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THE UTILITY OF HANDHELD PROGRAM-
MABLE CALCULATORS IN AIRCRAFT
LIFE CYCLE COST ESTIMATION

Captain Dennis P. Brooks, USAF

LSSR 41-82

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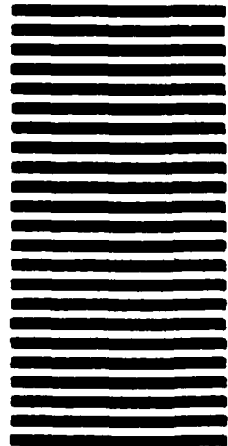PENALTY FOR PRIVATE USE. $300

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Life cycle cost estimation is a high priority issue in systems acquisition and maintenance. Interest begins with the Office of the President. Over the last twenty-three years this interest has generated a plethora of reports and models to estimate life cycle costs. The complexity and magnitude of this information has caused many to avoid life cycle cost analysis. This report explores the utility of handheld programmable calculators in estimating aircraft life cycle costs. Selected current computer models were analyzed by function and cost generation technique. Two were identified and simplified for use with a Hewlett-Packard HP-41CV calculator. Five other programs, currently in a format for the Texas Instruments TI-59 calculator, were converted and expanded as necessary for general usage with the HP-41CV. The report contains the research; programs generated; example program runs; a comparison between the HP-41CV output, the original format output, and where applicable actual costs; and suggestions for further research. The results indicate that programmable calculators can be a valuable tool in life cycle cost estimation.

LSSR 41-82

THE UTILITY OF HANDHELD PROGRAMMABLE

CALCULATORS IN AIRCRAFT LIFE CYCLE

COST ESTIMATION

A 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

By

Dennis P. Brooks, BS
Captain, USAF

September 1982

This thesis, written by

<div align="center">Captain Dennis P. Brooks</div>

has been accepted by the undersigned on behalf of the faculty of the School of Systems and Logistics in partial fulfillment of the requirements for the degree of

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COMMITTEE CHAIRMAN

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CHAPTER I

OVERVIEW

Managing costs in acquisition programs has assumed prime importance in today's budget environment. A realization that total program costs at times overshadow differences in acquisition costs has led to viewing programs in terms of life cycle cost (LCC). The complexity and sheer quantity of data required to manage a program through its life cycle has led to the use of computers. Yet, even the use of computers is hampered by complex computer programs requiring large amounts of input data, computer terminal accessibility, and computer time availability. Program managers are required to make their decisions based on readily available information, the quality of which makes a significant contribution to overall life cycle management efficiency and effectiveness.

The introduction of the handheld programmable calculator has had a significant impact on reducing the cost and time of the feedback loop in making life cycle cost assessments of design and in developing life cycle cost impacts. Their use has been made possible by the development of cost estimating relationships (CERs). These CERs are sets of variable inputs in fixed mathematical relationships. An example would be: Design Cost = 2.07 (Maximum Gross Weight)$^{1.09}$.

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The "Maximum Gross Weight" is a variable input with the fixed

values of 2.07 and 1.09 determined by regression of historical data

that influenced design cost in the past.

Proponents of using life cycle cost analysis begin with the

Executive Office of the President.

> Major system management objectives. Each agency
> acquiring major systems should: . . . Maintain a capability
> to: . . . Estimate life cycle costs during system design concept
> evaluation and selection, full-scale development, facility con-
> version, and production, to ensure appropriate trade-offs
> among investment costs, ownership costs, schedules, and
> performance [9:3-5].

Unfortunately, to date, there exists no comprehensive method of

determining total life cycle costs. A multitude of models exist, each

determining some portion of LCC, yet none are able to encompass

all variables and costs. This is due partially to the changing environ-

ment and partially to a lack of accurate historical data. There are

several evaluations of current models. Three that evaluate model

utility are: "Analysis of Available Life Cycle Cost Models and Their

Applications," AFSC/AFLC Commander's Working Group 1976;

"Selected Models Used in Life Cycle Cost Analyses," AFIT/LSCT

1977; and "An Appraisal of Models Used in Life Cycle Cost Estima-

tion for USAF Aircraft Systems," RAND 1978.

Despite the existence of current models, Air Force policies

and procedures have not been fully standardized and have failed to

provide a reliable method for accurately forecasting life cycle costs.

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As a result, LCC models and forecasts are often misused, inaccurate, and/or inconsistent. The purpose of this study is to examine several current LCC models used to estimate aircraft costs and to develop a limited, easily used model for use with a programmable calculator. The models examined are in use by Department of Defense (DOD) agencies and the civilian aircraft industry. Due to the speed and memory limitations of hand'ield programmable calculators, only models using CERs to estimate life cycle costs will be used or evaluated.

The next chapter will review, first, the life cycle cost concept, providing a background, vocabulary, and general knowledge of the theory of LCC. Second, the problem will be further defined. Third, justification will be presented to verify the existence of the problem. Finally, there will be a statement of the research objective and the research hypothesis with the research questions pertinent to the problem.

CHAPTER II

BACKGROUND

Life cycle cost is defined by the Office of Management and

Budget (OMB) as:

> . . . the sum total of the direct, indirect, recurring, non-
> recurring, and other related costs incurred, or estimated to be
> incurred, in the design, development, production, operation,
> maintenance, and support of a major system over its anticipated
> useful life span [9:3].

The Office of the Secretary of Defense, Cost Analysis Improvement

Group (OSD CAIG), separates life cycle cost into four areas:

research and development; procurement; operating and support; and

disposal (10:2).

The phrase, life cycle cost, first appeared in the early

nineteen sixties when the problem was identified that operations and

support costs of weapon systems at times far exceeded the initial

acquisition costs (5:1). It was considered essential to incorporate

"the total cost to the Government of acquisition and ownership of that

system over its full life [10:2]," in decisions that led to acquisition,

replacement, or major modification. Concern for cost control to

meet requirements with shrinking budgets led to the current DOD

life cycle cost program.

"Life Cycle Costing in the 80's," (5:1-7) gives an excellent

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recount of the history of LCC in the DOD. The following is a synopsis of that article. Table 1 portrays the development of LCC. The Logistics Management Institute, a nonprofit research organization working for the DOD, coined the phrase "life cycle cost" in studying contract awards. Their study found that consideration of costs from initiation of requirement to retirement of the system could have significant effects on contract award. Based on this, several trial LCC procurements were initiated. The better known of these is the purchase of aircraft tires. Several companies presented tires to meet an Air Force requirement. Based solely on price, company A would have received the contract. However, the various tires were tested to determine wear and failure rates. The "useful life" was to a point of maximum acceptable wear or failure. The results of the study led to the selection of company B's product. A higher priced tire with a significantly longer useful life yielded the best cost/ landing ratio. This study graphically portrayed the value of evaluating life cycle cost versus initial price in acquisition decisions. In 1964 DOD Directive 4100.35, calling for design of integrated logistics support to minimize system LCC, was part of a new emphasis to reduce support costs. At this same time, several systems considered life cycle costs during the advanced development and contract definition phase. In the late sixties defense spending was not popular with the public. This was due in part to the unpopular Vietnam War and

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TABLE 1

The History of Life Cycle Cost Development

1960-65	LMI Studies
1963-65	Trial LCC Procurements
1964	DOD Directive 4100.35 on ILS
1964-68	Trial System Level Life Cycle Costing
1967-72	Special Studies on Cost Growth
	Defense Science Board
	Blue Ribbon Committee
	Little Four Studies
	Congressional Commission
1969	DOD Instruction on Economic Analysis
1970	DOD Guide LCC-1 on Life Cycle Cost for Equipment; DOD Guide LCC-2 Casebook on Equipment Level LCC; Design to Cost Proposed
1971	DOD Directive 500.1 on Acquisition of Systems; AFLCM/ AFSCM 800-4 on ORLA
1972	DTC Test Cases on 17 systems/10 subsystems; Commission on Government Procurement; MIT Study on consumer life cycle cost
1973	DOD Guide LCC-3 on Life Cycle Costing for Systems;

