variable is then calculated by totaling the values of the variable for each of the replications and dividing by the number of replications made. These output variable means from each model are then compared statistically for differences.

Comparison of the models is done in this study by taking the difference of the output variables of the two models for each treatment in the experimental design and creating a distribution of 16 points for each of the two output variables. This distribution is then tested for normality using a Shapiro-Wilk test found in the Statistix statistical computer software (14). If the distribution is found to be normal, a parametric small-sample confidence interval for the mean of the distribution is performed at a 95% confidence level (13:392). Should the results of the Shapiro-Wilk test show that the distribution of model differences does not conform to a normal distribution, then the non-parametric Wilcoxon signed rank test is used to compare the two models (13:959).

Criteria for Analysis

The general purpose of the analysis is to test the following hypothesis:

H_0: The number of sorties flown, output by each of the models, are the same given the same initial inputs.

H_a: The number of sorties flown, output by each of the models, are different given the same initial input.

H_0: The manhours required, output be each of the models, are the same given the same initial input.

H_a: The manhours required, output by each of the models, are different given the same initial inputs.

Categorization of the Results

Statistical tests are performed on the preselected output variable pairs of the two models. Using either of the statistical tests mentioned above will yield one of the following results:

1. For both of the output variables being compared, there is no difference statistically between the two models with a confidence level of 95%.

2. For both of the output variables being compared, there is a difference statistically between the two models with a 95% confidence level.

3. There is statistically no difference between models for one of the variables but there is a difference for the other output variable with a confidence level of 95%.

Evaluation of the AMTAF Model. Once the results of the simulation runs are statistically compared, an evaluation as to whether AMTAF provides similar results to those of LCOM within a certain confidence level can be made. If the results of the tests fall into category one above, the compared outputs of the models have been shown to be the same within a certain confidence level and further study on the correlation of the two models is warranted.

If the results fall into category two above, the compared outputs of the models have been shown to be different within a certain confidence level and further study may be warranted as to the cause of the difference in the compared outputs.

If the results of the tests fall into category three above, no real conclusion can be drawn as to the difference or similarity of the output of the two models. Further study may be warranted on the cause of the difference for the output variable that was found to be different.

Summary

In order to properly compare the outputs of LCOM and AMTAF, it is necessary that the models have common input values and scenarios. To accomplish this, an LCOM database that was used in a previous model study is modified to match the unique characteristics of AMTAF and then an AMTAF database is developed to echo the LCOM database. The many differences in the way the models manipulate the databases are compensated for as best as possible to give the two models a common set of input values from which to run the simulations.

The experimental approach is used in this study to compare the two models. Specific outputs of the sortie generation components of each model are chosen for comparison using a 2^n factorial design (with $n = 3$), namely the total number of sorties flown and the manpower hours required over the simulation timeframe of 60 days.

Since the random number generators differ for each model, it is necessary to use a comparison test on the means of 20 replications of each scenario as opposed to a comparison test on the output values of a single simulation run.

Once the simulations have been run and the data compared statistically, a conclusion is drawn as to whether the outputs of the two models are the same within statistical constraints. There are three basic conclusions that can be drawn: 1) both preselected outputs of the models are the same given the same initial conditions, 2) both pre-selected outputs of the models are not the same given the same initial conditions, or 3) the test results do not support either of the previous two conclusions.

IV. Findings and Analysis

Introduction

This chapter begins by detailing the outputs of the simulation runs. The outputs of one model are subtracted from the outputs of the other model for each treatment at each flying level to form a difference distribution. This distribution is then tested for normality and found to conform to a normal distribution. A parametric confidence interval is then constructed to find the mean of the difference distribution. The chapter concludes with the analysis of the confidence intervals as well as the detailing of some observations.

Output From the Simulation Runs

For the simulation runs, eight different treatment combinations were input at each of the two flying levels. Twenty replications of each of these scenarios were then run in both LCOM and AMTAF. Table 4 shows the mean number of sorties flown in the sixteen different scenarios for each of the models as well as the difference in the mean values between the two models. Table 5 shows the same information for the number of manhours required during the 60-day simulation. The distributions to be analyzed are found in the Difference column. The number found in this column is the difference between the two models for either the number of sorties flown or the number of manhours required. Each

TABLE 4 - SORTIE VALUES

	Sortie Rate 3			Sortie Rate 2		
Constraint	AMTAF	LCOM	Difference	AMTAF	LCOM	Difference
None	12,701	11,800	901	8640	8640	0
Manpower	12,543	11,574	970	8342	8220	122
AGE	12,308	11,409	898	8186	7974	212
Parts	10,359	10,538	-180	7705	8067	-362
Manpower/AGE	12,019	11,159	860	8174	7791	383
Manpower/Parts	10,327	10,270	57	6875	7575	-700
Parts/AGE	10,337	10,449	-112	7423	7712	-289
All	10,232	10,278	-46	6770	7371	-601

TABLE 5 - MANPOWER VALUES

	Sortie Rate 3			Sortie Rate 2		
Constraint	AMTAF	LCOM	Difference	AMTAF	LCOM	Difference
None	158,999	154,079	4920	108,409	110,712	-2303
Manpower	156,938	150,479	6459	103,641	105,371	-1730
AGE	154,041	149,467	4574	101,379	102,654	-1275
Parts	129,259	134,931	-5672	[illegible],374	104,272	-7898
Manpower/AGE	150,296	145,554	4742	1[illegible],303	100,687	616
Manpower/Parts	128,185	131,255	-3070	84,820	97,329	-12509
Parts/AGE	128,883	134,360	-5477	92,577	100,305	-7728
All	127,323	131,775	-4452	83,829	95,516	-11687

of the two distributions, manhours and sorties, has sixteen point values.

In the tables, Sortie Rate 2 stands for a flying schedule of 2 sorties per aircraft per day. Sortie Rate 3 stands for a flying schedule of 3 sorties per aircraft per day. The Constraints column shows which treatment was applied; that is which combination of independent variables was given the constrained value in that particular scenario. If a variable is not mentioned for that particular run as a constraint then it was given the unconstrained value.

Analysis of the Output

Application of the Shapiro-Wilk Test. Before any statistical test can be made on the difference distributions, it is first necessary to test the data for normality. As stated in Chapter III, the Shapiro-Wilk Test found in the Statistix statistical computer software package is used for the test. To perform the test, the two distributions are loaded into a database and the software calculates a test statistic. This test statistic is then compared against a Shapiro-Wilk Quantile Table (Appendix B) at a specific confidence level to determine the rejection region (19:610). If the test statistic falls within that rejection region, the determination is made that the distribution is not normal. Table 6 below gives the results of the Shapiro-Wilk Test.

Table 6- SHAPIRO-WILK TEST RESULTS

Sortie Distribution		Manpower Distribution	
901	0	4920	-2303
970	122	6459	-1730
898	212	4754	-1275
-180	-362	-5672	-7898
860	383	4742	616
57	-700	-3070	-12509
-87	-241	-5172	-7476
-46	-601	-4452	-11687

	Sortie	Manpower
Test Statistic (W) :	.9404	.9690

Rejection Region for alpha = .05 and n = 16: W < 0.887

The results of the test show that the assumption can be made that both the sortie and manpower distributions of differences have the properties of a normal distribution. Therefore, the parametric small-sample confidence interval for the mean of the distribution mentioned in Chapter III can be used to test the hypothesis that there is no difference between the two models in the number of sorties flown and the number of manhours required respectively in a given scenario when the models use a common database.

Calculation of Small-sample Confidence Intervals. A small-sample confidence interval is warranted when the assumption of normality can be made and the distribution has less than 30 point values. The distributions in this study each have 16 point values and as shown above, the assumption of normality can be made for both distributions. The purpose of this calculation is to determine an interval in which lies the mean of distribution. The level of confidence is a measure of the probability that the true mean actually lies somewhere in the interval. In this study, a 95% confidence level is used.

If there is no difference in the sortie and manpower output values between models, the average difference of the values between models will be zero. The two distributions in question are distributions of the value differences between the models at different flying levels and using different treatment combinations. If the confidence interval of the mean of the distributions contains the value of zero, it can be stated with 95% confidence that the null hypothesis of this study cannot be rejected. The formula use for this calculation is given below:

$$\bar{x} +/- t_{a/2} \left(\frac{s}{n^{1/2}} \right)$$

where

t is a t-statistic based on (n - 1) degrees of freedom.

α = 0.05 and corresponds to a 95% confidence level

s = standard deviation of the distribution

$\bar{x}$ = the mean of the distribution

n = 16 (the number of point values in the distribution)

Table 7 below shows the result of the confidence interval calculations.

TABLE 7 - CONFIDENCE INTERVALS

	Sorties	Manpower
Distribution Mean	136.625	-2620.81
Distribution std. dev.	517.942	5641.55
95% C. I.	(-139.31, 412.56)	(-5626.35, 384.72)

Analysis of the Confidence Intervals. Once the confidence intervals have been calculated, an analysis can be made as to whether there is any difference in the selected output variables between the two models.

Sorties. The calculated confidence interval for the mean of the distribution of sortie differences between the two models ranges from -139.31 to 412.56. This says with 95% confidence, the *true mean* of the distribution lies within this interval. Zero certainly lies within this interval, therefore statistically we fail to reject the null hypothesis and conclude that there is no difference between the sortie values of the two models.

Manpower Hours. The calculated confidence interval for the mean of the distribution of manpower hour differences between the two models ranges from -5626.35 to 384.72. As in the case with the sortie distribution, zero lies within this confidence interval, therefore statistically we fail to reject the null hypothesis and conclude that there is no difference between the manpower hours of the two models.

Observations

Negative Tendency in the Manpower Distribution. Even though the manpower confidence interval contains zero, there is a negative tendency in the interval, meaning there is a tendency for more manpower hours to be used in the LCOM simulations than in the AMTAF simulations. This situation is especially evident when the simulations are run at the lower sortie rate as shown in Table 5.

This tendency could point to a possible difference in the way the models use manpower or it could be a result of the omission of manpower accounting for the Ferry mission configuration in the AMTAF database as mentioned in Chapter III. It is this researcher's opinion that if the AMTAF database were adjusted to account for these manhours in the Ferry mission configuration task, the tendency towards negativity in the manpower confidence interval would be much less negative.

Simulation Run Times. LCOM simulation run times were considerably longer than the corresponding AMTAF runs. Depending on the scenario, AMTAF run times were three to five times faster. Once the simulations were run, time was required to get the LCOM output information into a format needed for the study. The AMTAF information was sent directly to a printer with no extra time required.

Summary

The outputs of the two models were compared by creating a distribution of differences of the output values between the two models for both the number of sorties flown and the manpower hours required. These two distributions were tested for normality using a Shapiro-Wilk test found in the Statistix statistical computer software package. Using this test, it was determined that the assumption of normality for these two distributions is valid. A parametric confidence interval of the distribution of differences in treatment means was then calculated for each distribution. Each confidence interval included zero yielding the conclusion that there is no difference in the number of sorties flown and the manhours required for the two models.

An observation was made concerning the negative tendency in the manpower confidence interval especially in tne lower flying level scenario and possible reasons discussed were either inherent differences in the models or differences in the database that can be compensated for.

A second observation was made concerning the simulation run times. AMTAF runs were much faster than similar LCOM runs and LCOM required some extra time to retrieve the output where AMTAF's output could be sent directly to the printer.

V. Conclusions and Recommendations

Implications of Findings

The findings of this study lend credence to the suggestion that there is no difference between LCOM and AMTAF when it comes to the values of output data when common databases are used. AMTAF has several distinct advantages over LCOM such as: 1) learning how to use AMTAF takes much less time than learning to use LCOM, 2) data input and manipulation is much quicker and easier in AMTAF, 3) AMTAF has the capability to model the interactions of the logistics and sortie generation activities, 4) AMTAF can simulate wartime scenarios using the TSARINA component of the model, 5) AMTAF is written in FORTRAN 77 and is very portable across computer systems compared to LCOM's need for a SIMSCRIPT compiler, and 6) AMTAF run times are considerably faster than LCOM runs. The only major disadvantages this researcher has found are in the ability to assign only one Base Aircraft Maintenance Network per aircraft and the inability of AMTAF to simulate cannibalization.

LCOM has one distinct advantage over AMTAF in its capability to build its own databases (i.e. probability distributions, requirements, etc.) using raw maintenance data from databases found in such systems such as the Computer Aided Maintenance System (CAMS). Raw data must be extracted and reworked before it can used in AMTAF. With its inherent advantages over other simulation models, and if it can be shown that AMTAF does just as credible job at forecasting requirements, it is conceivable that AMTAF could replace LCOM and many other of the simulation models being used in the Air Force today. This could provide enough incentive to create a conversion process by which AMTAF can take raw maintenance out of CAMS and build its own databases, correct the limitations AMTAF has in its BAMN capabilities, and add a cannibalization capability.

Recommendations for Further Research

This study has only scratched the surface when it comes to comparing the two models. The biggest achievement of the study was creating a database that minimizes the inherent differences in the models to study the model outputs given common inputs.

In this study, everything was kept as simple as possible. The only variability was in the failure clocks for the LRUs. Future studies should now take these databases and start adding in more variability and complications. This can be done by allowing a probability distribution for the completion of maintenance tasks, allowing the probability of ground aborts, enabling the priority-interrupt capabilities of each model, etc.

This study has shown that there is appears to be no difference between the models under a limited scenario. Only by comparing the models using more complicated scenarios can a sound judgment be made as to whether the models do indeed produce the same results given the same inputs and scenarios. On an even broader scale, AMTAF should be compared with other sortie generation models, particularly TSAR because of the capabilities that both models have in the wartime scenario arena.

AMTAF has the capability of becoming a powerful tool used in modeling aircraft systems for analysis and forecasting purposes because it brings the capabilities of several different models together in one package that is easy to understand and run, allows for uncomplicated data manipulation, and generates output products that readily lend themselves to analysis. Its structure is useful for all kinds of logistics and operational analyses done at all levels. Because of its potential, more research should be done to compare the model with respect to the "accepted" models currently being used in the Air Force in order to validate its accuracy and reliability.

Appendix A: Input Variable Constraint Values

MANPOWER

AFSC	Sortie Rate 2 First Shift	Sortie Rate 2 Second Shift	Sortie Rate 3 First Shift	Sortie Rate 3 Second Shift
325X0	4	10	10	16
328X1	4	6	8	15
423X3	5	7	16	16
423X4	6	14	18	25
431X1	18	40	30	65
432L4	3	4	5	8
462X0	20	15	30	40
462X1	28	20	48	50
326S4	1	2	1	2
326S5	2	4	2	4
326X6	1	2	2	2
326X7	2	2	2	5
326X8	2	2	2	3
423X0	1	2	4	4
423X1	1	1	1	1
427X5	1	1	1	2

PARTS

LRU	Sortie Rate 2 QUANTITY	Sortie Rate 3 QUANTITY
P13A00	9	13
P13B00	7	11
P45100	50	75
P52100	30	45
P72100	34	50
P42CHA	0	0
P42CHG	1	1
P42CH4	1	1
P42CJ0	1	1
P51EA0	1	2
P51ED0	2	3
P55AB0	0	0
P55AE0	2	3
P71DA0	5	8
P74EB0	3	4

AGE

Type	Sortie Rate 2 Quantity	Sortie Rate 3 Quantity
ARCON	3	5
B-4	7	12
GCART	3	5
HCART	9	14
MD3	20	30
MJ2	6	8
TJACK	4	4