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TABLE 1--Continued

	DOD Directive 5000.4 on OSD CAIG, Dept. Sec. Defense Clements Implementation Memorandum; Joint Logistics Commander's Guide on Design to Costs; GSA Federal Supply Services LCC Program Implemented
1974	Budget Act on 1974; Public Law 93-400; MIL STD 1390A on Level of Repair
1975	DOD Directive 5000.2 on the Major System Acq. Process; DOD Directive 5000.28 on Design to Cost; DOD VAMOS Cost Study; GSA Federal Supply Services LCC Studies
1976	DOD Directive 4105.62 on Source Selection; OMB Circular A-109 on Systems Acquisition; Design to Life Cycle Cost Test Case (F-18)
1977	Bill S. 1264 (Chiles Bill) Initiated
1977-79	DOD Directive Updating; 5000.1, 5000.2, 5000.3, 5000.4, JCC DTC Guide, 4100.35
1978	Senate asks for Life Cycle on SAR Systems; Chiles Bill resubmitted; South Carolina State Purchasing Agents Seminar on LCC
1979	Chiles Bill resubmitted

partly because of an increasing movement toward the support of social programs in lieu of military spending. The shrinking funds and increasingly expensive weapon system costs led to several studies seeking alternatives to lower system replacement costs. A common recommendation of all the studies was initiation of LCC analysis in evaluations of system costs.

In 1970, the DOD issued the first guidance on how to apply LCC analysis: LCC-1, on equipment level (versus system level) acquisitions; and LCC-2, devoted to case studies in equipment level life cycle costs. 1971 brought three major steps in LCC development. DOD Directive 5000.1 firmly established the requirement for life cycle cost and design to cost. Air Force Logistics Command Manual (AFLCM)/Air Force Systems Command Manual (AFSCM) 800.4, Optimum Repair Level Analysis (ORLA), determined LCC in repairs at depot, intermediate, or base level. The third step was the evaluation of line replaceable units (LRUs) and shop replaceable units (SRUs) by LCC in the Logistics Support Cost (LSC) model. In 1973, the DOD issued LCC-3 giving LCC guidance for systems acquisition. This was followed with the establishment of the CAIG (DOD Directive 5000.4), and the Joint Logistics Commander's issuance of "Life Cycle Cost as a Design Parameter," integrating design to cost and life cycle costing. DOD Directive 5000.28, issued in 1975, required a modified form of LCC in design-to-unit-production-cost goals. The Visibility and

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Management of Support Cost (VAMOSC) study was implemented to improve estimation of downrange cost capability. In 1976, DOD Directive 4105.62 required consideration of LCC in source selection. The F-18 contract was a trial LCC procurement with a life cycle cost incentive clause in the contract. OMB Circular A-109 came out requiring the use of LCC in the acquisition process by all executive branch agencies. Senator Chiles, Subcommittee on Federal Spending Practices and Open Government, introduced and has continued to resubmit a bill requiring LCC considerations in all federal procurements. The Senate Committee on Armed Services, in 1978, asked for LCC estimates on selected acquisition review (SAR) programs. The DOD guidance on life cycle costing is continually updated. Keeping pace with the development of the life cycle costing field are models to portray LCC. The use of LCC models continues to expand as the models are more fully developed and proven useful.

The rationale for using LCC is that decisions made early in the acquisition phase have a potential for far-reaching effects in total system costs. Decisions involving system design, performance, and operational characteristics significantly affect operation and support costs. These and other factors can be controlled by managers in the acquisition phase if the managers have appropriate information for making decisions.

The Problem

The current LCC problem is twofold. First, models must be identified and derived that adequately portray the cost elements driving total cost in each phase of a system life cycle. Second, managers require a usable form of the models that is readily accessible.

> The effective application of life cycle costing (LCC) generally requires the use of a life cycle cost model. Historically, this has caused problems because many who should be involved in life cycle costing have felt they could not adequately comprehend the LCC models involved [8:1].

> . . . life cycle analysis is not yet a finished and fully effective management tool. The conceptual framework for life cycle analysis has developed in patchwork fashion and is still incomplete. Policy guidance for its use and purpose needs to be more fully explicated. Important questions remain about the preferred organizational and procedural arrangements for preparing, corroborating, documenting, reviewing, and acting upon life cycle analysis studies. The methodology of life cycle analysis is also incomplete. And while a wide array of life cycle cost (LCC) models are in common use, data to support them and conventions to guide their application are lacking [3:1].

The CAIG has identified simplicity as an important and desirable trait in the use of LCC models: "Often the cost, labor hours, and schedule required to set up and provide data for a complex model prohibits its effective and timely use in the decision process [10:5]." There is a continuing requirement to provide better information in LCC analyses on a timely basis to managers. " . . . maximum leverage for the control of life cycle (costs) lies in the use of

simpler models. This fact seems to be well recognized in both industry and government. The trend is in this direction [14:24]." Several LCC models have been reduced for use on the Texas Instruments TI-59 handheld programmable calculator. Table 2 provides a list of the calculator programs reviewed and their usage. Unfortunately, these programs develop results for isolated portions of total life cycle cost. Managers in the acquisition process need an analytical tool at their fingertips to evaluate LCC implications of daily decisions on a system as well as component level. At the present time, a consistent, reliable, accurate, and readily available method of estimating system life cycle cost has not been identified.

Research Objective

The objective of this research is to identify those cost elements in current LCC models that have historically driven aircraft LCC in each area of the life cycle. These elements will be used to identify a model for use in a handheld programmable calculator to provide acquisition managers with a reliable and useful LCC analysis at a level that will enhance time and effort expended on decisions. The model will be tested for utility by comparison with current full scale computer model results, actual system costs, and expert opinion.

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TABLE 2

Calculator Life Cycle Cost Programs Reviewed

1. Aircraft Top-Level Life Cycle Cost Models, Nov 1977. (Northrop)

2. Cost Oriented Resource Estimating (CORE) Model, Jun 1981.

3. Economic Analysis Model, Sep 1979.

4. External Tank Spares (Replacement Spares) Model, Mar 1978.

5. Learning Curve Programs, Aug 1978.

6. Life Cycle Cost Model, Apr 1981 Revision.

7. Logistics Support Cost Model for Ground Support Equipment,

    Mar 1978.

8. Next Generation Trainer (NGT) Operating and Support Cost

    Model, Sep 1980 Revision.

9. Optimal Repair Level Analysis for Ground Support Project, Mar

    1978.

10. Raw Inflation Programs, Jun 1979 Revision.

11. Weighted Inflation Programs, Jan 1980 Revision.

Research Hypothesis

A model can be developed, within the limitations of a hand-held programmable calculator, that will provide useful information in aircraft acquisition decisions. The alternate hypothesis is considered to be that the limitations of the handheld calculator or the methodology used in converting the programs for calculator use precluded the development of useful information within defined limits.

Research Questions

1. What are the cost drivers in the models available for each phase of the acquisition process and system life cycle?

2. What combination of cost elements will yield an effective model for aircraft LCC analysis on a handheld programmable calculator?