Appendix B: Shapiro-Wilk Quantile Table

n\α	0.01	0.02	0.05	0.10	0.50	0.90	0.95	0.98	0.99
3	0.753	0.756	0.767	0.789	0.959	0.998	0.999	1.000	1.000
4	0.687	0.707	0.748	0.792	0.935	0.987	0.992	0.996	0.997
5	0.686	0.715	0.762	0.806	0.927	0.979	0.986	0.991	0.993
6	0.713	0.743	0.788	0.826	0.927	0.974	0.981	0.986	0.989
7	0.730	0.760	0.803	0.838	0.928	0.972	0.979	0.985	0.988
8	0.749	0.778	0.818	0.851	0.932	0.972	0.978	0.984	0.985
9	0.764	0.791	0.829	0.859	0.935	0.972	0.978	0.984	0.986
10	0.781	0.806	0.842	0.869	0.938	0.972	0.978	0.983	0.986
11	0.792	0.817	0.850	0.876	0.940	0.973	0.979	0.984	0.986
12	0.805	0.828	0.859	0.883	0.943	0.973	0.979	0.984	0.986
13	0.814	0.837	0.866	0.889	0.945	0.974	0.979	0.984	0.986
14	0.825	0.846	0.874	0.895	0.947	0.975	0.980	0.984	0.986
15	0.835	0.855	0.881	0.901	0.050	0.975	0.980	0.984	0.987
16	0.844	0.863	0.887	0.906	0.952	0.976	0.981	0.985	0.987
17	0.851	0.869	0.892	0.910	0.954	0.977	0.981	0.985	0.987
18	0.858	0.874	0.897	0.914	0.956	0.978	0.982	0.986	0.988
19	0.863	0.879	0.901	0.917	0.957	0.978	0.982	0.986	0.988
20	0.868	0.884	0.905	0.920	0.959	0.979	0.983	0.986	0.988
21	0.873	0.888	0.908	0.923	0.960	0.980	0.983	0.987	0.989
22	0.878	0.892	0.911	0.926	0.961	0.980	0.984	0.987	0.989
23	0.881	0.895	0.914	0.928	0.962	0.981	0.984	0.987	0.989
24	0.884	0.898	0.916	0.930	0.963	0.981	0.984	0.987	0.989
25	0.888	0.901	0.918	0.931	0.964	0.981	0.985	0.988	0.989
26	0.891	0.904	0.920	0.933	0.965	0.982	0.985	0.988	0.990
27	0.894	0.906	0.923	0.935	0.965	0.982	0.985	0.988	0.990
28	0.896	0.908	0.924	0.936	0.966	0.982	0.985	0.988	0.990
29	0.898	0.910	0.926	0.937	0.966	0.982	0.985	0.988	0.990
30	0.900	0.912	0.927	0.939	0.967	0.983	0.985	0.988	0.990
31	0.902	0.914	0.929	0.940	0.967	0.983	0.986	0.988	0.990
32	0.904	0.915	0.930	0.941	0.968	0.983	0.986	0.988	0.990
33	0.906	0.917	0.931	0.942	0.968	0.983	0.986	0.989	0.990
34	0.908	0.919	0.933	0.943	0.969	0.983	0.986	0.989	0.990
35	0.910	0.920	0.934	0.944	0.969	0.984	0.986	0.989	0.990
36	0.912	0.922	0.935	0.945	0.970	0.984	0.986	0.989	0.990
37	0.914	0.924	0.936	0.946	0.970	0.984	0.987	0.989	0.990
38	0.916	0.925	0.938	0.947	0.971	0.984	0.987	0.989	0.990
39	0.917	0.927	0.939	0.948	0.971	0.984	0.987	0.989	0.991
40	0.919	0.928	0.940	0.949	0.972	0.985	0.987	0.989	0.991
41	0.920	0.929	0.941	0.950	0.972	0.985	0.987	0.989	0.991
42	0.922	0.930	0.942	0.951	0.972	0.985	0.987	0.989	0.991
43	0.923	0.932	0.943	0.951	0.973	0.985	0.987	0.990	0.991
44	0.924	0.933	0.944	0.952	0.973	0.985	0.987	0.990	0.991
45	0.926	0.934	0.945	0.952	0.973	0.985	0.987	0.990	0.991
46	0.927	0.935	0.945	0.953	0.974	0.985	0.988	0.990	0.991
47	0.928	0.936	0.946	0.954	0.974	0.985	0.988	0.990	0.9[illegible]
48	0.929	0.937	0.947	0.954	0.974	0.985	0.988	0.990	0.991
49	0.929	0.937	0.947	0.954	0.974	0.985	0.988	0.990	0.991
50	0.930	0.938	0.947	0.955	0.974	0.985	0.988	0.990	0.991

Appendix C: LCOM DATA BASE

```
         1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890

*****************************  CHANGE CARD FILE  *****************************

510SWT
STORAC      2             F-36
FLWSWT
NOCLWM      0
PSROUT
                  0.0
1,2,3,4,5,6,14,33,34,35,49,50,51,55,66, *
RFREQ      1    60.0
BOSTAT          60.0
IPSTAT          60.0
MMSTAT          60.0
QSTAT           60.0
STOP            60.125


*****************************  FORMS FILE  ***********************************

13 F-36   I  1 1KK       72
13 325X0  M001    10K
13 328X1  M002    10K
13 423X3  M003    10K
13 423X4  M004    10K
13 431X1  M005    10K
13 432L4  M006    10K
13 462X0  M007    10K
13 462X1  M008    10K
13 326S4  M009    10K
13 326S5  M010    10K
13 326X6  M011    10K
13 326X7  M012    10K
13 326X8  M013    10K
13 423X0  M014    10K
13 423X1  M015    10K
13 427X5  M016    10K
13 ARCON  A001    20K 100
13 B-4    A002    20K 100
13 GCART  A003    20K 100
13 HCART  A004    20K 100
13 MD3    A005    20K 100
13 MJ2    A006    20K 100
13 TJACK  A007    20K 100
13 13A00  P001    20K 100
13 13B00  P002    20K 100
13 45100  P003    20K 100
13 52100  P004    20K 100
```

```
         1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890

13 72100  P005    20K 100
13 42CHA  P006    20K 100
13 42CHG  P007    20K 100
13 42CH4  P008    20K 100
13 42CJD  P009    20K 100
13 51EA0  P010    20K 100
13 51ED0  P011    20K 100
13 55AB0  P012    20K 100
13 55AE0  P013    20K 100
13 71DA0  P014    20K 100
13 74EB0  P015    20K 100
13 F13000 C                        25.00   0.  X
13 F45000 C                         7.50   0.  X
13 F52000 C                        10.00   0.  X
13 F72000 C                        15.00   0.  X
13 F42C** C                        17.00   0.  X
13 F51E** C                        80.00   0.  X
13 F55A** C                        21.0    0.  X
13 F71D** C                        13.0    0.  X
13 F74E** C                        40.0    0.  X
24
24 F-36   BOMBS  I      4
24 SYSTEM FUEL   I 555555
12
12 DNJACK 22 1.500H     C          431X1  4 TJACK  4
12 DNRACK 22 1.000H     C          462X0  2
12 DNBOMB 22 1.000H     C          462X0  5 MJ2    1
12 EOR    31  .500      C          431X1  3 MJ2    1
12 G13A00 23            C *13A00
12 G13B00 23            C *13B00
12 G45100 23            C *45100
12 G52100 23            C *52100
12 G72100 23            C *72100
12 H13000 33 3.500H     C          432L4  2 431X1  4
12 H45000 33 3.000H     C          423X4  2 B-4    1 HCART   1
12 H52000 33 4.000H     C          325X0  2 B-4    1
12 H72000 33 3.000H     C          328X1  2 431X1  4
12 INRACK 22 1.000H     C          462X0  2
12 K13A00 73 1.000H     C          432L4  1
12 K13B00 73 1.500H     C          432L4  1
12 K45100 73 1.000H     C          423X4  2
12 K52100 73 1.000H     C          325X0  1
12 K72100 73 1.000H     C          328X1  1
12 LANCH1 31  .250H     C          431X1  1 GCART  1
12 LANCH2 31  .250H     C          431X1  1 GCART  1
12 LANCH3 31  .250H     C          431X1  1 GCART  1
12 LOADSB 31 1.000H     C          462X0  5 MJ2    1
12 MPREFT 31 1.000H     C          462X1  2 B-4    1 MO3     1
12 M13A00 22  .750H     C          432L4  1
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         1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890

12 M13B00 22  .750H      C         432L4  1
12 M45000 22 1.000H      C         423X4  2
12 M52000 22  .500H      C         325X0  2
12 M72000 23 1.000H      C         328X1  2
12 M13A00 31  .500H      C         432L4  1
12 M13B00 31  .500H      C         432L4  1
12 M45100 31  .500H      C         423X4  1
12 M52100 31  .500H      C         325X0  1
12 M72100 31  .500H      C         328X1  1
12 POSTF1 31 1.000H      C         431X1  3 MD3    1
12 POSTF2 31 1.000H      C         431X1  1 MD3    1
12 POSTF3 31 1.000H      C         431X1  3 MD3    1
12 Q13A00 23 1.000H      C         13A00 C 1432L4  1
12 Q13B00 23 1.000H      C         13B00 C 1432L4  1
12 Q45100 23 1.000H      C         45100 C 1423X4  1
12 Q52100 23 1.%w0H      C         52100 C 1325X0  1
12 Q72100 23 1.000H      C         72100 C 1328X1  1
12 REFUEL 31  .750H      C         423X3  1
12 R13A00 22 1.500H      C         432L4  2
12 R13B00 22 2.000H      C         432L4  2
12 R45100 22 2.500H      C         423X4  2
12 R52100 22 2.000H      C         325X0  2
12 R72100 22 2.500H      C         328X1  2
12 SERVHY 31  .750H      C         462X1  1 HCART  1
12 SORTIE 11
12 TSHOOT 22 3.500H      C         432L4  3 MD3    1 B-4    1
12 TSHOOTC               C         TJACK  4
12 T13000 22 1.000H      C         432L4  2 MD3    1
12 T45000 22 1.500H      C         423X4  2 MD3    1 HCART  1
12 T52000 22 1.000H      C         325X0  2 ARCON  1 MD3    1
12 T72000 23 1.500H      C         328X1  2 ARCON  1 MD3    1
12 UPJACK 22 2.500H      C         431X1  4 TJACK  4
12 V13000 22 1.000H      C         432L4  2 MD3    1
12 V45000 22 1.000H      C         423X4  2 MD3    1 HCART  1
12 V52000 22  .500H      C         325X0  2 MD3    1
12 V72000 23 1.000H      C         328X1  2 MD3    1 ARCON  1
12 W13A00 73 2.500H      C         432L4  2
12 W13B00 73 2.000H      C         432L4  2
12 W45100 73 2.000H      C         423X4  2
12 W52100 73 2.500H      C         325X0  2
12 W72100 73 2.500H      C         328X1  1
12 G42CHA 23             C *42CHA
12 G42CHG 23             C *42CHG
12 G42CH4 23             C *42CH4
12 G42CJ0 23             C *42CJ0
12 G51EA0 23             C *51EA0
12 G51ED0 23             C *51ED0
12 G55AB0 23             C *55AB0
12 G55AE0 23             C *55AE0
```

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         1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890

12 G71DA0 23            C *71DA0
12 G74EB0 23            C *74EB0
12 H71D00 21 1.500H     C         326X8  1
12 H74E00 21 1.700H     C         326X6  1
12 JDUMY1 22            C
12 JWSH2P 23            C
12 K51EA0 72 3.500H     C         326S4  1
12 K55AE0 72 4.000H     C         326S5  1
12 K71DA0 72 5.800H     C         326S5  1
12 K74EB0 72 9.600H     C         326S4  1
12 M42C00 21  .900H     C         423X0  1
12 M51E00 21 1.400H     C         326X7  1
12 M51E01 21 2.100H     C         427X5  1
12 M55A01 21 1.400H     C         326X7  1
12 M71D00 21 1.300H     C         326X8  1
12 M71D01 21 2.100H     C         427X5  1
12 M74E00 21 1.600H     C         326X6  1
12 M51EA0 22 5.400H     C         326S4  1
12 M51ED0 22 1.800H     C         326S5  1
12 M55AE0 22 4.000H     C         326S5  1
12 M71DA0 22 6.900H     C         326S5  1
12 M74EB0 22 11.80H     C         326S4  1
12 PDEPOT 43 11D        C
12 Q42CHA 21            C         42CHA C 1
12 Q42CHG 21 2.600H     C         42CHG C 1432X0  2
12 Q42CH4 21            C         42CH4 C 1
12 Q42CJD 21            C         42CJD C 1
12 Q51EA0 21 1.600H     C         51EA0 C 1326X7  1
12 Q51ED0 21 1.600H     C         51ED0 C 1326X7  1
12 Q55AB0 23            C         55AB0 C 1
12 Q55AE0 21 1.200H     C         55AE0 C 1326X7  1
12 Q71DA0 21  .600H     C         71DA0 C 1326X8  2
12 Q74EB0 21            C         74EB0 C 1
12 R42C00 21 2.900H     C         326X6  1
12 R42C01 21 1.100H     C         423X0  1
12 R42C02 21 1.200H     C         423X1  1
12 R51E00 21 1.600H     C         326X7  1
12 R55A00 21 1.400H     C         326X7  1
12 R71D00 21 1.400H     C         326X8  1
12 R74E00 21 2.400H     C         326X6  1
12 SHOP   23            C
12 T42C00 21  .800H     C         423X0  1
12 T51E00 21 1.300H     C         326X7  2
12 T55A01 21 1.000H     C         326X7  2
12 T71D00 21  .700H     C         326X8  1
12 T74E00 21  .300H     C         326X6  1
12 V42C00 21  .400H     C         423X0  2
12 V51E00 21 1.000H     C         326X7  2
12 V55A01 21  .400H     C         326X7  1
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         1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890

12 V71D00 21  .500H      C         326X8  1
12 V74E00 21  .200H      C         326X6  1
12 W42CHA 73 4.500H      C         423X0  1
12 W42CHG 73 13.50H      C         423X0  1
12 W42CH4 73 9.000H      C         423X0  1
12 W42CJD 73 7.500H      C         423X0  1
12 W51EA0 72 4.800H      C         326S4  1
12 W55AB0 72 2.200H      C         326S5  1
12 W55AE0 72 5.400H      C         326S5  1
12 W71DA0 72 7.900H      C         326S5  1
12 W74EB0 72 10.70H      C         326S4  1
12 X42C00 21 1.000H      C         423X0  1
12 X51E00 21 1.400H      C         326X7  1
12 X55A00 21 1.400H      C         326X7  1
12 X71D00 21 1.300H      C         326X8  1
12 X74E00 21 2.000H      C         326X6  1
11
11 PDEPOT PDEPOT         D
11 CAS003 PREFLT CAS03A C             LAUNCH FOR CLOSE AIR SUPPORT
11 CAS03A LANCH1 CAS004 D             LAUNCH FOR CLOSE AIR SUPPORT
11 CAS004 SORTIE CAS005 S
11 CAS005 POSTF1 CAS006 D             POST FLIGHT FOR CAS
11 CAS006 CALLS1        C             CALLING UNSCHEDULED MAINTENANCE
11 CAS005 REFUEL CAS007SUFUEL    10000
11 CAS007        CAS008LEFUEL    20000
11 CAS008               ADFUEL  500000
11 PREFLT MPREFT         D            CALLED SECTION FOR ALL MISSIONS
11 PREFLT SERVHY         D            CALLED SECTION FOR ALL MISSIONS
11 SMB02A        SMB004GEBOMBS  4
11 SMB02A        SMB02BLSBOMBS  4
11 SMB02B        SMB003ADBOMBS  4
11 SMB003 LOADSB SMB004 D             LOAD SMART BOMBS
11 SMB004 PREFLT SMB04A C             LAUNCH FOR SB MISSION
11 SMB04A LANCH2 SMB005 D             LAUNCH FOR SB MISSION
11 SMB005 SORTIE SMB006 S             SB MISSION FLYING
11 SMB006 EOR    SMB007SUBOMBS  4     END OF RUNWAY CHECK
11 SMB007 POSTF2 SMB008 D             POST FLIGHT FOR SB MISSION
11 SMB007 REFUEL CAS007SUFUEL    20000
11 SMB008 CALLS1        C             CALL UNSCHEDULED MAINTENANCE
11 FRY003 PREFLT FRY03A C             LAUNCH FOR FERRY MISSION
11 FRY03A LANCH3 FRY004 D             LAUNCH FOR FERRY MISSION
11 FRY004 SORTIE FRY005 S             FERRY MISSION FLYING
11 FRY005 POSTF3 FRY006 D             POST FLIGHT FOR FERRY
11 FRY005 REFUEL CAS007SUFUEL     5555
11 FRY006 CALLS1        C             CALL UNSCHEDULED MAINTENANCE
11 CALLS1        E2000A FF52000
11 E2000A T52000 E20001 D             TROUBLE SHOOT AUTO PILOT
11 E20001 M52000 E20002 E  .250       REPAIR AUTO PILOT ON AC
11 E20001 R52100 E20003 E  .750       REMOVE AND REPLACE LRU
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         1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890