3. What models are currently used at the Aerospace Systems Division for aircraft LCC analysis?

4. What additional models are in use in civilian industry that could ..ontribute to aircraft LCC analyses?

5. What are the results in evaluation of current models?

6. How well does a calculator model predict future costs when compared to original computer programs and actual costs?

CHAPTER III

SCOPE AND DELIMITATION

To maintain the usefulness of the model the equations and
requirements for data will be limited to the capabilities of a Hewlett-
Packard HP-41CV calculator with extended function and memory
modules. The HP-41CV was chosen because of its alpha-numeric
capability (the calculator has a full twenty-six letter keyboard with
limited punctuation) and because of the state-of-the-art versatility in
programming. Several peripherals are available for extended mem-
ory, hardcopy printout, video interface, and special application
software. Any calculator of comparable memory could be used.

Calculation of a completely accurate life cycle cost requires
a large amount of sometimes inaccessible data and a perfect know-
ledge of the future. The scope of life cycle cost estimations is
vividly portrayed in the complexity of current programs dealing with
limited areas of total life cycle costs. The major use of life cycle
cost models is to compare the relative costs of alternatives. Repre-
sentative costs can be derived from limited data with the use of CERs.
Several trends have been identified by Dr. H. I. Starr (PhD) of Logis-
tics Technology International, Ltd., in determining key cost drivers
in aircraft LCC (15:1-5):

	% of LCC
Research and Development	3-10%
Production	20-30%
Operating and Support	60-77%

1. R&D Cost Drivers

   a) item/assembly/system weight tends to be proportional to cost.

   b) power in electronics systems and engines tend to be proportional to cost.

   c) risk, quantified by advanced materials, power to weight, etc., has a significant influence on cost.

   d) even though a small percentage contribution, decisions made during R&D in design tradeoffs have a significant effect on later phases.

2. Production Cost Drivers

   a) chosen tolerance range and item reliability

   b) number of electronics subsystems

   c) production quantity

   d) advanced materials

   e) number of suppliers

3. Operating and Support Cost Drivers

   a) use rate

   b) deployed quantity

   c) mission scenario

   d) failure/maintenance rates

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4. Indirect Cost Drivers

   a) funding

   b) schedules

   c) current acquisition process

Current models were reviewed with these cost drivers in mind. The
models tended to support Doctor Starr's identification of cost drivers.

This study is designed to bring enough causal factors into a
limited model to produce a useful tool. There are several programs
available for use with a TI-59 calculator that have proven the useful-
ness of such limited programs. This study draws upon existing
models to produce an increasingly complex derivation of life cycle
cost. The complexity is governed by the amount of data available to
the user. Peripheral sub-programs provide information on learning
curves, reliability, line replaceable unit (LRU) and shop replaceable
unit (SRU) design trade-offs, and LRU/SRU optimal repair level
analysis.

Due to time constraints and calculator limitations, the analy-
sis is limited to those models in Table 2 and Table 3. The limita-
tions of the HP-41CV will identify the depth and scope of the model.
The calculator as used had a 2333 byte memory enhanced to a 6554
byte memory with three extended memory modules.

TABLE 3

Selected Computer Life Cycle Cost Models

1. Air Force Logistics Command Operations and Support Cost Model

2. Cost Oriented Resource Estimating (CORE) Model

3. Cost Reduction Is Everyone's Responsibility (CRIER) Life Cycle
   Cost Model

4. Designing to System Performance/Cost (DSPC)

5. Development and Production Costs of Aircraft III (DAPCA III)

6. Engine/Airframe Generalized Life Cycle Cost Evaluator (EAGLE)

7. Expected Values Model

8. Life Cycle Cost Model for Aircraft Engines

9. Life Cycle Cost Model for Inertial Navigation Systems (INS LCC)

10. Logistics Composite Model

11. Logistics Support Cost Model (LSC)

12. Modular Life Cycle Cost Model (MLCCM)

13. Multi-Echelon Technique for Recoverable Item Control (METRIC/
    MOD-METRIC)

14. Optimum Repair Level Analysis (ORLA)

15. Planning Programming and:

    Budgeting Annual Cost Estimating (BACE)

    Cost Analysis Cost Estimating (CACE)

    Missile Annual Cost Estimating (MACE)

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TABLE 3--<u>Continued</u>

16. Programmed Review of Information for Costing and Evaluation
    (PRICE)

17. Research into the Economics of Design and User Cost Effects
    (REDUCE)

18. Simplified Maintenance Cost Model

19. Weapon System Support Costs

Research Design

Data Source

The LCC models analyzed were collected from the Air Force Institute of Technology (AFIT), Wright-Patterson Air Force Base, Ohio, Aeronautical Systems Division/Life Cycle Cost Management Division (ASD/ACCL), Air Force Wright Aeronautical Labs/Vehicle Synthesis Branch (AFWAL/FIMB), and the civilian firms listed in Appendix B. These models have been developed and modified over the last twenty-two years. The models and equations chosen are identified and supported in Chapter 4. Data to evaluate the calculator model performance was obtained from AFWAL/FIMB and system program offices at Wright-Patterson Air Force Base. The data reflects acquisitions over the last twenty years.

Variables

The variables of concern are those cost elements identified as cost drivers in each area of the life cycle. The models are separated into phases of the life cycle. Where limitations of the HP-41CV or the models prevent accurate computation, variable inputs will be defined by input requirements and suggested LCC models to derive aggregate data.

CHAPTER IV

BASIC DESIGN

The model presented in this chapter is a three-step progres-
sively expanding input model for determining portions of aircraft life
cycle costs. The model begins with four required variable inputs,
progresses to twenty three, and ends with a version requiring one
hundred forty five different variable inputs. A description of the in-
put and output labels is found in Appendix A. The required units of
measure are also explained in Appendix A. There are four sub-
programs added for user convenience to determine the effects of
learning rates on production; component and/or system reliability;
LRU/SRU optimum levels of repair; and LRU/SRU logistics support
costs. Appendix B contains a listing of the programs in HP-41CV
format. They can be converted for use with any suitable calculator.
An example run of each subprogram is displayed in Appendix C.

Justification

The first step of the model is an airframe life cycle cost
estimate based on 1981 RAND CERs (6:1-3). The RAND CERs were
chosen for simplicity in use, yet are applicable to a broad range of
aircraft. This step generates research and development and

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production estimates of airframe cost. It can generate data on any fighter, attack, or cargo aircraft (not derived from a previous version ex: An F-5 is derived from a T-38). The lack of inputs and generality of use lead to inaccuracy, but this step does give guidance early in the acquisition cycle in estimating airframe costs. Statistical support has been generated by RAND and is listed in their documentation. Using four input variables the equations develop eight outputs. The outputs are based on one hundred aircraft and 1977 dollars. To convert to current dollars multiply the outputs in hours by the appropriate current hourly rate. Dollar outputs can be converted by application of an inflation factor. One source of inflation factors is Air Force Regulation 173-13. This step has the advantages of simplicity and early use, but the disadvantage of considering only airframe cost and there is no subsystem breakdown.

The second step of the model is a translation of a Northrop Aircraft-Top-Level Life Cycle Cost Model into the HP-41CV format. The Northrop program was chosen because it is still relatively simple, with twenty-three inputs, but it encompasses avionics and engine data as well as airframe and considers research, development, production, and operations and support costs. The model existed in a programmable calculator format. Minor mathmatical errors were corrected in the translation. The model is limited to fighter/attack aircraft. As can be seen by the required inputs in Appendix A, the

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model is useable early in the acquisition process. The model was designed to look for large cost differences among various alternatives during the early conceptual design phase of the acquisition cycle. The model is considered consistent with Air Force Regulation 173-10. Statistical support for the model can be obtained from the Northrop Aircraft Group. Using twenty-three inputs the model generates eighteen cost outputs. An example run is contained in Appendix B. The model is based on seven hundred and fifty aircraft and 1977 dollars. One of the inputs yields cost data on any quantity chosen. The dollar outputs can be converted to the desired year by application of the appropriate inflation factor. This step is usable early, is fairly simple, and encompasses total aircraft life cycle costs, but subsystem breakdowns are still not available.