11 E20002 V52000        D              VERIFY WORK ON AUTO PILOT
11 E20003 V52000 E20004 D              VERIFY WORK ON LRU
11 E20004 G52100 E20005 R              COMPONENT IDENTIFCATION
11 E20004 Q52100        I              DRAW LRU FROM SUPPLY
11 E20005 N52100 PDEPOT E  .250        LRU NOT REPAIRABLE THIS STATION
11 E20005 W52100        E  .750        CHECK AND REPAIRED LRU
11 E20005 K52100        E  .000        LRU CHECKED OK
11 CALLS1        G20001 FF72000
11 G20001 T72000 G20002 D              TROUBLE SHOOT RADAR
11 G20002 M72000 G20003 E  .300        REPAIR RADAR ON ACFT
11 G20003 V72000        D              VERIFY WORK ON RADAR
11 G20002 R72100 G20004 E  .700        REMOVE AND REPLACE LRU
11 G20004 V72000 G20005 D              VERIFY WORK ON LRU
11 G20005 G72100 G20006 D              COMPONENT IDENT FOR RADAR
11 G20005 Q72100        I              DRAW RADAR LRU FROM SUPPLY
11 G20006 N72100 PDEPOT E  .500        LRU NOT REPAIRABLE THIS STATION
11 G20006 W72100        E  .500        CHECK AND REPAIR LRU
11 G20006 K72100        E  .000        LRU CHECKED OK
11 CALLS1        D50001 FF45000        FAILURE CHECK FOR HYDRAULICS
11 D50001 T45000 D50002 D              TROUBLE SHOOT HYDRAULIC SYSTEM
11 D50002 M45000 D50003 E  .400        REPAIRED HYDRAULICS ON ACFT
11 D50002 R45100 D50004 E  .600        REMOVED AND REPLACED LRU
11 D50003 V45000        D              VERIFY LRU
11 D50004 G45100 D50005 D              COMPONENT IDENT FOR HYDRAULICS
11 D50004 Q45100 D50004 I              DRAW LRU FROM SUPPLY
11 D50006 V45000        D              VERIFY HYDRAULIC SYSTEM
11 D50005 N45100 PDEPOT E  .500        LRU NOT REPAIRABLE THIS STATION
11 D50005 W45100        E  .500        CHECKED AND REPAIRED LRU
11 D50005 K45100        E  .000        LRU CHECKED OK
11 CALLS1        A30000 FF13000        FAILURE CLOCK FOR LANDING GEAR
11 A30000 T13000 A30001 E  .900        TROUBLE SHOOT LANDING GEAR
11 A30000 UPJACK A30010 E  .100        JACK AIRCRAFT
11 A30010 TSHOOT A30011 D              TROUBLE SHOOT LANDING GEAR
11 A30011 DNJACK A30001 D              REMOVE ACFT FROM JACKS
11 A30001 M13A00 A30002 E  .200        REPAIR #1 LRU ON ACFT
11 A30002 V13000        D              VERIFY WORK ON LANDING GEAR
11 A30001 R13A00 A30003 E  .300        REMOVE AND REPLACE #1 LRU
11 A30003 V13000 A30004 D              VERIFY #1 LRU FOR ACFT
11 A30001 M13B00 A30006 E  .200        REPAIR #2 LRU ON ACFT
11 A30006 V13000        D              VERIFY #2 LRU ON ACFT
11 A30001 R13B00 A30007 E  .300        REMOVE AND REPLACE #2 LRU
11 A30007 V13000 A30008 D              VERIFY REPLACED #2 LRU ON ACFT
11 A30004 G13A00 A30005 D              COMPOENENT IDENT FOR #1 LRU
11 A30004 Q13A00        I              DRAW #1 LRU FROM SUPPLY
11 A30005 N13A00 PDEPOT E  .700        #1 LRU NOT REPAIRABLE THIS STATION
11 A30005 K13A00        E  .000        #1 LRU CHECK OK
11 A30005 W13A00        E  .300        CHECK AND REPAIR #1 LRU
11 A30008 G13B00 A30009 D              CMP ID FOR #2 LRU
11 A30008 Q13B00        I              DRAW #2 LRU FROM SUPPLY
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         1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890

11 A30009 N13800 PDEPOT E .300         #2 LRU NRTS
11 A30009 K13800        E .000         #2 LRU CHECK OK
11 A30009 W13800        E .700         CHECK AND REPAIR #2 LRU
11 RECON1 INRACK        D              UPLOAD RACKS
11 RECON2 DNRACK        D              DOWNLOAD RACKS
11 RECON3               D              DUMMY TASK TO PROCESS C
11 RECON4 DNBOMB        D              DOWNLOAD BOMBS
11 RECON5 DNBOMB RECON2 D              DOWNLOAD BOMBS
11 CALLS1        D2C01  FF42C**        FAILURE CLOCK FOR ELEC PWR SUPPLY
11 D2C01  V42C00        A .015         VERIFY POWER SUPPLY
11 D2C01  T42C00        A .029         TROUBLE SHOOT POWER SUPPLY
11 D2C01  X42C00        A .118
11 D2C01  M42C00        E .603         REPAIR POWER SUPPLY ON ACFT
11 D2C01  R42C00 ID2C00 E .030         REMOVE AND REPLACE LRU
11 D2C01  R42C01 ID2C00 E .336         REMOVE AND REPLACE LRU
11 D2C01  R42C02 ID2C00 E .031         REMOVE AND REPLACE LRU
11 ID2C00 SHOP   ID2C01 D
11 ID2C01 JNSH2P        E .629         LRU CHECK OK
11 ID2C01 JDUMY1 ID2C02 E .037         DUMMY TASK FOR #1 LRU
11 ID2C02 Q42CH4        D              CMPT ID FOR #1 LRU
11 ID2C02 G42CH4 ID2C03 D              DRAW #1 LRU FROM SUPPLY
11 ID2C03 W42CH4        D              CHECK AND REPAIR #1 LRU
11 ID2C01 JDUMY1 ID2C04 E .074         DUMMY TASK FOR #2 LRU
11 ID2C04 Q42CHA        D              CMPT ID FOR #2 LRU
11 ID2C04 G42CHA ID2C05 D              DRAW #2 LRU FROM SUPPLY
11 ID2C05 W42CHA        D              CHECK AND REPAIR #2 LRU
11 ID2C01 JDUMY1 ID2C06 E .037         DUMMY TASK FOR #3 LRU
11 ID2C06 Q42CHG        I              CMPT ID FOR #3 LRU
11 ID2C06 G42CHG ID2C07 D              DRAW #3 LRU FROM SUPPLY
11 ID2C07 W42CHG        D              CHECK AND REPAIR #3 LRU
11 ID2C01 JDUMY1 ID2C09 E .223         DUMMY TASK FOR #4 LRU
11 ID2C09 Q42CJD        D              CMPT ID FROM #4 LRU
11 ID2C09 G42CJD ID2C0A D              DRAW #4 LRU FROM SUPPLY
11 ID2C0A W42CJD        D              CHECK AND REPAIR #4 LRU
11 CALLS1        E1E01  FF51E**        FAILURE CLOCK FOR AIR DATA SYS
11 E1E01  V51E00        A .868         VERIFY AIR DATA SYSTEM
11 E1E01  T51E00        A .316         TROUBLE SHOOT AIR DATA SYSTEM
11 E1E01  X51E00        A .368
11 E1E01  M51E00        E .073         REPAIR #1 LRU ON ACFT
11 E1E01  M51E01        E .218         REPAIR #2 LRU ON ACFT
11 E1E10  R51E00 IE1E00 E .709         REMOVE AND REPLACE LRU
11 IE1E00 SHOP   IE1E01 D
11 IE1E01 JNSH2P        E .259         LRU CHECK OK
11 IE1E01 JDUMY1 IE1E02 E .593         DUMMY TASK FOR #1 LRU
11 IE1E02 Q51EA0        I              CMPT ID FOR #1 LRU
11 IE1E02 G51EA0 IE1E03 D              DRAW #1 LRU FROM SUPPLY
11 IE1E03 N51EA0 PDEPOT E .100         #1 LRU NRTS
11 IE1E03 W51EA0        E .900         CHECK AND REPAIR #1 LRU
11 IE1E03 K51EA0        E .000         #1 LRU CHECK OK
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         1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890

11 IE1E01 JDUMY1 ID1E05 E  .148       DUMMY TASK FOR #2 LRU
11 ID1E05 Q51ED0        I             CMPT ID FOR #2 LRU
11 ID1E05 G51ED0 IE1E06 D             DRAW LRU FROM SUPPLY
11 ID1E06 N51ED0 POEPOT D             #2 LRU NRTS
11 CALLS1        E5A01  FF55A**       FAILURE CLOCK FOR TEST DISPLAY
11 E5A01  V55A01        A  .185       VERITY BUILT-IN TEST DISPLAY
11 E5A01  T55A01        A  .046       TROUBLE SHOOT TEST DISPLAY
11 E5A01  X55A01 E5A02  A  .169
11 E5A02  V55A03        A  .182       VERIFY TEST DISPLAY
11 E5A01  M55A01        E  .739       REPAIR TEST DISPLAY ON ACFT
11 E5A01  R55A00 IE5A00 E  .261       REMOVE AND REPLACE LRU
11 IE5A00 SHOP   IE5A01 D
11 IE5A01 JNSH2P        E  .118       LRU CHECK OK
11 IE5A01 JDUMY1 IE5A0A E  .235       DUMMY TASK FOR #1 LRU
11 IE5A0A Q55AB0        D             COMPONENT CHECK FOR #1 LRU
11 IE5A0A G55AB0 IE5A02 D             DRAW #1 LRU FROM SUPPLY
11 IE5A02 W55AB0        D             CHECK AND REPAIR #1 LRU
11 IE5A01 JDUMY1 IE5A05 E  .647       DUMMY TASK FOR #2 LRU
11 IE5A05 Q55AE0        I             CMPT CHECK FOR #2 LRU
11 IE5A05 G55AE0 IE5A06 D             DRAW #2 LRU FROM SUPPLY
11 IE5A06 N55AE0 PDEPOT E  .046       #2 LRU NRTS
11 IE5A06 K55AE0        E  .000       #2 LRU CHECK OK
11 IE5A06 W55AE0        E  .954       CHECK AND REPAIR #2 LRU
11 CALLS1        G1D01  FF71D**       FAILURE CLOCK FOR TACTICAL AIR NAV SET
11 G1D01  V71D00        A  .172       VERIFY NAVIGATION SET
11 G1D01  T71D00        A  .276       TROUBLE SHOOT NAVIGATION SET
11 G1D01  X71D00           .069
11 G1D01  H71000        E  .569
11 G1D01  M71D00        E  .035       REPAIR #1 LRU ON ACFT
11 G1D01  M71D01        E  .034       REPAIR #2 LRU ON ACFT
11 G1D01  R71D00 IG1D02 E  .362       REMOVE AND REPLACE LRU
11 IG1D02 Q71DA0        I             CMPT ID FOR LRU
11 IG1D02 G71DA0 IG1D03 D             DRAW LRU FROM SUPPLY
11 IG1D03 N71DA0 PDEPOT E  .159       LRU NRTS
11 IG1D03 K71DA0        E  .000       LRU CHECK OK
11 IG1D03 W71DA0        E  .841       CHECK AND REPAIR LRU
11 CALLS1        G4E01  FF74E**       FAILURE CLOCK FOR GYRO
11 G4E01  V74E00        A  .310       VERIFY GYRO
11 G4E01  T74E00        A  .103       TROUBLE SHOOT GYRO
11 G4E01  X74E00        A  .379
11 G4E01  H74E00        E  .448
11 G4E01  M74E00        E  .069       REPAIR LRU ON ACFT
11 G4E01  R74E00 IG4E00 E  .483
11 IG4E00 SHOP   IG4E01 D
11 IG4E01 JNSH2P        E  .071       LRU CHECK OK
11 IG4E01 JDUMY1 IG4E02 E  .929       DUMMY TASK FOR LRU
11 IG4E02 Q74EB0        D             CMPT ID FOR LRU
11 IG4E02 G74EB0 IG4E03 D             DRAW LRU FROM SUPPLY
11 IG4E03 N74EB0 PDEPOT E  .104       LRU NRTS
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         1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890

11 IG4E03 K74EB0       E  .000       LRU CHECK OK
11 IG4E03 W74EB0       E  .896       CHECK AND REPAIR LRU
14
14 SORTIE C F52000 1.000
14 SORTIE C F72000
14        C F45000
14        C F13000
14        C F42C**
14        C F51E**
14        C F55A**
14        C F71D**
14        C F74E**
16
16 *          12  12
16 R               7
16   325X0   200 200
16   328X1   200 200
16   423X3   200 200
16   423X4   200 200
16   431X1   200 200
16   432L4   200 200
16   462X0   200 200
16   462X1   200 200
16   326S4   200 200
16   326S5   200 200
16   326X6   200 200
16   326X7   200 200
16   326X8   200 200
16   423X0   200 200
16   423X1   200 200
16   427X5   200 200
17
17 FERRY     FRY003 CLEAN  CLEAN  FERRY  F-36
17 CLSPT     CAS003 RACKS  RACKS  CLSPT  F-36
17 SMTBM     SMB02A BOMBS  RACKS  SMTBM  F-36
18
18 1 10
18 2 20
18 3 30
18 4 0     0     0
18 5 .25   .50   .75
18 6 0     0     0
18 7  20    48    48
18 8 1.0
18 9 1.0
1810  5
21
21 CLSPT    C RACKS                   0.0
21 CLSPT  C A RACKS                   3.0
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         1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890

21         C C CLEAN    RECON1        3.0
21         C A CLEAN    RECON1        4.0
21         C A BOMBS    RECON4        4.0
21         C C BOMBS    RECON4        4.0
21 SMTBM     C BOMBS                  0.0
21 SMTBM   C A BOMBS                  3.0
21         C A RACKS                  4.0
21         C C RACKS    RECON3        4.0
21         C C CLEAN    RECON1        4.0
21         C A CLEAN    RECON1        4.0
21 FERRY     C CLEAN                  0.0
21 FERRY   C A CLEAN                  2.0
21         C A RACKS    RECON2        3.0
21         C C RACKS    RECON2        3.0
21         C A BOMBS    RECON5        4.0
21         C C BOMBS    RECON5        4.0
21 MPREFT    A CLEAN                  0.0
21 MPREFT  C A RACKS    RECON2        2.0
21         C C CLEAN                  0.0
21         C C RACKS    RECON2        3.0
21         C A BOMBS    RECON5        4.0
21         C C BOMBS    RECON5        4.0
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******************************  LCOM FLYING SCHEDULES  **********************

                                  TSDR 2

     60 F-36  THESIS PROBLEM SR = 2.0
20 1       1  0530 F-36   CLSPT  1 2 0  1.5        C 4.0  2.0  1  1  999
20 1       1  0530 F-36   SMTBM  1 2 0  1.5        C 4.0  2.0  1  1  999
20 1       1  0530 F-36   FERRY  1 2 0  1.5        C 4.0  2.0  1  1  999
20 1       1  0600 F-36   CLSPT  1 2 0  1.5        C 4.0  2.0  1  1  999
20 1       1  0606 F-36   SMTBM  1 2 0  1.5        C 4.0  2.0  1  1  999
20 1       1  0630 F-36   CLSPT  1 2 0  1.5        C 4.0  2.0  1  1  999
20 1       1  0642 F-36   SMTBM  1 2 0  1.5        C 4.0  2.0  1  1  999
20 1       1  0700 F-36   CLSPT  1 2 0  1.5        C 4.0  2.0  1  1  999
20 1       1  0718 F-36   SMTBM  1 2 0  1.5        C 4.0  2.0  1  1  999
20 1       1  0730 F-36   CLSPT  1 2 0  1.5        C 4.0  2.0  1  1  999
20 1       1  0754 F-36   SMTBM  1 2 0  1.5        C 4.0  2.0  1  1  999
20 1       1  0800 F-36   CLSPT  1 2 0  1.5        C 4.0  2.0  1  1  999
20 1       1  0830 F-36   SMTBM  1 2 0  1.5        C 4.0  2.0  1  1  999
20 1       1  0830 F-36   FERRY  1 2 0  1.5        C 4.0  2.0  1  1  999
20 1       1  0830 F-36   CLSPT  1 2 0  1.5        C 4.0  2.0  1  1  999
20 1       1  0900 F-36   CLSPT  1 2 0  1.5        C 4.0  2.0  1  1  999
20 1       1  0906 F-36   SMTBM  1 2 0  1.5        C 4.0  2.0  1  1  999
20 1       1  0930 F-36   CLSPT  1 2 0  1.5        C 4.0  2.0  1  1  999
20 1       1  0942 F-36   SMTBM  1 2 0  1.5        C 4.0  2.0  1  1  999
20 1       1  1000 F-36   CLSPT  1 2 0  1.5        C 4.0  2.0  1  1  999
20 1       1  1018 F-36   SMTBM  1 2 0  1.5        C 4.0  2.0  1  1  999
20 1       1  1030 F-36   CLSPT  1 2 0  1.5        C 4.0  2.0  1  1  999
20 1       1  1054 F-36   SMTBM  1 2 0  1.5        C 4.0  2.0  1  1  999
20 1       1  1100 F-36   CLSPT  1 2 0  1.5        C 4.0  2.0  1  1  999
20 1       1  1130 F-36   SMTBM  1 2 0  1.5        C 4.0  2.0  1  1  999
20 1       1  1130 F-36   FERRY  1 2 0  1.5        C 4.0  2.0  1  1  999
20 1       1  1130 F-36   CLSPT  1 2 0  1.5        C 4.0  2.0  1  1  999
20 1       1  1200 F-36   CLSPT  1 2 0  1.5        C 4.0  2.0  1  1  999
20 1       1  1206 F-36   SMTBM  1 2 0  1.5        C 4.0  2.0  1  1  999
20 1       1  1230 F-36   CLSPT  1 2 0  1.5        C 4.0  2.0  1  1  999
20 1       1  1242 F-36   SMTBM  1 2 0  1.5        C 4.0  2.0  1  1  999
20 1       1  1300 F-36   CLSPT  1 2 0  1.5        C 4.0  2.0  1  1  999
20 1       1  1318 F-36   SMTBM  1 2 0  1.5        C 4.0  2.0  1  1  999
20 1       1  1330 F-36   CLSPT  1 2 0  1.5        C 4.0  2.0  1  1  999
20 1       1  1354 F-36   SMTBM  1 2 0  1.5        C 4.0  2.0  1  1  999
20 1       1  1400 F-36   CLSPT  1 2 0  1.5        C 4.0  2.0  1  1  999
20 1       1  1430 F-36   SMTBM  1 2 0  1.5        C 4.0  2.0  1  1  999
20 1       1  1430 F-36   FERRY  1 2 0  1.5        C 4.0  2.0  1  1  999
20 1       1  1430 F-36   CLSPT  1 2 0  1.5        C 4.0  2.0  1  1  999
20 1       1  1500 F-36   CLSPT  1 2 0  1.5        C 4.0  2.0  1  1  999
20 1       1  1506 F-36   SMTBM  1 2 0  1.5        C 4.0  2.0  1  1  999
20 1       1  1530 F-36   CLSPT  1 2 0  1.5        C 4.0  2.0  1  1  999
20 1       1  1542 F-36   SMTBM  1 2 0  1.5        C 4.0  2.0  1  1  999
20 1       1  1600 F-36   CLSPT  1 2 0  1.5        C 4.0  2.0  1  1  999
20 1       1  1618 F-36   SMTBM  1 2 0  1.5        C 4.0  2.0  1  1  999
20 1       1  1630 F-36   CLSPT  1 2 0  1.5        C 4.0  2.0  1  1  999
```