The third and final step of the model is a limited handheld version of the Grumman Modular Life Cycle Cost Model (MLCCM), January 1980 revision. This step illustrates the expanded capabilities of handheld calculators. Although the output in the example run in Appendix C is limited it can be expanded to include any portion of the output generated by the original computer model. The example output illustrates the various formats: airframe, avionics, and engine; subsystem breakdown, avionics, and engine; and maintenance level breakdown. The program listed in Appendix B takes approximately fifteen minutes to run R&D and production costs and an additional

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forty minutes to run initial spares and operations and support costs.
The second portion length is due to the repetitive summation of individual costs in each subsystem. The number of inputs, memory required, and available outputs graphically illustrate the capabilities of handheld programmable calculators. This step entails one hundred and forty five different inputs and was the most comprehensive CER format computer program found. The example run displays thirty-eight outputs in R&D, production, initial spares, and operations and support costs encompassing total system life cycle costs. Quantities and inflation factors are inputted yielding output in desired year dollars and quantities. The original CERs were expressed in terms of 100 airframes, 150 avionics units, and 1000 engines. The dollar outputs are converted from 1975 dollars. According to Mr. Nathan L. Sternberger, MLCCM Air Force Point of Contact, the model is more sensitive to airframe data, but it does provide engine and avionics information for total life cycle cost estimates. Justification, support, and development of the CERs can be found in the four volume library covering the computer model. The calculator version is limited in user interaction but can be tailored to individual and program needs. Any handheld calculator with suitable memory and card reader ability can be used with an appropriate translation of the calculator model.

The engine data can be significantly enhanced by developing

engine estimations with the "Engine/Airframe Generalized Life Cycle Cost Evaluator (EAGLE)" developed by Pratt and Whitney. The program is currently being introduced as a replacement to the engine modules of the MLCCM program.

The Avionics Lab at Wright-Patterson Air Force Base, is currently developing a similar model for avionics to be introduced into the MLCCM.

Both computer models and future updates can be incorporated into the calculator model as direct inputs into the appropriate storage registers or as additions to/additional calculator programs.

The MLCCM has the advantage of subsystem breakdown to explore alternatives at a lower level. It cannot be used as early as the other models due to input requirements, but it can still be used relatively early in the acquisition cycle.

To complement the base model, Hewlett-Packard versions of ORLA, LSC, LCC Reliability, and the unit curve and cumulative average learning curve programs are provided.

The complete package is programmed and recorded on magnetic cards. Copies can be obtained through the author.

The Learning Curve (LN CURV) program is designed to determine specified unit or total production costs given first unit cost and learning rate. The program will calculate the output based on unit curve or cumulative average curve equations.

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The Optimum Repair Level Analysis (ORLA) program is an expanded version of the W. E. Rogers AFLCM/AFSCM 800-4 ORLA for GSS Project for general usage. The program is designed for use at an LRU/SRU level to evaluate hardware design tradeoffs. The program determines the cost of discarding, repairing at base level, or repairing at depot level. The model does not consider common or unique AGE or facilities costs.

The Life Cycle Component Reliability program computes system reliability by evaluating reliability at each sequential level starting at any level in the system. A level is defined as a set of components with equal functional importance. An example is to start at the resistor level. Inputs consist of resistor reliability and placement in parallel or series. As each set of resistors is placed in another series or parallel arrangement a new level is reached. Sets become circuits, then circuit boards, components, black boxes, subsystems, and ultimately an aircraft, computer, or system.

The Logistics Support Cost model is useful in examining design tradeoffs, support costs, and support alternatives at a line replaceable/shop replaceable unit level. The model does not consider: training equipment, documentation, facilities, war readiness material, initial hardware installation, support equipment maintenance, modification costs, or energy requirements. The model assumes:
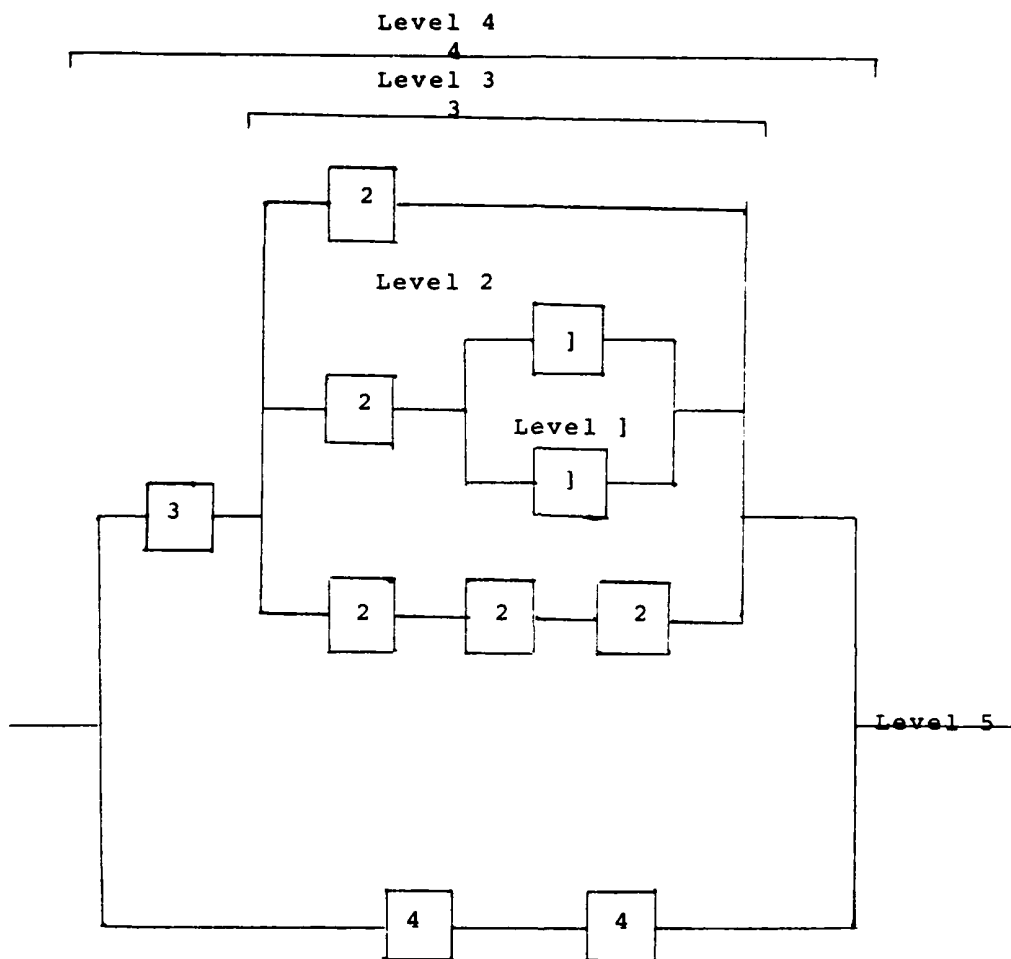
All components have an MTBF of 500 for T = 1.

Fig. 1. LCC Reliability Example Circuit

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1. A uniform level of program activity.

2. The spares stock level and pipeline quantities are computed to support peak activity levels.

3. There is one depot and a specified number of base repair locations.

4. Each base has the same number of systems (7:1-2).

CHAPTER V

CONCLUSION

There is utility in transferring computer programs, or por-
tions thereof, into programs for programmable calculators. Appen-
dix D contains the percentage accuracy of the models used and the
variations to actual costs incurred. The utility of the subprograms
has and is being shown through their use in the DOD and industry.

This report has identified a number of Life Cycle Cost models
in use in the DOD and civilian industry. It has also identified several
recognized evaluations of model use and utility. The important cost
drivers in each phase were identified and models chosen that utilized
predominately those drivers. The programs/models were further
evaluated for utility in conversion to use with programmable calcula-
tors. Several models were identified that existed in a programmable
calculator form and were converted for use with the HP-41CV. The
results of the models were compared to current computer model
results and actual costs. The programmable calculator is a feasible
tool and shows an expanded capacity and utility beyond its current
use.

The recommendations from this study are twofold. First,
continue to develop calculator LCC models using regression based

CER computer models with updates as current aircraft are acquired. Second, continue to encourage the use and development of calculator programs throughout DOD in all fields. The user orientation, availability, and cost savings are daily proving the utility of programmable calculators.

Research should be continued to increase the usability of the models herein. The programs should be updated with current information and evaluated and modified for user utility. The increasing capacity of handheld calculators with increasing technology greatly enhances their utility now and in the future.

APPENDICES

APPENDIX A

ACRONYM DEFINITIONS

RAND INPUTS

EM/UN WGT?	Empty or Unit Weight?
EMP WGT?	Empty Weight?
CARGO?	Cargo Type Aircraft?
MAX SPD KNOTS?	Maximum Speed in Knots
NUM FLT TEST?	Number of Flight Test Aircraft
UNIT WGT?	Unit Weight?

RAND OUTPUTS   100 Aircraft   1977 Dollars

HRS EN =	Hours Engineering
HRS TO =	Hours Tooling
HRS LA =	Hours Labor
$ MATL =	Materials Cost
$ DEV =	Development Cost
$ PROG =	Program Cost
$ FL T =	Flight Test Cost
QC =	Quality Control Costs

NORTHROP INPUTS

DTJ	Dry Turbojet
ABTJ	After Burner Turbojet
ABTF	After Burner Turbofan
AW-A/A-A/G	All Weather, Air to Air, Air to Ground
AW-SF	All Weather, Single Function

VFR-SF	Visual Flying Rules, Single Function
NF	New Fighter
SS	Single Seat
AF LR	Air Frame Learning Rate in Decimal Form
EW	Empty Weight
%G	Percent Graphite (Decimal)
%T	Percent Titanium (Decimal)
%O	Percent Other Advanced Materials (Decimal)
EN LR	Engine Learning Rate (Decimal)
F MIL	Military (30 Minute) Thrust
BPR	By Pass Ratio
F MAX	Maximum (5 Minute) Thrust
N	Number of engines per aircraft
AV LR	Avionics Learning Rate (Decimal)
AV WT	Avionics Weight Uninstalled
UF	Utilization Factor (Decimal)
NYRS	Useful Life of System (Years)
UR	Utilization Rate (Hours/Year)
$/GAL	Fuel Cost (Dollars/Gallon)
F*S	Specific Fuel Consumption per Engine at Military (30 Minute) Thrust
L/D	Maximum Lift/Drag Ratio
Q	Number of Aircraft

NORTHROP OUTPUTS   1977 Dollars

AF 750	Airframe Cost at Unit 750
PU 1000	Engine Cost at Unit 1000
P 750	Engine Cost per Aircraft at Unit 750
E 750	Avionics Cost at Unit 750
F 750	Total Cost at Unit 750
RΣD	Research and Development Cost
POL\$/FH	POL Cost per Flying Hour
AQ	Airframe Cost (Q Units)
PQ	Engine Cost (Q Units)
EQ	Avionics Cost (Q Units)
FQ	Total Cost (Q Units)
I OΣS	Initial Support Cost
FH OΣS	Operation and Support Cost per Flying Hour
CL IV M	Class IV Modification Cost
UE OΣS	Support Equipment Cost
POL OΣS	POL Operation and Support Cost
OTH OΣS	Other Operation and Support Cost
TLCC	Total Life Cycle Cost

GRUMMAN INPUTS

1. Advanced Material   AM

W - Wing
F - Fuselage
N - Nacelle
T - Tail

$Ti\%$, $S\%$, $G\%$, $GR\%$, $B\%$
Percentage by weight of subscripted materials (1) titanium,
(2) steel, (3) fiberglass, (4) graphite epoxy, (5) boron epoxy.

2. Data   DA

AL	Aircraft Length	Feet
AT	Aircraft Type	fighter/attack = 1; cargo/transport/tanker = 2.
AVIW	Avionics Installation Weight	Lbs

Weight of brackets, shelves, wiring & plugs used to
install avionics equipment. Does not include black box
equipment.

AVW	Avionics Weight	Lbs

Weight of avionics black box equipment uninstalled. Does
not include wiring, shelves, cooling ducts, and fasteners.

ATBO	Average Time Between Overhaul	Hours

Number of flight hours accumulated by the average engine
from one overhaul to next overhaul. Average number for
a new development engine = 250 hours. Average number
for an off-the-shelf engine = 1000 hours.

B/H	BTU per Hour	BTU/Hr/1000

Total cooling capacity of air conditioning equipment used
for personnel and equipment cooling.

CW   Cargo Weight   .   Lbs

Maximum internal cargo weight that a cargo/transport/
tanker aircraft is capable of transporting.

CFA   Cargo Floor Area   Square Feet

Total area of compartment floors on which passengers/
troops, wheeled vehicles and cargo are transported.
Excludes baggage type compartments.

CV   Cargo Volume   Cubic Feet

Total volume of all compartments in which cargo is
normally carried.

EPR   Engine Pressure Ratio   Ratio

Ratio of compressor outlet total pressure to engine inlet
total pressure, at sea level static standard highest power
rating uninstalled.

FFY   First Flight Year (FFYR in years since 1900)

FD   Fuselage Density   Lbs/Cubic Feet

To compute, add weight of the fuselage basic and second-
ary structure, auxiliary power plant, instruments and
navigational equipment, electrical, electronics, arma-
ment including guns and ammunition, crew furnishings
and equipment, air conditioning, photographic, auxiliary
gear groups, fuel system and useful load including crew
but excluding fuel and stores. Also include weight of
fuselage mounted landing gear and ballast. Weight of
the engine section and propulsion group including air
inlet shall be included for those aircraft with engines
internal to the fuselage. One half of the surface controls
and hydraulic/pneumatic group weight shall also be
included. The remaining half is considered to be external
to the fuselage. Total weight of the above is divided by
fuselage volume. For those aircraft with engines installed
in the fuselage, delete volume of the engine inlet duct
from fuselage volume.

FV   Fuselage Volume   Cubic Feet

Fuselage total volume less calculated engine inlet duct volume i.e., for engine installed in fuselage.

FL VA   Fuel Valves   Number

Number of main line shut-off valves in main and auxiliary fuel systems for feed, distribution, refueling/defueling and jettison. Excludes APU fuel feed, vent valves and fuel shut-off valves.

H/M   Hours per Mission   Hours

Average mission duration for either fighter/attack or cargo/transport/tanker aircraft.

IFLW   Internal Fuel Weight   Lbs

Weight of total internal usable fuel for the aircraft. Includes fuel in wing, tail and fuselage.

LW   Landing Weight   Lbs

Maximum basic mission weight with which an aircraft must be capable of landing.

L+S   Length + Span   Feet

Aircraft length plus wing span.

MM   Maximum Mach Number   Ratio
            at Optimum Altitude

Aircraft speed in terms of maximum mach number at optimum altitude in clean configuration.

MQT   Military/Model Qualifica-   Years
            tion Test

Date of approval of engine qualification test expressed as years since 1900.

≠ACT   Number of Flight   Number
         Control Actuators

         Total number of hydraulic or electro mechanical actuators
         required to operate all aircraft movable flight surfaces.
         Example: ailerons, flaps, rudders, speed brakes,
         elevators, and spoilers.