```
         1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890
20 1       1  1654 F-36   SMTBM  1 2 0  1.5         C 4.0  2.0  1  1  999
20 1       1  1700 F-36   CLSPT  1 2 0  1.5         C 4.0  2.0  1  1  999
20 1       1  1730 F-36   SMTBM  1 2 0  1.5         C 4.0  2.0  1  1  999
20 1       1  1730 F-36   FERRY  1 2 0  1.5         C 4.0  2.0  1  1  999
20 1       1  1730 F-36   CLSPT  1 2 0  1.5         C 4.0  2.0  1  1  999
20 1       1  1800 F-36   CLSPT  1 2 0  1.5         C 4.0  2.0  1  1  999
20 1       1  1806 F-36   SMTBM  1 2 0  1.5         C 4.0  2.0  1  1  999
20 1       1  1830 F-36   CLSPT  1 2 0  1.5         C 4.0  2.0  1  1  999
20 1       1  1842 F-36   SMTBM  1 2 0  1.5         C 4.0  2.0  1  1  999
20 1       1  1900 F-36   CLSPT  1 2 0  1.5         C 4.0  2.0  1  1  999
20 1       1  1918 F-36   SMTBM  1 2 0  1.5         C 4.0  2.0  1  1  999
20 1       1  1930 F-36   CLSPT  1 2 0  1.5         C 4.0  2.0  1  1  999
20 1       1  1954 F-36   SMTBM  1 2 0  1.5         C 4.0  2.0  1  1  999
20 1       1  2000 F-36   CLSPT  1 2 0  1.5         C 4.0  2.0  1  1  999
20 1       1  2030 F-36   SMTBM  1 2 0  1.5         C 4.0  2.0  1  1  999
20 1       1  2030 F-36   FERRY  1 2 0  1.5         C 4.0  2.0  1  1  999
20 1       1  2030 F-36   CLSPT  1 2 0  1.5         C 4.0  2.0  1  1  999
20 1       1  2100 F-36   CLSPT  1 2 0  1.5         C 4.0  2.0  1  1  999
20 1       1  2106 F-36   SMTBM  1 2 0  1.5         C 4.0  2.0  1  1  999
20 1       1  2130 F-36   CLSPT  1 2 0  1.5         C 4.0  2.0  1  1  999
20 1       1  2142 F-36   SMTBM  1 2 0  1.5         C 4.0  2.0  1  1  999
20 1       1  2200 F-36   CLSPT  1 2 0  1.5         C 4.0  2.0  1  1  999
20 1       1  2218 F-36   SMTBM  1 2 0  1.5         C 4.0  2.0  1  1  999
20 1       1  2230 F-36   CLSPT  1 2 0  1.5         C 4.0  2.0  1  1  999
20 1       1  2254 F-36   SMTBM  1 2 0  1.5         C 4.0  2.0  1  1  999
20 1       1  2300 F-36   CLSPT  1 2 0  1.5         C 4.0  2.0  1  1  999
```

TDSR 3

```
    60 F-36   THESIS PROBLEM SR = 3.0
20 1       1  0530 F-36   CLSPT  1 2 0  1.5         C 4.0  2.0  1  1  999
20 1       1  0530 F-36   SMTBM  1 2 0  1.5         C 4.0  2.0  1  1  999
20 1       1  0550 F-36   CLSPT  1 2 0  1.5         C 4.0  2.0  1  1  999
20 1       1  0554 F-36   SMTBM  1 2 0  1.5         C 4.0  2.0  1  1  999
20 1       1  0610 F-36   CLSPT  1 2 0  1.5         C 4.0  2.0  1  1  999
20 1       1  0618 F-36   SMTBM  1 2 0  1.5         C 4.0  2.0  1  1  999
20 1       1  0630 F-36   FERRY  1 2 0  1.5         C 4.0  2.0  1  1  999
20 1       1  0630 F-36   CLSPT  1 2 0  1.5         C 4.0  2.0  1  1  999
20 1       1  0642 F-36   SMTBM  1 2 0  1.5         C 4.0  2.0  1  1  999
20 1       1  0650 F-36   CLSPT  1 2 0  1.5         C 4.0  2.0  1  1  999
20 1       1  0706 F-36   SMTBM  1 2 0  1.5         C 4.0  2.0  1  1  999
20 1       1  0710 F-36   CLSPT  1 2 0  1.5         C 4.0  2.0  1  1  999
20 1       1  0730 F-36   SMTBM  1 2 0  1.5         C 4.0  2.0  1  1  999
20 1       1  0730 F-36   CLSPT  1 2 0  1.5         C 4.0  2.0  1  1  999
20 1       1  0750 F-36   CLSPT  1 2 0  1.5         C 4.0  2.0  1  1  999
20 1       1  0754 F-36   SMTBM  1 2 0  1.5         C 4.0  2.0  1  1  999
20 1       1  0810 F-36   CLSPT  1 2 0  1.5         C 4.0  2.0  1  1  999
20 1       1  0818 F-36   SMTBM  1 2 0  1.5         C 4.0  2.0  1  1  999
20 1       1  0830 F-36   FERRY  1 2 0  1.5         C 4.0  2.0  1  1  999
```

```
         1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890
20 1        1  0830 F-36   CLSPT  1 2 0   1.5         C 4.0  2.0  1  1  999
20 1        1  0842 F-36   SMTBM  1 2 0   1.5         C 4.0  2.0  1  1  999
20 1        1  0850 F-36   CLSPT  1 2 0   1.5         C 4.0  2.0  1  1  999
20 1        1  0906 F-36   SMTBM  1 2 0   1.5         C 4.0  2.0  1  1  999
20 1        1  0910 F-36   CLSPT  1 2 0   1.5         C 4.0  2.0  1  1  999
20 1        1  0930 F-36   SMTBM  1 2 0   1.5         C 4.0  2.0  1  1  999
20 1        1  0930 F-36   CLSPT  1 2 0   1.5         C 4.0  2.0  1  1  999
20 1        1  0950 F-36   CLSPT  1 2 0   1.5         C 4.0  2.0  1  1  999
20 1        1  0954 F-36   SMTBM  1 2 0   1.5         C 4.0  2.0  1  1  999
20 1        1  1010 F-36   CLSPT  1 2 0   1.5         C 4.0  2.0  1  1  999
20 1        1  1018 F-36   SMTBM  1 2 0   1.5         C 4.0  2.0  1  1  999
20 1        1  1030 F-36   FERRY  1 2 0   1.5         C 4.0  2.0  1  1  999
20 1        1  1030 F-36   CLSPT  1 2 0   1.5         C 4.0  2.0  1  1  999
20 1        1  1042 F-36   SMTBM  1 2 0   1.5         C 4.0  2.0  1  1  999
20 1        1  1050 F-36   CLSPT  1 2 0   1.5         C 4.0  2.0  1  1  999
20 1        1  1106 F-36   SMTBM  1 2 0   1.5         C 4.0  2.0  1  1  999
20 1        1  1110 F-36   CLSPT  1 2 0   1.5         C 4.0  2.0  1  1  999
20 1        1  1130 F-36   SMTBM  1 2 0   1.5         C 4.0  2.0  1  1  999
20 1        1  1130 F-36   CLSPT  1 2 0   1.5         C 4.0  2.0  1  1  999
20 1        1  1150 F-36   CLSPT  1 2 0   1.5         C 4.0  2.0  1  1  999
20 1        1  1154 F-36   SMTBM  1 2 0   1.5         C 4.0  2.0  1  1  999
20 1        1  1210 F-36   CLSPT  1 2 0   1.5         C 4.0  2.0  1  1  999
20 1        1  1218 F-36   SMTBM  1 2 0   1.5         C 4.0  2.0  1  1  999
20 1        1  1230 F-36   FERRY  1 2 0   1.5         C 4.0  2.0  1  1  999
20 1        1  1230 F-36   CLSPT  1 2 0   1.5         C 4.0  2.0  1  1  999
20 1        1  1242 F-36   SMTBM  1 2 0   1.5         C 4.0  2.0  1  1  999
20 1        1  1250 F-36   CLSPT  1 2 0   1.5         C 4.0  2.0  1  1  999
20 1        1  1306 F-36   SMTBM  1 2 0   1.5         C 4.0  2.0  1  1  999
20 1        1  1310 F-36   CLSPT  1 2 0   1.5         C 4.0  2.0  1  1  999
20 1        1  1330 F-36   SMTBM  1 2 0   1.5         C 4.0  2.0  1  1  999
20 1        1  1330 F-36   CLSPT  1 2 0   1.5         C 4.0  2.0  1  1  999
20 1        1  1350 F-36   CLSPT  1 2 0   1.5         C 4.0  2.0  1  1  999
20 1        1  1354 F-36   SMTBM  1 2 0   1.5         C 4.0  2.0  1  1  999
20 1        1  1410 F-36   CLSPT  1 2 0   1.5         C 4.0  2.0  1  1  999
20 1        1  1418 F-36   SMTBM  1 2 0   1.5         C 4.0  2.0  1  1  999
20 1        1  1430 F-36   FERRY  1 2 0   1.5         C 4.0  2.0  1  1  999
20 1        1  1430 F-36   CLSPT  1 2 0   1.5         C 4.0  2.0  1  1  999
20 1        1  1442 F-36   SMTBM  1 2 0   1.5         C 4.0  2.0  1  1  999
20 1        1  1450 F-36   CLSPT  1 2 0   1.5         C 4.0  2.0  1  1  999
20 1        1  1506 F-36   SMTBM  1 2 0   1.5         C 4.0  2.0  1  1  999
20 1        1  1510 F-36   CLSPT  1 2 0   1.5         C 4.0  2.0  1  1  999
20 1        1  1530 F-36   SMTBM  1 2 0   1.5         C 4.0  2.0  1  1  999
20 1        1  1530 F-36   CLSPT  1 2 0   1.5         C 4.0  2.0  1  1  999
20 1        1  1550 F-36   CLSPT  1 2 0   1.5         C 4.0  2.0  1  1  999
20 1        1  1554 F-36   SMTBM  1 2 0   1.5         C 4.0  2.0  1  1  999
20 1        1  1610 F-36   CLSPT  1 2 0   1.5         C 4.0  2.0  1  1  999
20 1        1  1618 F-36   SMTBM  1 2 0   1.5         C 4.0  2.0  1  1  999
20 1        1  1630 F-36   FERRY  1 2 0   1.5         C 4.0  2.0  1  1  999
20 1        1  1630 F-36   CLSPT  1 2 0   1.5         C 4.0  2.0  1  1  999
20 1        1  1642 F-36   SMTBM  1 2 0   1.5         C 4.0  2.0  1  1  999
```

```
         1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890
20 1       1  1650 F-36   CLSPT  1 2 0  1.5         C 4.0  2.0  1  1  999
20 1       1  1706 F-36   SMTBM  1 2 0  1.5         C 4.0  2.0  1  1  999
20 1       1  1710 F-36   CLSPT  1 2 0  1.5         C 4.0  2.0  1  1  999
20 1       1  1730 F-36   SMTBM  1 2 0  1.5         C 4.0  2.0  1  1  999
20 1       1  1730 F-36   CLSPT  1 2 0  1.5         C 4.0  2.0  1  1  999
20 1       1  1750 F-36   CLSPT  1 2 0  1.5         C 4.0  2.0  1  1  999
20 1       1  1754 F-36   SMTBM  1 2 0  1.5         C 4.0  2.0  1  1  999
20 1       1  1810 F-36   CLSPT  1 2 0  1.5         C 4.0  2.0  1  1  999
20 1       1  1818 F-36   SMTBM  1 2 0  1.5         C 4.0  2.0  1  1  999
20 1       1  1830 F-36   FERRY  1 2 0  1.5         C 4.0  2.0  1  1  999
20 1       1  1830 F-36   CLSPT  1 2 0  1.5         C 4.0  2.0  1  1  999
20 1       1  1842 F-36   SMTBM  1 2 0  1.5         C 4.0  2.0  1  1  999
20 1       1  1850 F-36   CLSPT  1 2 0  1.5         C 4.0  2.0  1  1  999
20 1       1  1906 F-36   SMTBM  1 2 0  1.5         C 4.0  2.0  1  1  999
20 1       1  1910 F-36   CLSPT  1 2 0  1.5         C 4.0  2.0  1  1  999
20 1       1  1930 F-36   SMTBM  1 2 0  1.5         C 4.0  2.0  1  1  999
20 1       1  1930 F-36   CLSPT  1 2 0  1.5         C 4.0  2.0  1  1  999
20 1       1  1950 F-36   CLSPT  1 2 0  1.5         C 4.0  2.0  1  1  999
20 1       1  1954 F-36   SMTBM  1 2 0  1.5         C 4.0  2.0  1  1  999
20 1       1  2010 F-36   CLSPT  1 2 0  1.5         C 4.0  2.0  1  1  999
20 1       1  2018 F-36   SMTBM  1 2 0  1.5         C 4.0  2.0  1  1  999
20 1       1  2030 F-36   FERRY  1 2 0  1.5         C 4.0  2.0  1  1  999
20 1       1  2030 F-36   CLSPT  1 2 0  1.5         C 4.0  2.0  1  1  999
20 1       1  2042 F-36   SMTBM  1 2 0  1.5         C 4.0  2.0  1  1  999
20 1       1  2050 F-36   CLSPT  1 2 0  1.5         C 4.0  2.0  1  1  999
20 1       1  2106 F-36   SMTBM  1 2 0  1.5         C 4.0  2.0  1  1  999
20 1       1  2110 F-36   CLSPT  1 2 0  1.5         C 4.0  2.0  1  1  999
20 1       1  2130 F-36   SMTBM  1 2 0  1.5         C 4.0  2.0  1  1  999
20 1       1  2130 F-36   CLSPT  1 2 0  1.5         C 4.0  2.0  1  1  999
20 1       1  2150 F-36   CLSPT  1 2 0  1.5         C 4.0  2.0  1  1  999
20 1       1  2154 F-36   SMTBM  1 2 0  1.5         C 4.0  2.0  1  1  999
20 1       1  2210 F-36   CLSPT  1 2 0  1.5         C 4.0  2.0  1  1  999
20 1       1  2218 F-36   SMTBM  1 2 0  1.5         C 4.0  2.0  1  1  999
20 1       1  2230 F-36   FERRY  1 2 0  1.5         C 4.0  2.0  1  1  999
20 1       1  2230 F-36   CLSPT  1 2 0  1.5         C 4.0  2.0  1  1  999
20 1       1  2250 F-36   CLSPT  1 2 0  1.5         C 4.0  2.0  1  1  999
20 1       1  2254 F-36   SMTBM  1 2 0  1.5         C 4.0  2.0  1  1  999
20 1       1  2310 F-36   CLSPT  1 2 0  1.5         C 4.0  2.0  1  1  999
20 1       1  2318 F-36   SMTBM  1 2 0  1.5         C 4.0  2.0  1  1  999
```

Appendix D: AMTAF Data Base

Database : SCENARIO
Relation : GENERAL **Version : THESISTEST** **Record : 1**