≠APU   Number of Auxiliary   Number
         Power Units

≠C/A   Number of Crew   Number
         per Aircraft

≠CLS   Number of Control   Number
         Surfaces

         Total number of primary and secondary flight control
         surfaces, i.e., ailerons, rudders, elevators, tabs,
         flaps, flight and ground spoilers and slats.

≠EN   Number of Engines   Number

≠EX   Number of Emergency   Number
         Exits

≠G+S   Total number of fixed internal guns and external hard
         point attachment stations. Attachment stations that carry
         multiple weapon racks are counted as one (1).

≠HS   Total number of aircraft sub-systems which require the
         use of hydraulic or pneumatic power in their normal and/
         or auxiliary operating mode.

≠IT   Number of separate fuel cells, bladders and integral
         tanks which contain the internal fuel.

≠S   Number of Seats per   Number
         Aircraft

         This includes all crew seats plus seats or bunks for alter-
         nate crew members. Does not include passenger seats or
         litters.

#W	Number of primary landing gear wheels normally used during taxi, take-off and landing.
ULF	Structural ultimate load factor that an aircraft at Flight Design Gross Weight can withstand.
#P	Planned or actual number of prototype and flight test aircraft.
RMFG	Labor rate for manufacturing, including overhead. This category includes machinists, assemblers/riveters, installation mechanics, laboratory technicians, sheet metal fabrications, mechanical/fluid system technicians and finishing and processing personnel. $/Hr
SS	Sink Speed Feet/Sec
	The maximum vertical landing velocity the aircraft can withstand.
TFF	Date of first flight of aircraft design expressed as months since 1 January 1950.
TGWC	Take-Off Gross Lbs Weight-Clean
	Basic mission take-off gross weight with full internal fuel, internal guns and ammunition, racks and pylons, but no external stores.
TGWM	Take-Off Gross Lbs Weight-Maximum
	Maximum basic mission take-off gross weight including stores.
#PSN	Total of flight crew, relief crew, attendants and passengers/troops.
TAVSS	Total number of avionic AN nomenclatured subsystems per aircraft. If two identical subsystems are used, count as two.

TT   Total Thrust per   Lbs
          Aircraft, including
          Afterburner

          Sum of the maximum thrust rating of uninstalled engines
          at sea level static standard conditions.

TKA   Total KVA Maximum   KVA
          Design

          Total normal electrical power output capability of engine,
          air turbine motors and auxiliary power unit driven gener-
          ators/alternators.

TWA   Total Wetted Area   Square Feet
          per Aircraft

          Total external surface area of the aircraft including the
          canopy. This can be calculated by viewing the total area
          of the external skin as being minus curves and laid flat.

UR   Utilization Rate   Hours/Year

          Average flight hours per active aircraft per year obtained
          by multiplying the average flight hours per active aircraft
          per month by 12 months.

WN   Horizontal distance from wing tip to wing tip. Exclude
          wing tip missile installations.

#A   Total Number of Aircraft

FH/A   Flight Hours per   Hours/Month
          Aircraft

LC   Life Cycle   Months

INF   A factor to account for inflation rate from 1975 to the out-
          put year desired.

WA   Wing Area   Square Feet

          The gross planform area of the wings from aircraft
          centerline to wing tips.

WT/C	Wing Thickness to Chord Ratio, Average	Ratio

Average of theoretical root chord and tip chord thickness divided by average of the theoretical root chord and tip chord length.

KFD	KFOLD	WING TYPE
	1.000	Fixed
	1.728	Fold
	1.377	Variable Sweep

FWA	Fuselage Wetted Area	Square Feet

External area of fuselage including the canopy.

TA — Sum of the gross theoretical vertical tail area and gross theoretical horizontal tail area. For aircraft with engines breaking through carry-thru structure of horizontal tail, use exposed horizontal tail area.

≠T	Number of Tail Surfaces	Number

Each vertical tail is counted as (1), the left hand stabilizer counts as (1), as does the right hand stabilizer.

NWA	Nacelle Wetted Area	Square Feet

Total wetted area of all wing nacelles on the aircraft.

TPS	Type of Seat	Factor

Fixed crew seats are designated (1), while ejection or high "G" seats are designated (2).

SF	SWPFAC	WING TYPE
	0	Fixed
	0	Fold
	1	Variable Sweep

MT — $\dfrac{\text{Total Thrust}}{\text{Number of Engines}}$

TPEN   Type of Engine   Factor

            Jet propelled aircraft are designated (1), propeller
            driven aircraft (2).

CSD   Constant speed drive integral to engine = 1, remotely
            located = 2.

ANFT   Percentage of aluminum and steel lines using flared or
            flareless type AN/MS fittings.

FTR   Yes/No   Fighter Aircraft

ATK   Yes/No   Attack Aircraft

C/T   Yes/No   Cargo/Tanker/Transport

SUBIF   Subsystem Inflation Factor

RMIF   Raw Material Inflation Factor

PDR   Planned highest rate of aircraft production per month to
            be attained during the production phase of the program.

REGR   Labor rate for design engineering, including overhead.
            This category includes product engineering, vehicle
            technology, systems technology, engineering development
            test operations, engineering operations, production
            engineering, engineering management, and materials
            and processes.

RFLT   Labor rate for flight test, including overhead. This
            category includes flight test planning, instrumentation,
            conducting of tests, flight test reporting and data acqui-
            sition.

REN   Labor rate for engineering support, including overhead.
            This category includes support equipment engineering,
            trainer engineering, field service, publications and
            customer training.

RMGT   Labor rate for program management, including overhead.
            This category includes program management, subcon-
    •   tract management, configuration/information and pro-
            gram control and budgets.

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RMFS   Labor rate for manufacturing support, including over-
        head. This category includes production control,
        industrial engineering, scheduling and shop loading,
        estimating, trade studies, budgeting and manpower
        analysis, and manufacturing program management.

RFBS   Labor rate for fabrication support services, including
        overhead. This category includes mechinists, techni-
        cians and mechanics necessary in the fabrication and
        test of support equipment and factory test equipment.

RTDE   Labor rate for tool design, including overhead. This
        category includes tool and fixture design, numerical con-
        trol programs and methods engineering.

RTFB   Labor rate for tool fabrication including overhead. This
        category includes the skills required for fabrication of
        tools and fixtures.

RQCL   Labor rate for quality control, including overhead. This
        category includes quality assurance management, quality
        engineering, procurement control, inspection operations,
        quality control laboratory and measurement standards.

ALL RATES IN DOLLARS/HOUR

APU   Auxiliary power unit production cost for the 100th unit.
        1975 $

LR AF   Learning Curve   Decimal
        Slope - Structure

        A log linear plot of unit cost vs quantity representing
        learning experience, i.e., the expected increase in
        productivity, as measured by time to do a particular
        job, resulting from repetitive effort. The slope repre-
        sents the ratio of unit cost of the 2Nth unit to unit cost
        of the Nth unit.

ENTWR   Engine Thrust to   Ratio
        Weight Ratio

        Maximum SLS uninstalled engine thrust divided by engine
        dry weight.

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TIT   Turbine Inlet   Degrees R
         Temperature

         Maximum total gas temperature leaving the first stage
         turbine stators in degrees Rankine.

SLM   The maximum design mach number of the engine at sea
         level on a standard day.

AVIF   Avionics Inflation Factor (Decimal)

AVLR   Learning Curve   Decimal
         Slope - Avionics

ENLR   Learning Curve   Decimal
         Slope - Engine

DT   Number of years from start of full scale development
         through completion of military/model qualification test
         for engine only.

EAF   Engine Airflow   Lb/Sec

         Total airflow through the engine at sea level static
         standard condition highest rating, including total fan
         flow of a turbofan engine.

AFIF   Airframe Inflation Factor (Decimal)

R&D LRAF   Production Learning Rate for the Airframe during
         Research and Development (R&D)

INS   Inertial Navigation   Yes/No
         System

ECM   Electronic Counter-   Yes/No
         measures capability

SPFAC   Spares Factor for Flight
         Test

         Total number of engines required during development
         flight testing divided by (PROTO x NOENG). A number
         greater than 1. Suggested value = 1.5.

LR EN RΣD	Engine Production Learning Rate During R&D (Decimal)	
ENIF	Engine Inflation Factor (Decimal)	
%GΣA	General and Administrative expense percentage (Decimal)	
%PR	Percentage for manufacturer's profit (Decimal)	
LR SUB	Learning Curve Slope - Sub-Systems	Decimal
$\neq$B	Number of Bases	
A/S/B =	All bases have an equal number of squadrons and aircraft per squadron.	Yes/No
$\neq$Ba	Number of Bases with 1, 2, or 3 Squadrons ($\neq B_1$, $\neq B_2$, $\neq B_3$)	
S/B	Number of Squadrons per Base (1, 2, or 3)	
A/S	Number of Aircraft per Squadron (12, 16, 18, 20, 22, 24, or 28)	
$\neq$DAVS	Total number of different AN nomenclatured avionic sub-systems per aircraft. If there are two or more identical units, count that unit as one (1).	
MLD	Minimum Landing Distance	Feet
	Basic mission first landing minimum ground roll distance at sea level.	
CSW	Crew System Weight	Lbs
	Weight of furnishings and accommodations for personnel. Includes seats, bunks, oxygen, windshield wiper, instrument boards, consoles, fire detection and prevention, control stick and rudder pedals.	
$\neq$PCP	Number of compartments on cargo/transport/tanker aircraft normally used for crew, relief crew, passengers/troops and cargo.	

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MVSQ Mass Times Velocity   Lbs x Knots^2
     Squared

     A relative measure of the energy required to stop an air-
     craft computed by multiplying first landing weight by the
     square of the landing speed. Landing weight is the maxi-
     mum basic mission weight with which the aircraft is
     capable of landing.

≠LGB   Total number of main wheel brakes per aircraft.

MAL   Maximum Altitude   Feet

     Highest service ceiling which the aircraft can attain while
     climbing at 100 FPM for any mission.

%SUP   Fraction of aircraft operational or in the maintenance
     pipeline repaired. (Decimal)

≠LIM   Number of Landings per Month

APUW   Auxiliary Power   Lbs
     Unit Weight

     Includes weight of airborne APU as well as plumbing,
     circuitry, ducts, supports, and fasteners for installation.

ECSW   Total weight of the environmental control system including
     temperature control, pressurizing, ventilating, heating
     and cooling systems and anti-icing equipment.

CT   Number of air cooling turbines in the aircraft air condi-
     tioning system.

≠G   Total number of engine, air turbine motor (ATM) and
     auxiliary power unit (APU) driven generator/alternators.

≠HP   Total number of power driven hydraulic pumps used in
     main and auxiliary hydraulic systems, power transfer
     units excluded.

≠HSPS   Total number of power driven main and auxiliary hydraulic
     supply systems.

≠ATM   Number of air turbine motors on the aircraft to drive
        generators/alternators.

≠PTU   Number of hydraulic power transfer units on an aircraft.

FUSW   Fuel System Weight   Lbs

        Weight of fuel tank bladders, if any, and all fuel transfer
        lines, vents, drains, components and equipment installed.

≠FUBP   Number of pumps used in the fuel systems to distribute,
        jettison, feed and defuel. Excludes engine mounted pumps.

≠ANT   Total number of antennas required by aircraft communi-
        cation and navigation subsystems.

NOAC   Number of aircraft in the inventory that are operationally
        ready and which are not grounded for maintenance or
        spare parts. This quantity is obtained by multiplying the
        number of aircraft produced by an attrition factor and
        pipeline rate.

G/H   Gallons of Fuel pe.   Gal/Hour
        Flight Hour

        Total fuel used for an average mission, divided by number
        of hours for an average mission.

C/G   Cost of fuel per gallon in selected year dollars.

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GRUMMAN OUTPUTS

1. Research Development Test & Evaluation

AFM   Airframe

AV   Avionics

EN   Engine

RΣD   Total RDT&E

2. Production

SUB PRD   Subsystem Production

AF PRD   Airframe Production

AV PRD   Avionics Production

EN PRD   Engine Production

GΣA   General and Administrative Expenses

PROF   Profit

TOT PRD   Total Production

3. Initial Support

IS   Initial Support

STR   Structure

CR   Crew System

LG   Landing Gear

FC   Flight Controls

EI   Engine Installation

ECS   Environmental Control System

EL   Electrical

HYD	Hydraulic
FUEL	Fuel System
CH	Cargo Handling
ARM	Armament
APU	Auxiliary Power Unit
SSE	Special Support Equipment
IT	Initial Contractor Training
EN	Engines
AV	Avionics
TOT IS	Total Initial Support

4. Operations and Support

POL	Petroleum, Oil, and Lubricants
BLM	Base Level Maintenance
RS	Replenishment Spares
DCR	Depot Component Repair
BLO	Base Level Operations
BLT	Base Level Training
PDM	Depot Airframe
OM	Other Maintenance
TOT OS	Total Operations and Support

LEARNING CURVE INPUTS

UNIT/CUM?   Unit Curve or Cumulative Curve Equations?

≠ Units?   Total Number of Units?

Unit of Int?   Unit of Interest?

Unit 1 Cost?   First Unit Production Cost?

% Learn?   Learning Rate? (Decimal)

LEARNING CURVE OUTPUTS

Un Cost =   Unit of Interest Production Cost

Tot Cost =   Total Production Cost of All Units

LRU/SRU LOGISTICS SUPPORT COST INPUTS

DEVC   All nonrecurring and recurring engineering, tooling, manufacturing (e.g., breadboards, prototypes, flight vehicles, DT&E items, IOT&E items and spares to support RDT&E efforts), purchased equipment, quality control, allowance for changes, General and Administrative, and Profit associated with RDT&E funded efforts over the life cycle for the appropriate Work Breakdown Structure (WBS) elements.

SYS I   The cost of acquiring the production funded items including engineering, tooling, manufacturing, subcontract, purchased parts and equipment, quality control, General and Administrative (G&A) and Profit.

SEC   The cost of equipment, vehicles and tools required to maintain and care for the item or portions of the item while not directly engaged in the performance of the items' mission including all effort associated with design development and production of the support equipment.

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M	Number of intermediate repair locations (operating bases).
AOH	Average manhours to perform a shop bench check, screening, and fault verification of an item prior to initiating repair action or condemning the item.
POH	Expected operating hours for one month during the peak usage period for all items.
PIUP	Program Inventory Usage Period. Operational service life in years.
UC	Expected unit cost (including G&A and Profit) of the item at the time of initial spares provisioning.
W	Item unit weight in pounds.
MTBD	Mean Time Between Demand in operating hours. The average time between demand for supply support expressed in operating hours.
MTBR	Mean Time Between Removals Expressed in operating hours.
NRTS	Fraction of removed items expected to be returned to the depot for repair or condemnation.
RTS	Fraction of removed items expected to be repaired at base level.
COND	Fraction of failed items expected to result in condemnation at base and depot.
PAMH	Average manhours expended on the installed equipment for preparation and assessment to the item; for example, jacking, unbuttoning, removal of other units and hook up of support equipment.
RMH	Average manhours to fault isolate, remove, and replace the item on the installed equipment and verify restoration of the equipment to operational status.
SMI	Operating hour intervals between scheduled, periodic, or phased inspections on the installed item.