```
Output Comment       : SR2 ALL CONSTRAINED
RESOURCES Ver        : F36PARTS
RES ORDER Ver        : F36TEST
TSRNA EQUIV Ver      :
Min Remain Time      : 1.00000
Min Accum. Time      : 0.00000
Priority Intrpt?*    : N
Defer Tasks?*        : N
Auto Res Rspy?*      : Y
Use X-Train?*        : N
Unsh Mnt Prb Mod     : 1.0000000
%ShltrDmg=destyd     : 0.0000000
```

Database : SCENARIO
Relation : BASES **Version : THESISTEST** **Record : 1**

```
Type*                : MOB
Name                 : WUESCHHEIM
BASE Version         : THESISTEST
ATTACK Version       :
BASE-MODS Versn      :
```

(FOR SORTIE RATE 2)

Database : SCENARIO
Relation : MISSIONS **Version : THESISTEST** **Record : 1**

```
Type*                : RECUR
Mission Name         : CLSPT
1st Takeoff Time     : 0530
Lst Takeoff Time     : 602300
Open Daily Window    : 0530
Clos Daily Window    : 2310
Resch. Interval      : 0.5
Hours Notice         : 4.0
```

Database : SCENARIO
Relation : MISSIONS **Version : THESISTEST** **Record : 2**

```
Type*                : RECUR
Mission Name         : SMTBM
1st Takeoff Time     : 0530
Lst Takeoff Time     : 602300
Open Daily Window    : 0530
Clos Daily Window    : 2300
Resch. Interval      : 0.6
Hours Notice         : 4.0
```

Database : SCENARIO
Relation : MISSIONS **Version :** THESISTEST **Record :** 3

Type* : RECUR
Mission Name : FERRY
1st Takeoff Time : 0530
Lst Takeoff Time : 602030
Open Daily Window : 0530
Clos Daily Window : 2130
Resch. Interval : 3
Hours Notice : 4.0

(FOR SORTIE RATE 3)

Database : SCENARIO
Relation : BASES **Version :** SR3 **Record :** 1

Type* : MOB
Name : WUESCHHEIM
BASE Version : SR3
ATTACK Version :
BASE-MODS Versn :

Database : SCENARIO
Relation : MISSIONS **Version :** SR3 **Record :** 1

Type* : RECUR
Mission Name : CLSPT
1st Takeoff Time : 0530
Lst Takeoff Time : 602300
Open Daily Window : 0530
Clos Daily Window : 2315
Resch. Interval : 0.333333
Hours Notice : 4.0

Database : SCENARIO
Relation : MISSIONS **Version :** SR3 **Record :** 2

Type* : RECUR
Mission Name : SMTBM
1st Takeoff Time : 0530
Lst Takeoff Time : 602300
Open Daily Window : 0530
Clos Daily Window : 2320
Resch. Interval : 0.40
Hours Notice : 4.0

Database : **SCENARIO**
Relation : **MISSIONS** **Version : SR3** **Record : 3**

Type*	: RECUR
Mission Name	: FERRY
1st Takeoff Time	: 0630
Lst Takeoff Time	: 602030
Open Daily Window	: 0530
Clos Daily Window	: 2300
Resch. Interval	: 2
Hours Notice	: 4.0

Database : **SCENARIO**
Relation : **AC_DATABASES** **Version : THESISTEST** **Record : 1**

Aircraft Name	: F36
AC Database Name	: F36C

Database : **BASE**
Relation : **GENERAL** **Version : THESISTEST (OR SR3)** **Record : 1**

Base Type*	: MOB	Survey/EOD Time	:
Begin Day Shift	: 0000	PA Task Delay	:
Begin Nite Shift	: 1200	Crater Repair Time	:
Init POL Stocks	: 60	Distribution Parameter	:
POL Capacity	: 60	Dist Type*	:
POL Threshold	: 55	#Parallel Reprs	:
POL Reord Amt	: 5	MCL	:
Number of Rwys	:	MCW	:
Number of Nodes	:	Extended MCL	:
Number of Arcs	:	Extended MCW	:
Number of Ramps	:	Max Runways	:
Number Shelters	:	RRMODE	:
Pre Taxi Time	:		
Post Taxi Time	:		

Database : **BASE**
Relation : **AC_BASING** **Version : THESISTEST (OR SR3)** **Record : 1**

Aircraft Name	: F36
Quantity	: 72
Arrival Time	: 0
Init Flight Hrs	: 0.0000000E+00
Initial Status*	: READY
Mission Config	: FERRY

Database : **BASE**
Relation : **AC_NETWORKS** **Version : THESISTEST (OR SR3)** **Record : 1**

Aircraft Name	: F36
Task Field 1	: READY POOL
Task Field 2	:
Task Field 3	: MISSION CONFIG
Task Field 4	:
Task Field 5	: PREFLT
Task Field 6	:
Task Field 7	: LAUNCH
Task Field 8	:
Task Field 9	: MISSION READY
Task Field 10	:
Task Field 11	: MISSION
Task Field 12	:
Task Field 13	: EOR
Task Field 14	:
Task Field 15	: POSTFLT
Task Field 16	: FUELING
Task Field 17	:
Task Field 18	: ABDR
Task Field 19	: @LANDGEAR
Task Field 20	: @PSUPPLY
Task Field 21	: @DATA
Task Field 22	: @TESTER
Task Field 23	: @TANS
Task Field 24	: @GYRO
Task Field 25	: @AVIONICS
Task Field 26	: @RADAR
Task Field 27	

Database : **BASE**
Relation : **PERSONNEL** **Version : THESISTEST**

	Record : 1	**Record : 2**	**Record : 3**	**Record : 4**	**Record : 5**
Personnel Name	: 325X0	: 328X1	: 423X3	: 423X4	: 431X1
Initial Number	: 200	: 200	: 200	: 200	: 200
Target Number	: 200	: 200	: 200	: 200	: 200
Min Crew Size	: 1	: 1	: 1	: 1	: 1
% Day Shift	: 50	: 50	: 50	: 50	: 50

	Record : 6	**Record : 7**	**Record : 8**	**Record : 9**	**Record : 10**
Personnel Name	: 432L4	: 462X0	: 462X1	: 326S4	: 326S5
Initial Number	: 200	: 200	: 200	: 200	: 200
Target Number	: 200	: 200	: 200	: 200	: 200
Min Crew Size	: 1	: 1	: 1	: 1	: 1
% Day Shift	: 50	: 50	: 50	: 50	: 50

	Record : 11	Record : 12	Record : 13	Record : 14	Record : 15
Personnel Name	: 326X6	: 326X7	: 326X8	: 423X0	: 423X1
Initial Number	: 200	: 200	: 200	: 200	: 200
Target Number	: 200	: 200	: 200	: 200	: 200
Min Crew Size	: 1	: 1	: 1	: 1	: 1
% Day Shift	: 50	: 50	: 50	: 50	: 50

	Record : 16
Personnel Name	: 427X5
Initial Number	: 200
Target Number	: 200
Min Crew Size	: 1
% Day Shift	: 50

Database : **BASE**
Relation : **PARTS** **Version : THESISTEST (OR SR3)**

	Record : 1	Record : 2	Record : 3	Record : 4
Part Name	: P13A00	: P13B00	: P45100	: P52100
Initial Number	: 100	: 100	: 100	: 100
Min Inventory	: 0	: 0	: 0	: 0
Reordr Threshold **	: 98	: 98	: 98	: 98
Reorder Quantity	: 1	: 1	: 1	: 1

	Record : 5	Record : 6	Record : 7	Record : 8
Part Name	: P72100	: P42CHA	: P42CHG	: P42CH4
Initial Number	: 100	: 100	: 100	: 100
Min Inventory	: 0	: 0	: 0	: 0
Reordr Threshold **	: 98	: 98	: 98	: 98
Reorder Quantity	: 1	: 1	: 1	: 1

	Record : 9	Record : 10	Record : 11	Record : 12
Part Name	: P42CJD	: P51EA0	: P51ED0	: P55AB0
Initial Number	: 100	: 100	: 100	: 100
Min Inventory	: 0	: 0	: 0	: 0
Reordr Threshold **	: 98	: 98	: 98	: 98
Reorder Quantity	: 1	: 1	: 1	: 1

	Record : 13	Record : 14	Record : 15
Part Name	: P55AE0	: P71DA0	: P74EB0
Initial Number	: 100	: 100	: 100
Min Inventory	: 0	: 0	: 0
Reordr Threshold **	: 98	: 98	: 98
Reorder Quantity	: 1	: 1	: 1

** To properly simulate the return of NRTS items, the reorder threshold value should always be 2 units less than the initial number (whenever possible)

Database : BASF
Relation : AGE Version : THESISTEST (OR SR3)

	Record : 1	Record : 2	Record : 3	Record : 4
AGE Name	: ARCON	: B-4	: GCART	: HCART
Initial Number	: 100	: 100	: 100	: 100
Min Inventory	: 0	: 0	: 0	: 0
Reorder Threshold	: 0	: 0	: 0	: 0
Reorder Quantity	: 0	: 0	: 0	: 0

	Record : 5	Record : 6	Record : 7
AGE Name	: MD3	: MJ2	: TJACK
Initial Number	: 100	: 100	: 100
Min Inventory	: 0	: 0	: 0
Reorder Threshold	: 0	: 0	: 0
Reorder Quantity	: 0	: 0	: 0

Database : BASE
Relation : TRAP Version : WUES Record : 1

	Record : 1	Record : 2
TRAP Name	: RACKS	: PYLONS
Initial Number	: 500	: 500
Min Inventory	: 0	: 0
Reorder Threshold	: 496	: 496
Reorder Quantity	: 4	: 4

Database : BASE
Relation : MUNITIONS Version : WUES

	Record : 1	Record : 2
Munition Name	: BOMBS	: MISSILES
Initial Number	: 500	: 500
Min Inventory	: 0	: 0
Reordr Thrshold	: 496	: 496
Reorder Quantity	: 4	: 4

Database : MISSION
Relation : MISSION

Version :	FERRY	CLSPT	SMTBM
Priority	: 1	: 1	: 1
Aircraft Type	: F36	: F36	: F36
Desired # AC	: 2	: 2	: 2
Minimum # AC	: 1	: 1	: 2
Avg Config Time	: 1	: 1	: 1
Config Dist Par	: 0.000000E+00	: 0.000000E+00	: 0.000000E+00
Config Dist Typ*	: CONST	: CONST	: CONST
Shop	: ARMAMENT	: ARMAMENT	: ARMAMENT
Per # 1 Type	: 462X0	:	: 462X0
Pers # 2 Quantity	: 2	:	: 5
Pers # 2 Type	:	:	:
Pers # 2 Quantity	:	:	:
AGE Type	:	:	: MJ2
AGE Quantity	:	:	: 1
Primary Munition	:	: MISSILES	: BOMBS
PM Quantity	:	: 4	: 4
Second Munition	:	:	:
SM Quantity	:	:	:
TRAP Type	:	: PYLONS	: RACKS
TRAP Quantity	:	: 2	: 2
FM Effect Val	: 1.0	: 1.0	: 1.0
PM Effect Val	: 1.0	: 1.0	: 1.0
Mission Window	: 2.0	: 2.0	: 2.0
Prob Gnd Abort	: 0.0	: 0.0	: 0.0
Pkill	: 0.0	: 0.0	: 0.0
Prd	: 0.0	: 0.0	: 0.0
Pnrd	: 0.0	: 0.0	: 0.0
Avg Sortie Time	: 1.5	: 1.5	: 1.5
Sortie Dist Par	: 0.0000000E+00	: 0.0000000E+00	: 0.000000E+00
Sortie Dist Typ*	: CONST	: CONST	: CONST

Database : AIRCRAFT
Relation : GENERAL Version : F36C Record : 1

Defer Tasks : 0

Database : **AIRCRAFT**
Relation : **TSKRQT** **Version : F36C**

	Record : 1	Record : 2	Record : 3	Record : 4
Name	: E2000A	: T52000	: T5200A	: T5200B
Shop	: AVIONICS	: AVIONICS	: AVIONICS	: AVIONICS
Root Task ?*	: Y	: N	: N	: N
Failure Mech*	: MS	:	:	:
Fail Mech Value	: 10.0	: 0.0	: 0.0	: 0.0
Deferability	: 0	: 0	: 0	: 0
MTTR	: 0.0	: 0.0	: 1.0	: 1.0
Dist Parameter	: 0.0	: 0.0	: 0.0	: 0.0
Dist Type*	:	: CONST	: CONST	: CONST
Task Location*	: 1	: 1	: 1	: 1
LRU/Consumable	:	:	:	:
LC Quantity	:	:	:	:
LC Probability	:	:	:	:
Pers #1 Type	:	:	: 325X0	:
Pers #1 Quantity	:	:	: 2	:
Pers #2 Type	:	:	:	:
Pers #2 Quantity	:	:	:	:
AGE Type	:	:	: ARCON	: MD3
AGE Quantity	:	:	: 1	: 1
Unscheduled*	: Y	:	:	:

	Record : 5	Record : 6	Record : 7	Record : 8
Name	: E20001	: M52000	: V52000	: R52100
Shop	: AVIONICS	: AVIONICS	: AVIONICS	: AVIONICS
Root Task ?*	: N	: N	: N	: N
Failure Mech*	:	:	:	:
Fail Mech Value	: 0.0	: 0.0	: 0.0	: 0.0
Deferability	: 0	: 0	: 0	: 0
MTTR	: 0.0	: 0.5	. 0.5	: 2.0
Dist Parameter	: 0.0	: 0.0	: 0.0	: 0.0
Dist Type*	: CONST	: CONST	: CONST	: CONST
Task Location*	: 1	: 1	: 1	: 1
LRU/Consumable	:	:	:	:
LC Quantity	:	:	:	:
LC Probability	:	:	:	:
Pers #1 Type	:	: 325X0	: 325X0	: 325X0
Pers #1 Quantity	:	: 2	: 2	: 2
Pers #2 Type	:	:	:	:
Pers #2 Quantity	:	:	:	:
AGE Type	:	:	: MD3	:
AGE Quantity	:	:	: 1	:
Unscheduled*	:	:	:	:

	Record : 9	Record : 10	Record : 11	Record : 12
Name	: V52001	: G200001	: T72000	: T7200A
Shop	: AVIONICS	: RADAR	: RADAR	: RADAR
Root Task ?*	: N	: Y	: N	: N
Failure Mech*	:	: MS	:	:
Fail Mech Value	: 0.0	: 15.0	: 0.0	: 0.0
Deferability	: 0	: 0	: 0	: 0
MTTR	: 0.5	: 0.0	: 0.0	: 1.5
Dist Parameter	: 0.0	: 0.0	: 0.0	: 0.0
Dist Type*	: CONST	:	: CONST	: CONST
Task Location*	: 1	: 1	: 1	: 1
LRU/Consumable	: P52100	:	:	:
LC Quantity	: 1	:	:	:
LC Probability	: 1.0	:	:	:
Pers #1 Type	: 325X0	:	:	: 328X1
Pers #1 Quantity	: 2	:	:	: 2
Pers #2 Type	:	:	:	:
Pers #2 Quantity	:	:	:	:
AGE Type	: MD3	:	:	: ARCON
AGE Quantity	: 1	:	:	: 1
Unscheduled*	:	:	:	:

	Record : 13	Record : 14	Record : 15	Record : 16
Name	: T7200B	: G20002	: M72000	: V72000
Shop	: RADAR	: RADAR	: RADAR	: RADAR
Root Task ?*	: N	: N	: N	: N
Failure Mech*	:	:	:	:
Fail Mech Value	: 0.0	: 0.0	: 0.0	: 0.0
Deferability	: 0	: 0	: 0	: 0
MTTR	: 1.5	: 0.0	: 1.0	: 0.0
Dist Parameter	: 0.0	: 0.0	: 0.0	: 0.0
Dist Type*	: CONST	: CONST	: CONST	: CONST
Task Location*	: 1	: 1	: 1	: 1
LRU/Consumable	:	:	:	:
LC Quantity	:	:	:	:
LC Probability	:	:	:	:
Pers #1 Type	:	:	: 328X1	:
Pers #1 Quantity	:	:	: 2	:
Pers #2 Type	:	:	:	:
Pers #2 Quantity	:	:	:	:
AGE Type	: MD3	:	:	:
AGE Quantity	: 1	:	:	:
Unscheduled*	:	:	:	:

	Record : 17	Record : 18	Record : 19	Record : 20
Name	: V7200A	: V72008	: R72100	: V72001
Shop	: RADAR	: RADAR	: RADAR	: RADAR
Root Task ?*	: N	: N	: N	: N
Failure Mech*	:	:	:	:
Fail Mech Value	: 0.0	: 0.0	: 0.0	: 0.0
Deferability	: 0	: 0	: 0	: 0
MTTR	: 1.0	: 1.0	: 2.5	: 0.0
Dist Parameter	: 0.0	: 0.0	: 0.0	: 0.0
Dist Type*	: CONST	: CONST	: CONST	: CONST
Task Location*	: 1	: 1	: 1	: 1
LRU/Consumable	:	:	:	: P72100
LC Quantity	:	:	:	: 1
LC Probability	:	:	:	: 1.0
Pers #1 Type	: 328X1	:	: 328X1	:
Pers #1 Quantity	: 2	:	: 2	:
Pers #2 Type	:	:	:	:
Pers #2 Quantity	:	:	:	:
AGE Type	: MD3	: ARCON	:	:
AGE Quantity	: 1	: 1	:	:
Unscheduled*	:	:	:	:

	Record : 21	Record : 22	Record : 23	Record : 24
Name	: V72002	: V72003	: D50001	: T45000
Shop	: RADAR	: RADAR	: HYDRO	: HYDRO
Root Task ?*	: N	: N	: Y	: N
Failure Mech*	:	:	: MS	:
Fail Mech Value	: 0.0	: 0.0	: 7.5	: 0.0
Deferability	: 0	: 0	: 0	: 0
MTTR	: 1.0	: 1.0	:	: 0.0
Dist Parameter	: 0.0	: 0.0	: 0.0	: 0.0
Dist Type*	: CONST	: CONST	:	: CONST
Task Location*	: 1	: 1	: 1	: 1
LRU/Consumable	:	:	:	:
LC Quantity	:	:	:	:
LC Probability	:	:	:	:
Pers #1 Type	: 328X1	:	:	:
Pers #1 Quantity	: 2	:	:	:
Pers #2 Type	:	:	:	:
Pers #2 Quantity	:	:	:	:
AGE Type	: MD3	: ARCON	:	:
AGE Quantity	: 1	: 1	:	:
Unscheduled*	:	:	: Y	:

	Record : 25	Record : 26	Record : 27	Record : 28
Name	: T4500A	: T4500B	: D50002	: M45000
Shop	: HYDRO	: HYDRO	: HYDRO	: HYDRO
Root Task ?*	: N	: N	: N	: N
Failure Mech*	:	:	:	:
Fail Mech Value	: 0.0	: 0.0	: 0.0	: 0.0
Deferability	: 0	: 0	: 0	: 0
MTTR	: 1.5	: 1.5	: 0.0	: 1.0
Dist Parameter	: 0.0	: 0.0	: 0.0	: 0.0
Dist Type*	: CONST	: CONST	: CONST	: CONST
Task Location*	: 1	: 1	: 1	: 1
LRU/Consumable	:	:	:	:
LC Quantity	:	:	:	:
LC Probability	:	:	:	:
Pers #1 Type	: 423X4	:	:	: 423X4
Pers #1 Quantity	: 2	:	:	: 2
Pers #2 Type	:	:	:	:
Pers #2 Quantity	:	:	:	:
AGE Type	: MD3	: HCART	:	:
AGE Quantity	: 1	: 1	:	:
Unscheduled*	:	:	:	:

	Record : 29	Record : 30	Record : 31	Record : 32
Name	: V45000	: V4500A	: V4500B	: R45100
Shop	: HYDRO	: HYDRO	: HYDRO	: HYDRO
Root Task ?*	: N	: N	: N	: N
Failure Mech*	:	:	:	:
Fail Mech Value	: 0.0	: 0.0	: 0.0	: 0.0
Deferability	: 0	: 0	: 0	: 0
MTTR	: 0.0	: 1.0	: 1.0	: 2.5
Dist Parameter	: 0.0	: 0.0	: 0.0	: 0.0
Dist Type*	: CONST	: CONST	: CONST	: CONST
Task Location*	: 1	: 1	: 1	: 1
LRU/Consumable	:	:	:	:
LC Quantity	:	:	:	:
LC Probability	:	:	:	:
Pers #1 Type	:	: 423X4	:	: 423X4
Pers #1 Quantity	:	: 2	:	: 2
Pers #2 Type	:	:	:	:
Pers #2 Quantity	:	:	:	:
AGE Type	:	: MD3	: HCART	:
AGE Quantity	:	: 1	: 1	:
Unscheduled*	:	:	:	:

	Record : 33	Record : 34	Record : 35	Record : 36
Name	: R45101	: A30000	: A3000A	: T13000
Shop	: HYDRO	: LANDGEAR	: LANDGEAR	: LANDGEAR
Root Task ?*	: N	: Y	: N	: N
Failure Mech*	:	: MS	:	:
Fail Mech Value	: 0.0	: 25.0	: 0.0	: 0.0
Deferability	: 0	: 0	: 0	: 0
MTTR	: 0.0	: 0.0	: 0.0	: 1.0
Dist Parameter	: 0.0	: 0.0	: 0.0	: 0.0
Dist Type*	: CONST	:	: CONST	: CONST
Task Location*	: 1	: 1	: 1	: 1
LRU/Consumable	: P45100	:	:	:
LC Quantity	: 1	:	:	:
LC Probability	: 1.0	:	:	:
Pers #1 Type	:	:	:	: 432L4
Pers #1 Quantity	:	:	:	: 2
Pers #2 Type	:	:	:	:
Pers #2 Quantity	:	:	:	:
AGE Type	:	:	:	: MD3
AGE Quantity	:	:	:	: 1
Unscheduled*	:	: Y	:	:

	Record : 37	Record : 38	Record : 39	Record : 40
Name	: UPJACK	: TSHOOT	: TSHOO1	: TSHOO2
Shop	: LANDGEAR	: LANDGEAR	: LANDGEAR	: LANDGEAR
Root Task ?*	: N	: N	: N	: N
Failure Mech*	:	:	:	:
Fail Mech Value	: 0.0	: 0.0	: 0.0	: 0.0
Deferability	: 0	: 0	: 0	: 0
MTTR	: 2.5	: 0.0	: 3.5	: 3.5
Dist Parameter	: 0.0	: 0.0	: 0.0	: 0.0
Dist Type*	: CONST	: CONST	: CONST	: CONST
Task Location*	: 1	: 1	: 1	: 1
LRU/Consumable	:	:	:	:
LC Quantity	:	:	:	:
LC Probability	:	:	:	:
Pers #1 Type	: 431X1	:	: 432L4	:
Pers #1 Quantity	: 4	:	: 3	:
Pers #2 Type	:	:	:	:
Pers #2 Quantity	:	:	:	:
AGE Type	: TJACK	:	: TJACK	: B-4
AGE Quantity	: 4	:	: 4	: 1
Unscheduled*	:	:	:	:

	Record : 41	Record : 42	Record : 43	Record : 44
Name	: TSH003	: TSH004	: DNJACK	: A30001
Shop	: LANDGEAR	: LANDGEAR	: LANDGEAR	: LANDGEAR
Root Task ?*	: N	: N	: N	: N
Failure Mech*	:	:	:	:
Fail Mech Value	: 0.0	: 0.0	: 0.0	: 0.0
Deferability	: 0	: 0	: 0	: 0
MTTR	: 3.5	: 0.0	: 1.5	: 0.0
Dist Parameter	: 0.0	: 0.0	: 0.0	: 0.0
Dist Type*	: CONST	: CONST	: CONST	: CONST
Task Location*	: 1	: 1	: 1	: 1
LRU/Consumable	:	:	:	:
LC Quantity	:	:	:	:
LC Probability	:	:	:	:
Pers #1 Type	:	:	: 431X1	:
Pers #1 Quantity	:	:	: 4	:
Pers #2 Type	:	:	:	:
Pers #2 Quantity	:	:	:	:
AGE Type	: MD3	:	: TJACK	:
AGE Quantity	: 1	:	: 4	:
Unscheduled*	:	:	:	:

	Record : 45	Record : 46	Record : 47	Record : 48
Name	: M13A00	: R13A00	: M13B00	: R13B00
Shop	: LANDGEAR	: LANDGEAR	: LANDGEAR	: LANDGEAR
Root Task ?*	: N	: N	: N	: N
Failure Mech*	:	:	:	:
Fail Mech Value	: 0.0	: 0.0	: 0.0	: 0.0
Deferability	: 0	: 0	: 0	: 0
MTTR	: 0.75	: 1.5	: 0.75	: 2.0
Dist Parameter	: 0.0	: 0.0	: 0.0	: 0.0
Dist Type*	: CONST	: CONST	: CONST	: CONST
Task Location*	: 1	: 1	: 1	: 1
LRU/Consumable	:	:	:	:
LC Quantity	:	:	:	:
LC Probability	:	:	:	:
Pers #1 Type	: 432L4	: 432L4	: 432L4	: 432L4
Pers #1 Quantity	: 1	: 2	: 1	: 2
Pers #2 Type	:	:	:	:
Pers #2 Quantity	:	:	:	:
AGE Type	:	:	:	:
AGE Quantity	:	:	:	:
Unscheduled*	:	:	:	:

	Record : 49	Record : 50	Record : 51	Record : 52
Name	: V13000	: V13001	: V13002	: D2C01
Shop	: LANDGEAR	: LANDGEAR	: LANDGEAR	: PSUPPLY
Root Task ?*	: N	: N	: N	: Y
Failure Mech*	:	:	:	: MS
Fail Mech Value	: 0.0	: 0.0	: 0.0	: 17.0
Deferability	: 0	: 0	: 0	: 0
MTTR	: 1.0	: 1.0	: 1.0	: 0.0
Dist Parameter	: 0.0	: 0.0	: 0.0	: 0.0
Dist Type*	: CONST	: CONST	: CONST	:
Task Location*	: 1	: 1	: 1	: 1
LRU/Consumable	:	: P13A00	: P13B00	:
LC Quantity	:	: 1	: 1	:
LC Probability	:	: 1.0	: 1.0	:
Pers #1 Type	: 432L4	: 432L4	: 432L4	:
Pers #1 Quantity	: 2	: 2	: 2	:
Pers #2 Type	:	:	:	:
Pers #2 Quantity	:	:	:	:
AGE Type	: MD3	: MD3	: MD3	:
AGE Quantity	: 1	: 1	: 1	:
Unscheduled*	:	:	:	: Y

	Record : 53	Record : 54	Record : 55	Record : 56
Name	: D2C02	: V42C00	: T42C00	: X42C00
Shop	: PSUPPLY	: PSUPPLY	: PSUPPLY	: PSUPPLY
Root Task ?*	: N	: N	: N	: N
Failure Mech*	:	:	:	:
Fail Mech Value	: 0.0	: 0.0	: 0.0	: 0.0
Deferability	: 0	: 0	: 0	: 0
MTTR	: 0.0	: 0.4	: 0.8	: 1.0
Dist Parameter	: 0.0	: 0.0	: 0.0	: 0.0
Dist Type*	: CONST	: CONST	: CONST	: CONST
Task Location*	: 1	: 1	: 1	: 1
LRU/Consumable	:	:	:	:
LC Quantity	:	:	:	:
LC Probability	:	:	:	:
Pers #1 Type	:	: 423X0	: 423X0	: 423X0
Pers #1 Quantity	:	: 2	: 1	: 1
Pers #2 Type	:	:	:	:
Pers #2 Quantity	:	:	:	:
AGE Type	:	:	:	:
AGE Quantity	:	:	:	:
Unscheduled*	:	:	:	:

	Record : 57	Record : 58	Record : 59	Record : 60
Name	: M42C00	: R42C00	: R42C01	: R42C02
Shop	: PSUPPLY	: PSUPPLY	: PSUPPLY	: PSUPPLY
Root Task ?#	: N	: N	: N	: N
Failure Mech#	:	:	:	:
Fail Mech Value	: 0.0	: 0.0	: 0.0	: 0.0
Deferability	: 0	: 0	: 0	: 0
MTTR	: 0.9	: 2.9	: 1.1	: 1.2
Dist Parameter	: 0.0	: 0.0	: 0.0	: 0.0
Dist Type#	: CONST	: CONST	: CONST	: CONST
Task Location#	: 1	: 1	: 1	: 1
LRU/Consumable	:	:	:	:
LC Quantity	:	:	:	:
LC Probability	:	:	:	:
Pers #1 Type	: 423X0	: 326X6	: 423X0	: 423X1
Pers #1 Quantity	: 1	: 1	: 1	: 1
Pers #2 Type	:	:	:	:
Pers #2 Quantity	:	:	:	:
AGE Type	:	:	:	:
AGE Quantity	:	:	:	:
Unscheduled#	:	:	:	:

	Record : 61	Record : 62	Record : 63	Record : 64
Name	: ID2C00	: JNSH2P	: JDUMY1	: JDUMY1A
Shop	: PSUPPLY	: PSUPPLY	: PSUPPLY	: PSUPPLY
Root Task ?#	: N	: N	: N	: N
Failure Mech#	:	:	:	:
Fail Mech Value	: 0.0	: 0.0	: 0.0	: 0.0
Deferability	: 0	: 0	: 0	: 0
MTTR	: 0.0	: 0.0	: 0.0	: 0.0
Dist Parameter	: 0.0	: 0.0	: 0.0	: 0.0
Dist Type#	: CONST	: CONST	: CONST	: CONST
Task Location#	: 1	: 1	: 1	: 1
LRU/Consumable	:	:	: P42CH4	: P42CHA
LC Quantity	:	:	: 1	: 1
LC Probability	:	:	: 1.0	: 1.0
Pers #1 Type	:	:	:	:
Pers #1 Quantity	:	:	:	:
Pers #2 Type	:	:	:	:
Pers #2 Quantity	:	:	:	:
AGE Type	:	:	:	:
AGE Quantity	:	:	:	:
Unscheduled#	:	:	:	:

	Record : 65	Record : 66	Record : 67	Record : 68
Name	: JDUMY1B	: JDUMY1C	: E1E01	: E1E02
Shop	: PSUPPLY	: PSUPPLY	: DATA	: DATA
Root Task ?*	: N	: N	: Y	: N
Failure Mech*	:	:	: MS	:
Fail Mech Value	: 0.0	: 0.0	: 80.0	: 0.0
Deferability	: 0	: 0	: 0	: 0
MTTR	: 0.0	: 0.0	: 0.0	: 0.0
Dist Parameter	: 0.0	: 0.0	: 0.0	: 0.0
Dist Type*	: CONST	: CONST	:	: CONST
Task Location*	: 1	: 1	: 1	: 1
LRU/Consumable	: P42CHG	: P42CJD	:	:
LC Quantity	: 1	: 1	:	:
LC Probability	: 1.0	: 1.0	:	:
Pers #1 Type	:	:	:	:
Pers #1 Quantity	:	:	:	:
Pers #2 Type	:	:	:	:
Pers #2 Quantity	:	:	:	:
AGE Type	:	:	:	:
AGE Quantity	:	:	:	:
Unscheduled*	:	:	: Y	:

	Record : 69	Record : 70	Record : 71	Record : 72
Name	: V51E00	: T51E00	: X51E00	: R51E00
Shop	: DATA	: DATA	: DATA	: DATA
Root Task ?*	: N	: N	: N	: N
Failure Mech*	:	:	:	:
Fail Mech Value	: 0.0	: 0.0	: 0.0	: 0.0
Deferability	: 0	: 0	: 0	: 0
MTTR	: 1.0	: 1.3	: 1.4	: 1.6
Dist Parameter	: 0.0	: 0.0	: 0.0	: 0.0
Dist Type*	: CONST	: CONST	: CONST	: CONST
Task Location*	: 1	: 1	: 1	: 1
LRU/Consumable	:	:	:	:
LC Quantity	:	:	:	:
LC Probability	:	:	:	:
Pers #1 Type	: 326X7	: 326X7	: 326X7	: 326X7
Pers #1 Quantity	: 2	: 2	: 1	: 1
Pers #2 Type	:	:	:	:
Pers #2 Quantity	:	:	:	:
AGE Type	:	:	:	:
AGE Quantity	:	:	:	:
Unscheduled*	:	:	:	:

	Record : 73	Record : 74	Record : 75	Record : 76
Name	: M51E00	: M51E01	: IE1E01	: JNSH2PA
Shop	: DATA	: DATA	: DATA	: DATA
Root Task ?*	: N	: N	: N	: N
Failure Mech*	:	:	:	:
Fail Mech Value	: 0.0	: 0.0	: 0.0	: 0.0
Deferability	: 0	: 0	: 0	: 0
MTTR	: 1.4	: 2.1	: 0.0	: C.0
Dist Parameter	: 0.0	: 0.0	: 0.0	: 0.0
Dist Type*	: CONST	: CONST	: CONST	: CONST
Task Location*	: 1	: 1	: 1	: 1
LRU/Consumable	:	:	:	:
LC Quantity	:	:	:	:
LC Probability	:	:	:	:
Pers #1 Type	: 326X7	: 427X5	:	:
Pers #1 Quantity	: 1	: 1	:	:
Pers #2 Type	:	:	:	:
Pers #2 Quantity	:	:	:	:
AGE Type	:	:	:	:
AGE Quantity	:	:	:	:
Unscheduled*	:	:	:	:

	Record : 77	Record : 78	Record : 79	Record : 80
Name	: G51EA0	: G51ED0	: E5A01	: E5A02
Shop	: DATA	: DATA	: TESTER	: TESTER
Root Task ?*	: N	: N	: Y	: N
Failure Mech*	:	:	: MS	:
Fail Mech Value	: 0.0	: 0.0	: 21.0	: 0.0
Deferability	: 0	: 0	: 0	: 0
MTTR	: 0.0	: 0.0	: 0.0	: 0.0
Dist Parameter	: 0.0	: 0.0	: 0.0	: 0.0
Dist Type*	: CONST	: CONST	:	: CONST
Task Location*	: 1	: 1	: 1	: 1
LRU/Consumable	: P51EA0	: P51ED0	:	:
LC Quantity	: 1	: 1	:	:
LC Probability	: 1.0	: 1.0	:	:
Pers #1 Type	:	:	:	:
Pers #1 Quantity	:	:	:	:
Pers #2 Type	:	:	:	:
Pers #2 Quantity	:	:	:	:
AGE Type	:	:	:	:
AGE Quantity	:	:	:	:
Unscheduled*	:	:	: Y	:

	Record : 81	Record : 82	Record : 83	Record : 84
Name	: V55A01	: T55A01	: X55A01	: V55A03
Shop	: TESTER	: TESTER	: TESTER	: TESTER
Root Task ?*	: N	: N	: N	: N
Failure Mech*	:	:	:	:
Fail Mech Value	: 0.0	: 0.0	: 0.0	: 0.0
Deferability	: 0	: 0	: 0	: 0
MTTR	: 0.4	: 1.0	: 1.4	: 0.4
Dist Parameter	: 0.0	: 0.0	: 0.0	: 0.0
Dist Type*	: CONST	: CONST	: CONST	: CONST
Task Location*	: 1	: 1	: 1	: 1
LRU/Consumable	:	:	:	:
LC Quantity	:	:	:	:
LC Probability	:	:	:	:
Pers #1 Type	: 326X7	: 326X7	: 326X7	: 326X7
Pers #1 Quantity	: 1	: 2	: 1	: 1
Pers #2 Type	:	:	:	:
Pers #2 Quantity	:	:	:	:
AGE Type	:	:	:	:
AGE Quantity	:	:	:	:
Unscheduled*	:	:	: N	:

	Record : 85	Record : 86	Record : 87	Record : 88
Name	: M55A01	: R55A01	: IE5A01	: JNSH2PB
Shop	: TESTER	: TESTER	: TESTER	: TESTER
Root Task ?*	: N	: N	: N	: N
Failure Mech*	:	:	:	:
Fail Mech Value	: 0.0	: 0.0	: 0.0	: 0.0
Deferability	: 0	: 0	: 0	: 0
MTTR	: 1.4	: 1.4	: 0.0	: 0.0
Dist Parameter	: 0.0	: 0.0	: 0.0	: 0.0
Dist Type*	: CONST	: CONST	: CONST	: CONST
Task Location*	: 1	: 1	: 1	: 1
LRU/Consumable	:	:	:	:
LC Quantity	:	:	:	:
LC Probability	:	:	:	:
Pers #1 Type	: 326X7	: 326X7	:	:
Pers #1 Quantity	: 1	: 1	:	:
Pers #2 Type	:	:	:	:
Pers #2 Quantity	:	:	:	:
AGE Type	:	:	:	:
AGE Quantity	:	:	:	:
Unscheduled*	:	:	:	:

	Record : 89	Record : 90	Record : 91	Record : 92
Name	: G55A80	: G55AE0	: GD101	: GD102
Shop	: TESTER	: TESTER	: TANS	: TANS
Root Task ?*	: N	: N	: Y	: N
Failure Mech*	:	:	: MS	:
Fail Mech Value	: 0.0	: 0.0	: 13.0	: 0.0
Deferability	: 0	: 0	: 0	: 0
MTTR	: 0.0	: 0.0	: 0.0	: 0.0
Dist Parameter	: 0.0	: 0.0	: 0.0	: 0.0
Dist Type*	: CONST	: CONST	:	: CONST
Task Location*	: 1	: 1	: 1	: 1
LRU/Consumable	: P55A80	: P55AE0	:	:
LC Quantity	: 1	: 1	:	:
LC Probability	: 0.0	: 0.0	:	:
Pers #1 Type	:	:	:	:
Pers #1 Quantity	:	:	:	:
Pers #2 Type	:	:	:	:
Pers #2 Quantity	:	:	:	:
AGE Type	:	:	:	:
AGE Quantity	:	:	:	:
Unscheduled*	:	:	: Y	:

	Record : 93	Record : 94	Record : 95	Record : 96
Name	: V71D00	: T71D00	: X71D00	: H17D00
Shop	: TANS	: TANS	: TANS	: TANS
Root Task ?*	: N	: N	: N	: N
Failure Mech*	:	:	:	:
Fail Mech Value	: 0.0	: 0.0	: 0.0	: 0.0
Deferability	: 0	: 0	: 0	: 0
MTTR	: 0.5	: 0.7	: 1.3	: 1.5
Dist Parameter	: 0.0	: 0.0	: 0.0	: 0.0
Dist Type*	: CONST	: CONST	: CONST	: CONST
Task Location*	: 1	: 1	: 1	: 1
LRU/Consumable	:	:	:	:
LC Quantity	:	:	:	:
LC Probability	:	:	:	:
Pers #1 Type	: 326X8	: 326X8	: 326X8	: 326X8
Pers #1 Quantity	: 1	: 1	: 1	: 1
Pers #2 Type	:	:	:	:
Pers #2 Quantity	:	:	:	:
AGE Type	:	:	:	:
AGE Quantity	:	:	:	:
Unscheduled*	:	:	:	:

	Record : 97	Record : 98	Record : 99	Record : 100
Name	: M71D00	: M71D01	: R71D00	: R71D01
Shop	: TANS	: TANS	: TANS	: TANS
Root Task ?*	: N	: N	: N	: N
Failure Mech*	:	:	:	:
Fail Mech Value	: 0.0	: 0.0	: 0.0	: 0.0
Deferability	: 0	: 0	: 0	: 0
MTTR	: 1.3	: 2.1	: 1.4	: 0.0
Dist Parameter	: 0.0	: 0.0	: 0.0	: 0.0
Dist Type*	: CONST	: CONST	: CONST	: CONST
Task Location*	: 1	: 1	: 1	: 1
LRU/Consumable	:	:	:	: P71DA0
LC Quantity	:	:	:	: 1
LC Probability	:	:	:	: 1.0
Pers #1 Type	: 326X8	: 427X5	: 326X8	:
Pers #1 Quantity	: 1	: 1	:	:
Pers #2 Type	:	:	:	:
Pers #2 Quantity	:	:	:	:
AGE Type	:	:	:	:
AGE Quantity	:	:	:	:
Unscheduled*	:	:	:	:

	Record : 101	Record : 102	Record : 103	Record : 104
Name	: G4E01	: G4E02	: V74E00	: T74E00
Shop	: GYRO	: GYRO	: GYRO	: GYRO
Root Task ?*	: Y	: N	: N	: N
Failure Mech*	: MS	:	:	:
Fail Mech Value	: 40.0	: 0.0	: 0.0	: 0.0
Deferability	: 0	: 0	: 0	: 0
MTTR	: 0.0	: 0.0	: 0.2	: 0.3
Dist Parameter	: 0.0	: 0.0	: 0.0	: 0.0
Dist Type*	:	: CONST	: CONST	: CONST
Task Location*	: 1	: 1	: 1	: 1
LRU/Consumable	:	:	:	: P71DA0
LC Quantity	:	:	:	: 1
LC Probability	:	:	:	: 1.0
Pers #1 Type	:	:	: 326X6	: 326X6
Pers #1 Quantity	:	:	: 1	: 1
Pers #2 Type	:	:	:	:
Pers #2 Quantity	:	:	:	:
AGE Type	:	:	:	:
AGE Quantity	:	:	:	:
Unscheduled*	: Y	:	:	:

	Record : 105	Record : 106	Record : 107	Record : 108
Name	: X74E00	: H74E00	: M74E00	: R74E00
Shop	: GYRO	: GYRO	: GYRO	: GYRO
Root Task ?*	: N	: N	: N	: N
Failure Mech*	:	:	:	:
Fail Mech Value	: 0.0	: 0.0	: 0.0	: 0.0
Deferability	: 0	: 0	: 0	: 0
MTTR	: 2.0	: 1.7	: 1.6	: 2.4
Dist Parameter	: 0.0	: 0.0	: 0.0	: 0.0
Dist Type*	: CONST	: CONST	: CONST	: CONST
Task Location*	: 1	: 1	: 1	: 1
LRU/Consumable	:	:	:	: P710A0
LC Quantity	:	:	:	: 1
LC Probability	:	:	:	: 1.0
Pers #1 Type	: 326X6	: 326X6	: 326X6	: 326X6
Pers #1 Quantity	: 1	: 1	: 1	: 1
Pers #2 Type	:	:	:	:
Pers #2 Quantity	:	:	:	:
AGE Type	:	:	:	:
AGE Quantity	:	:	:	:
Unscheduled*	:	:	:	:

	Record : 109	Record : 110	Record : 111	Record : 112
Name	: IG4E00	: JNSH2PC	: G74EB0	: PREFLT
Shop	: GYRO	: GYRO	: GYRO	: PREP
Root Task ?*	: N	: N	: N	: Y
Failure Mech*	:	:	:	: PROB
Fail Mech Value	: 0.0	: 0.0	: 0.0	: 1.0
Deferability	: 0	: 0	: 0	: 0
MTTR	: 0.0	: 0.0	: 0.0	: 0.0
Dist Parameter	: 0.0	: 0.0	: 0.0	: 0.0
Dist Type*	: CONST	: CONST	: CONST	:
Task Location*	: 1	: 1	: 1	: 1
LRU/Consumable	:	:	: P74EB0	:
LC Quantity	:	:	: 1	:
LC Probability	:	:	: 1.0	:
Pers #1 Type	:	:	:	:
Pers #1 Quantity	:	:	:	:
Pers #2 Type	:	:	:	:
Pers #2 Quantity	:	:	:	:
AGE Type	:	:	:	:
AGE Quantity	:	:	:	:
Unscheduled*	:	:	:	: N

	Record : 113	Record : 114	Record : 115	Record : 116
Name	: MPREFLT	: MPREFL1	: MPREFL2	: SERVHY
Shop	: PREP	: PREP	: PREP	: PREP
Root Task ?*	: N	: N	: N	: N
Failure Mech*	:	:	:	:
Fail Mech Value	: 0.0	: 0.0	: 0.0	: 0.0
Deferability	: 0	: 0	: 0	: 0
MTTR	: 0.0	: 1.0	: 1.0	: 0.75
Dist Parameter	: 0.0	: 0.0	: 0.0	: 0.0
Dist Type*	: CONST	: CONST	: CONST	: CONST
Task Location*	: 1	: 1	: 1	: 1
LRU/Consumable	:	:	: P74EB0	:
LC Quantity	:	:	: 1	:
LC Probability	:	:	: 1.0	:
Pers #1 Type	:	: 462X1	:	: 462X1
Pers #1 Quantity	:	: 2	:	: 1
Pers #2 Type	:	:	:	:
Pers #2 Quantity	:	:	:	:
AGE Type	:	: B-4	: MD3	: HCART
AGE Quantity	:	: 1	: 1	: 1
Unscheduled*	:	:	:	:

	Record : 117	Record : 118	Record : 119	Record : 120	Record : 121
Name	: LAUNCH	: LAUNCH1	: FUELING	: POSTFLT	: EOR
Shop	: FLIGHTLINE	: FLIGHTLINE	: FUEL	: POST	: RUNWAY
Root Task ?*	: Y	: N	: N	: Y	: Y
Failure Mech*	: PROB	:	:	: PROB	: PROB
Fail Mech Value	: 1.0	: 0.0	: 0.0	: 1.0	: 0.42
Deferability	: 0	: 0	: 0	: 0	: 0
MTTR	: 0.0	: 0.25	: 0.75	: 1.04	: 0.5
Dist Parameter	: 0.0	: 0.0	: 0.0	: 0.0	: 0.0
Dist Type*	:	: CONST	: CONST	: CONST	: CONST
Task Location*	: 1	: 1	: 1	: 1	: 1
LRU/Consumable	:	:	: POL	:	:
LC Quantity	:	:	: 1	:	:
LC Probability	:	:	: 1.0	:	:
Pers #1 Type	:	: 431X1	: 423X3	: 431X1	: 431X1
Pers #1 Quantity	:	: 1	: 1	: 2	: 3
Pers #2 Type	:	:	:	:	:
Pers #2 Quantity	:	:	:	:	:
AGE Type	:	: GCART	:	: MD3	: MJ2
AGE Quantity	:	: 1	:	: 1	: 1
Unscheduled*	: N	:	:	: N	: Y

Database : **AIRCRAFT**
Relation : **NETWORK** **Version : F36C**

	Record: 1	**Record: 2**	**Record: 3**	**Record: 4**	**Record: 5**	**Record: 6**
Base Task	: E2000A	T52000	T5200A	T52000	T5200B	E20001
Spawned Task	: T52000	T5200A	E20001	T5200B	E20001	M52000
Mutually Exclusive	: N	N	N	N	N	Y
Prob Spawn	: 1.0	1.0	1.0	1.0	1.0	0.25

	Record: 7	**Record: 8**	**Record: 9**	**Record: 10**	**Record: 11**	**Record: 12**
Base Task	: E20001	M52000	R52100	G20001	T72000	T72000
Spawned Task	: R52100	V52000	V52001	T72000	T7200A	T7200B
Mutually Exclusive	: Y	N	N	N	N	N
Prob Spawn	: 0.75	1.0	1.0	1.0	1.0	1.0

	Record: 13	**Record: 14**	**Record: 15**	**Record: 16**	**Record: 17**	**Record: 18**
Base Task	: T7200A	T7200B	G20002	G20002	M72000	V72000
Spawned Task	: G20002	G20002	M72000	R72100	V72000	V7200A
Mutually Exclusive	: N	N	Y	Y	N	N
Prob Spawn	: 1.0	1.0	0.3	0.7	1.0	1.0

	Record: 19	**Record: 20**	**Record: 21**	**Record: 22**	**Record: 23**	**Record: 24**
Base Task	: V72000	R72100	V72001	V72001	D50001	T45000
Spawned Task	: V7200B	V72001	V72002	V72003	T45000	T4500A
Mutually Exclusive	: N	N	N	N	N	N
Prob Spawn	: 1.0	1.0	1.0	1.0	1.0	1.0

	Record: 25	**Record: 26**	**Record: 27**	**Record: 28**	**Record: 29**	**Record: 30**
Base Task	: T45000	T4500A	T4500B	D50002	D50002	R45100
Spawned Task	: T4500B	D50002	D50002	M45000	R45100	R45101
Mutually Exclusive	: N	N	N	Y	Y	N
Prob Spawn	: 1.0	1.0	1.0	0.4	0.6	1.0

	Record: 31	**Record: 32**	**Record: 33**	**Record: 34**	**Record: 35**	**Record: 36**
Base Task	: M45000	V45000	V45000	A30000	A3000A	A3000A
Spawned Task	: V45000	V4500A	V4500B	A3000A	T13000	UPJACK
Mutually Exclusive	: N	N	N	N	Y	Y
Prob Spawn	: 1.0	1.0	1.0	1.0	0.9	0.1

	Record: 37	**Record: 38**	**Record: 39**	**Record: 40**	**Record: 41**	**Record: 42**
Base Task	: T13000	UPJACK	TSHOOT	TSHOOT	TSHOOT	TSHOO1
Spawned Task	: A30001	TSHOOT	TSHOO1	TSHOO2	TSHOO3	TSHOO4
Mutually Exclusive	: N	N	N	N	N	N
Prob Spawn	: 1.0	1.0	1.0	1.0	1.0	1.0

	Record: 43	**Record: 44**	**Record: 45**	**Record: 46**	**Record: 47**	**Record: 48**
Base Task	: TSHOO2	TSHOO3	TSHOO4	DNJACK	A30001	A30001
Spawned Task	: TSHOO4	TSHOO4	DNJACK	A30001	M13A00	R13A00
Mutually Exclusive	: N	N	N	N	Y	Y
Prob Spawn	: 1.0	1.0	1.0	1.0	0.2	0.3

	Record: 49	Record: 50	Record: 51	Record: 52	Record: 53	Record: 54
Base Task	: A30001	A30001	M13A00	R13A00	M13B00	R13B00
Spawned Task	: M13B00	R13B00	V13000	V13001	V13000	V13002
Mutually Exclusive	: Y	Y	N	N	N	N
Prob Spawn	: 0.2	0.3	1.0	1.0	1.0	1.0

	Record: 55	Record: 56	Record: 57	Record: 58	Record: 59	Record: 60
Base Task	: D2C01	D2C02	D2C02	D2C02	D2C02	D2C02
Spawned Task	: D2C02	V42C00	T42C00	X42C00	M42C00	R42C00
Mutually Exclusive	: N	N	N	N	Y	Y
Prob Spawn	: 1.0	0.015	0.029	0.118	0.603	0.03

	Record: 61	Record: 62	Record: 63	Record: 64	Record: 65	Record: 66
Base Task	: D2C02	D2C02	R42C00	R42C01	R42C02	ID2C00
Spawned Task	: R42C01	R42C02	ID2C00	ID2C00	ID2C00	JNSH2P
Mutually Exclusive	: Y	Y	N	N	N	Y
Prob Spawn	: 0.336	0.031	1.0	1.0	1.0	0.629

	Record: 67	Record: 68	Record: 69	Record: 70	Record: 71	Record: 72
Base Task	: ID2C00	ID2C00	ID2C00	ID2C00	E1E01	E1E02
Spawned Task	: JDUMY1	JDUMY1A	JDUMY1B	JDUMY1C	E1E020	V51E00
Mutually Exclusive	: Y	Y	Y	Y	N	N
Prob Spawn	: 0.037	0.074	0.037	0.223	1.0	0.868

	Record: 73	Record: 74	Record: 75	Record: 76	Record: 77	Record: 78
Base Task	: E1E02	E1E02	E1E02	E1E02	E1E02	R51E00
Spawned Task	: T51E00	X51E00	M51E00	M51E01	R51E00	IE1E01
Mutually Exclusive	: N	N	Y	Y	Y	N
Prob Spawn	: 0.316	0.368	0.073	0.218	0.709	1.0

	Record: 79	Record: 80	Record: 81	Record: 82	Record: 83	Record: 84
Base Task	: IE1E01	IE1E01	IE1E01	E5A01	E5A01	E5A02
Spawned Task	: JNSH2PA	G51EA0	G51ED0	E5A02	V55A01	T55A01
Mutually Exclusive	: Y	Y	Y	N	N	N
Prob Spawn	: 0.259	0.593	0.148	1.0	0.185	0.046

	Record: 85	Record: 86	Record: 87	Record: 88	Record: 89	Record: 90
Base Task	: E5A02	X55A00	E5A02	E5A02	R55A00	IE5A01
Spawned Task	: X55Z00	V55A03	M55A01	R55A00	IE5A01	JNSH2PB
Mutually Exclusive	: N	N	Y	Y	N	Y
Prob Spawn	: 0.169	0.182	0.739	0.261	1.0	0.118

	Record: 91	Record: 92	Record: 93	Record: 94	Record: 95	Record: 96
Base Task	: IE5A01	IE5A01	GD101	GD102	GD102	GD102
Spawned Task	: G55AB0	G55AE0	GD102	V71D00	T71D00	X71D00
Mutually Exclusive	: Y	Y	N	N	N	N
Prob Spawn	: 0.235	0.647	1.0	0.172	0.276	0.069

	Record: 97	Record: 98	Record: 99	Record: 100	Record: 101	Record: 102
Base Task	: GD102	GD102	GD102	GD102	R71D00	G4E01
Spawned Task	: H71D00	M71D00	M71D01	R71D00	R71D01	G4E02
Mutually Exclusive	: Y	Y	Y	Y	N	N
Prob Spawn	: 0.569	0.034	0.035	0.362	1.0	1.0

	Record: 103	Record: 104	Record: 105	Record: 106	Record: 107	Record: 108
Base Task	: G4E02	G4E02	G4E02	G4E02	G4E02	G4E02
Spawned Task	: V74E00	T74E00	X74E00	H74E00	M74E00	R74E00
Mutually Exclusive	: N	N	N	Y	Y	Y
Prob Spawn	: 0.310	0.103	0.379	0.448	0.069	0.483

	Record: 109	Record: 110	Record: 111	Record: 112	Record: 113	Record: 114
Base Task	: R74E00	IG4E00	IG4E00	PREFLT	MPREFLT	MPREFLT
Spawned Task	: IG4E00	JNSH2PC	G74EB0	MPREFLT	MPREFL1	MPREFL2
Mutually Exclusive	: N	Y	Y	N	N	N
Prob Spawn	: 1.0	0.071	0.929	1.0	1.0	1.0

	Record: 116	Record: 117
Base Task	: PREFLT	LAUNCH
Spawned Task	: SERVHY	LAUNCH1
Mutually Exclusive	: N	N
Prob Spawn	: 1.0	1.0

Database : RESOURCE
Relation : RESOURCES Version : F36PARTS

	Record: 1	Record: 2	Record: 3	Record: 4	Record: 5	Record: 6
Resource Name	: ARCON	: B-4	: GCART	: HCART	: MD3	: MJ2
Priority	: 1	: 1	: 1	: 1	: 1	: 1
Resource Type	: AGE	: AGE	: AGE	: AGE	: AGE	: AGE
Parent LRU	:	:	:	:	:	:
Failure Mech*	: PROB	: PROB	: PROB	: PROB	: PROB	: PROB
Failure Mech Value	: 0.0	: 0.0	: 0.0	: 0.0	: 0.0	: 0.0
Quant per LRU	:	:	:	:	:	:
Locat of Repair	: 1	: 1	: 1	: 1	: 1	: 1
Base Repair Time	:	:	:	:	:	:
Base Dist Param	:	:	:	:	:	:
Base Dist Type*	:	:	:	:	:	:
Base Person Type	:	:	:	:	:	:
Base Person Quant	:	:	:	:	:	:
Base AGE Type	:	:	:	:	:	:
Base Condemned	:	:	:	:	:	:
Base NRTS Rate	:	:	:	:	:	:
CIRF Repair Time	:	:	:	:	:	:
CIRF Dist Para	:	:	:	:	:	:
CIRF Dist Type	:	:	:	:	:	:
CIRF Pers Type	:	:	:	:	:	:
CIRF Pers Quant	:	:	:	:	:	:
CIRF AGE Type	:	:	:	:	:	:
CIRF Condemned	:	:	:	:	:	:
CIRF NRTS	:	:	:	:	:	:
Depot Repair Time	:	:	:	:	:	:
Depot Dist Param	:	:	:	:	:	:
Depot Dist Type*	:	:	:	:	:	:
Depot Pers Type	:	:	:	:	:	:
Depot Pers Quant	:	:	:	:	:	:
Depot AGE Type	:	:	:	:	:	:
Depot Condemned	:	:	:	:	:	:
Resupply Time	:	:	:	:	:	:
Cost	:	:	:	:	:	:
WUC	:	:	:	:	:	:
Shop	: PARTSHOP	: PARTSHOP	: PARTSHOP	: PARTSHOP	: PARTSHOP	: PARTSHOP
Pallet Equiv	: 1.0	: 1.0	: 1.0	: 1.0	: 1.0	: 1.0

	Record: 7	Record: 8	Record: 9	Record: 10	Record: 11	Record: 12
Resource Name	TJACK	P13A00	P13B00	P45100	P52100	P72100
Priority	1	1	1	1	1	1
Resource Type	AGE	LRU	LRU	LRU	LRU	LRU
Parent LRU						
Failure Mech*	PROB	MS	MS	MS	MS	MS
Failure Mech Value	0.0	25.0	25.0	7.5	10.0	15.0
Quant per LRU						
Locat of Repair	1	1	1	1	1	1
Base Repair Time		2.5	2.0	2.0	2.5	2.5
Base Dist Param		0.0	0.0	0.0	0.0	0.0
Base Dist Type*		CONST	CONST	CONST	CONST	CONST
Base Person Type		432L4	432L4	423X4	325X0	328X1
Base Person Quant		2	2	2	2	1
Base AGE Type						
Base Condemned		0.0	0.0	0.0	0.0	0.0
Base NRTS Rate		0.7	0.3	0.5	0.25	0.5
CIRF Repair Time						
CIRF Dist Para						
CIRF Dist Type						
CIRF Pers Type						
CIRF Pers Quant						
CIRF AGE Type						
CIRF Condemned						
CIRF NRTS						
Depot Repair Time		264.5	264.5	264.5	264.5	264.5
Depot Dist Param		0.0	0.0	0.0	0.0	0.0
Depot Dist Type*		CONST	CONST	CONST	CONST	CONST
Depot Pers Type						
Depot Pers Quant						
Depot AGE Type						
Depot Condemned						
Resupply Time						
Cost						
WUC						
Shop	PARTSHOP	PARTSHOP	PARTSHOP	PARTSHOP	PARTSHOP	PARTSHOP
Pallet Equiv	1.0	1.0	1.0	1.0	1.0	1.0

	Record: 13	Record: 14	Record: 15	Record: 16	Record: 17	Record: 18
Resource Name	: P42CHA	: P42CHG	: P42CH4	: P42CJD	: P51EA0	: P51ED0
Priority	: 1	: 1	: 1	: 1	: 1	: 1
Resource Type	: LRU	: LRU	: LRU	: LRU	: LRU	: LRU
Parent LRU	:	:	:	:	:	:
Failure Mech*	: MS	: MS	: MS	: MS	: MS	: MS
Failure Mech Value	: 17.0	: 17.0	: 17.0	: [illegible] 0	: 80.0	: 80.0
Quant per LRU	: 0	: 0	: 0	: 0	: 0	: 0
Locat of Repair	: 1	: 1	: 1	: 1	: 1	: 1
Base Repair Time	: 4.5	: 13.5	: 9.0	: 7.5	: 4.8	: 0.0
Base Dist Param	: 0.0	: 0.0	: 0.0	: 0.0	: 0.0	: 0.0
Base Dist Type*	: CONST	: CONST	: CONST	: CONST	: CONST	: CONST
Base Person Type	: 423X0	: 423X0	: 423X0	: 423X0	: 326S4	:
Base Person Quant	: 1	: 1	: 1	: 1	: 1	:
Base AGE Type	:	:	:	:	:	:
Base Condemned	: 0.0	: 0.0	: 0.0	: 0.0	: 0.0	: 0.0
Base NRTS Rate	: 0.0	: 0.0	: 0.0	: 0.0	: 0.10	: 1.0
CIRF Repair Time	:	:	:	:	:	:
CIRF Dist Para	:	:	:	:	:	:
CIRF Dist Type	:	:	:	:	:	:
CIRF Pers Type	:	:	:	:	:	:
CIRF Pers Quant	:	:	:	:	:	:
CIRF AGE Type	:	:	:	:	:	:
CIRF Condemned	:	:	:	:	:	:
CIRF NRTS	:	:	:	:	:	:
Depot Repair Time	: 0.0	: 0.0	: 0.0	: 0.0	: 269.4	: 265.8
Depot Dist Param	: 0.0	: 0.0	: 0.0	: 0.0	: 0.0	: 0.0
Depot Dist Type*	: CONST	: CONST	: CONST	: CONST	: CONST	: CONST
Depot Pers Type	:	:	:	:	:	:
Depot Pers Quant	:	:	:	:	:	:
Depot AGE Type	:	:	:	:	:	:
Depot Condemned	:	:	:	:	:	:
Resupply Time	:	:	:	:	:	:
Cost	:	:	:	:	:	:
WUC	:	:	:	:	:	:
Shop	: PARTSHOP	: PARTSHOP	: PARTSHOP	: PARTSHOP	: PARTSHOP	: PARTSHOP
Pallet Equiv	: 1.0	: 1.0	: 1.0	: 1.0	: 1.0	: 1.0

	Record: 19	Record: 20	Record: 21	Record: 22	Record:	Record:
Resource Name	: P55A80	: P55AE0	: P71DA0	: P74EB0	:	:
Priority	: 1	: 1	: 1	: 1	:	:
Resource Type	: LRU	: LRU	: LRU	: LRU	:	:
Parent LRU	:	:	:	:	:	:
Failure Mech*	: MS	: MS	: MS	: MS	:	:
Failure Mech Value	: 21.0	: 21.0	: 13.0	: 40.0	:	:
Quant per LRU	: 0	: 0	: 0	: 0	:	:
Locat of Repair	: 1	: 1	: 1	: 1	:	:
Base Repair Time	: 2.2	: 5.4	: 7.9	: 10.7	:	:
Base Dist Param	: 0.0	: 0.0	: 0.0	: 0.0	:	:
Base Dist Type*	: CONST	CONST	: CONST	: CONST	:	:
Base Person Type	: 326S5	: 326S5	: 326S5	: 326S4	:	:
Base Person Quant	: 1	: 1	: 1	: 1	:	:
Base AGE Type	:	:	:	:	:	:
Base Condemned	: 0.0	: 0.0	: 0.0	: 0.0	:	:
Base NRTS Rate	: 0.0	: 0.046	: 0.159	: 0.104	:	:
CIRF Repair Time	:	:	:	:	:	:
CIRF Dist Para	:	:	:	:	:	:
CIRF Dist Type	:	:	:	:	:	:
CIRF Pers Type	:	:	:	:	:	:
CIRF Pers Quant	:	:	:	:	:	:
CIRF AGE Type	:	:	:	:	:	:
CIRF Condemned	:	:	:	:	:	:
CIRF NRTS	:	:	:	:	:	:
Depot Repair Time	: 0.0	: 268.0	: 270.9	: 275.8	:	:
Depot Dist Param	: 0.0	: 0.0	: 0.0	: 0.0	:	:
Depot Dist Type*	: CONST	: CONST	: CONST	: CONST	:	:
Depot Pers Type	:	:	:	:	:	:
Depot Pers Quant	:	:	:	:	:	:
Depot AGE Type	:	:	:	:	:	:
Depot Condemned	:	:	:	:	:	:
Resupply Time	:	:	:	:	:	:
Cost	:	:	:	:	:	:
WUC	:	:	:	:	:	:
Shop	: PARTSHOP	: PARTSHOP	: PARTSHOP	: PARTSHOP	:	:
Pallet Equiv	: 1.0	: 1.0	: 1.0	: 1.0	:	:

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VITA

Captain David P. Leonhardt was born 21 March 1958 in American Fork, Utah. He graduated from high school in Orem, Utah in 1976 and attended the University of Utah from which he received a Bachelor of Science Degree in Mining Engineering in March of 1985. Shortly after graduation he was accepted to Officer Training School and was commissioned in the Air Force on January 21, 1986. His first assignment was to the 3096th Aviation Depot Squadron, Nellis AFB, Nevada where he served as Branch Chief of the Munitions Supply Branch. In April, 1987, Captain Leonhardt was reassigned to the 38th Tactical Missile Maintenance Squadron, Wueschheim Air Station, Germany. While there he served as the Munitions Accountable Systems Officer and the Branch Chief of the Weapons Branch until entering the School of Systems and Logistics, Air Force Institute of Technology in May, 1990.

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13. ABSTRACT *(Maximum 200 words)*
The sortie generation component of AMTAF was compared to LCOM with respect to the number of sorties generated and the number of maintenance manpower hours utilized during a 60-day scenario. a 2^n factorial experimental design was used for the study with an n-value of three. Three variables, the number of LRUs available in the supply pool, the number of personnel available for maintenance tasks, and the quantity of AGE available on the base, were allowed to take on either a constrained or unconstrained value in the study. A distribution of the differences in each output variable between the two models was developed and a confidence interval of the distribution mean was calculated using a 95% confidence factor. Results showed that there was no statistical difference in the number of sorites generated and the manpower hours utilized between the two models. Recommendations were made to continue the comparisons by adding more variability into the database and enabling many of the model functions that were disabled for this study.

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LCOM TSAR AMTAF SIMULATION COMPUTER FORECASTING

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