SMH   Average manhours to perform a scheduled, periodic, or phased inspection of the installed item.

BCMH Average manhours to perform a shop bench check, screening, and fault verification of an item prior to initiating repair action or condemning the item.

BMH   Average manhours to perform intermediate level (base shop) maintenance on a removed item including fault isolation, repair, and verification.

BMC   Average direct material cost to repair an item at base level including direct material cost of repairing lower level assemblies.

BRCT   Average Base Repair Cycle Time in months. The elapsed time for an item repaired at the base from removal of the failed item until it is returned to base serviceable stock (less time awaiting parts). For items of a "black box" variety (e.g., avionics LRUs), the repair of which normally consists of removal and replacement of "plug-in" components (SRUs), BRCT = 0.13 months (4 days). For other, nonmodular components, BRCT = 0.20 months (6 days).

DMH   Average manhours to perform depot-level maintenance on a removed item including fault isolation, repair, and verification.

DMC   Average direct material cost to repair an item at depot level including direct material cost of repairing lower level assemblies.

PA   Number of new "P" coded (i.e. National Stock Number has not been established) reparable assemblies within the item.

PP   Number of new "P" coded consumable items within this item.

PCB   Number of consumable items within this item that will be stocked at base level for the first time.

OST   Average Order and Shipping Time in months. The
             elapsed time between the initiation of a request for a
             serviceable item and its receipt by the requesting activ-
             ity. The value of OST is a function of the base location
             (CONUS and/or OVERSEAS) and therefore a weighted
             average value must be calculated as shown below:

$$OST_{WT} = (\% \text{ CONUS BASES})(.4 \text{ months}) +$$

$$(\% \text{ OVERSEAS BASES})(.53 \text{ months})$$

             The .4 months for CONUS and .53 months for overseas
             bases are standard factors. (Ref AFLCR 173-10)

DRCT   Average depot repair cycle time in months. The elapsed
             time for a NRTS item from removal of the failed item
             until it is made available to depot serviceable stock.
             This includes the time required for base-to-depot trans-
             portation and handling and the shop flow time within the
             specialized repair activity required to repair the item.
             (Ref AFLCP 173-10)

BLR   Base Labor Rate including direct labor and indirect labor
             and material costs. (Ref AFLC Pamphlet 173-10, dated
             28 Aug 1980)

DLR   Depot Labor Rate including direct labor and indirect labor
             and material costs. (Ref AFLCP 173-10)

PSC   Average Packing and Shipping Cost. The value of PSC is
             a function of the shipping location (CONUS &/or OVER-
             SEAS) and therefore a weighted average value must be
             calculated as shown below:

$$PSC_{WT} = (\% \text{ CONUS BASES})(\$.72/\text{lb}) +$$

$$(\% \text{ OVERSEAS BASES})(\$1.49/\text{lb})$$

SA   Annual base supply line item inventory management cost.
             (Ref AFLCP 173-10)

IMC   Initial management cost to introduce a new line item of
             supply (assembly or piece part) into the Government
             inventory. (Ref AFLCP 173-10)

RMC   Recurring Management Cost to maintain a line item of supply (assembly or piece part) in the wholesale inventory system. (Ref AFLCP 173-10)

LRU/SRU LOGISTICS SUPPORT COST OUTPUTS

BSC   The cost to provide base repair pipeline spares for all bases.

BSTK   The number of spares required for each base to fill the base repair pipeline including a safety stock to protect against random fluctuations in demand.

DSC   The cost to provide depot repair pipeline spares.

DSTK   The number of spares required to fill the depot repair pipeline.

SIC   The cost of support equipment, base spares and depot spares.

TPC   The total cost of system investment and support investment.

BMHC   The cost of base maintenance manhours (direct and indirect) over the life cycle.

BMMH   Direct labor manhours per year to accomplish base-level repairs.

PMSH   Direct intermediate level (base shop) manhours for the peak month.

BMMC   Cost of material to repair failed units at the base.

DMHC   The cost to accomplish depot-level maintenance of failed items over the program inventory usage period.

DMMH   The direct labor manhours per year to accomplish depot-level repairs.

DMMC   The cost of material to repair failed items at the depot level.

SDTC   The cost of roundtrip transportation of items sent to the
         depot for repair.

CSC   The cost of spares required over the life cycle to replace
         condemned items.

QSC   Quantity of spares required over the life cycle to replace
         condemned items.

IMCC   The cost to enter new line items of supply into the Govern-
         ment inventory and to manage these over the life of the
         equipment, and the cost of base level supply management
         of these new items.

TOC   The total cost of ownership including, base maintenance
         manhour and material costs, depot maintenance manhour
         and material cost, second destination transportation
         costs, condemnation spares costs and inventory manage-
         ment costs.

LCC   The total cost to the Government for an item over its full
         life, including the cost of development, procurement and
         ownership as computed by the model.

ORLA INPUTS   Optimum Repair Level Analysis

BRCYT   Base Repair Cycle Time (Modular LRU 0.20 month - Non
         Modular LRU 0.33 month).

LWRD   Depot Labor Wage Rate

LURI   Intermediate Labor Wage Rate

DSST   Depot Safety Stock Level (months)

NTDPRD   Number of technical data pages required at depot level

NTDPRI   Number of technical data pages required at intermediate
         level.

MCFA   Management cost to introduce new FSN assembly into Air
         Force inventory.

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MCFP	Management Cost to introduce new FSM part into Air Force inventory
NRA	Number of repairable assemblies introduced into inventory
NNRA	Number of non-repairable parts introduced into inventory
MTBCT	Mean Time Between Corrective Tasks (hours)
MTBF	Mean Time Between Failures (hours)
NB	Number of bases
NBC	Number of Bases Conus
NBOS	Number of Bases Overseas
OSTC	Order and Shipping Time (Continental U.S.)
OSTOS	Order and Shipping Time Overseas
IL	Planned Inventory Usage Period
FRCPP	Fraction of average repair cost comprised of known piece parts
PSLRC	Packing and Shipping Labor Rate (Continental U.S.)
PSLROS	Packing and Shipping Labor Rate Overseas
PSMRC	Packing and Shipping Material Rate (Continental U.S.)
PSMROS	Packing and Shipping Material Rate Overseas
PWRC	Packing Weight Ratio (Continental U.S.)
PWROS	Packing Weight Ratio Overseas
QPA	Quantity per Assembly (used with UE)
MCA	Annual Supply Management Cost for Assembly
MHCT	Required Man Hours per Corrective Task (AVG)
MCP	Annual Supply Management Cost for Part

DRPT	Depot Repair Pipeline Time (months)
FSAC	Annual Field Supply Administration Cost
CRM	Cost of Repair Material (dollars per task) including Piece Parts
SSRC	Shipping Rate - Continental U.S. - Surface
SSROS	Shipping Rate Overseas
RMW	Weight of Repair Materials per repair task (lbs)
TDOCP	Technical Data Origination Cost per page
UC	Unit Cost (dollars)
U/B	Units per Operating Element (station sets per base)
OH/M	Usage Rate (operating hours per month)
UW	Unit Weight (lbs)
PTRD	Annual personnel turnover rate at Depot level
PTRI	Annual personnel turnover rate at Intermediate level
PTTD	Number of intermediate personnel to be trained
PTTI	Number of depot personnel to be trained
DTD	Duration of depot level training (weeks)
DTI	Depot level training instruction and material cost
TCPD	Duration of intermediate level training (weeks)
TCPI	Intermediate level training instruction and material cost per man

LIFE CYCLE COMPONENT RELIABILITY INPUTS

≠LEV	Number of Levels
≠CIR/LEV	Number of circuits at the level
COM MTBF=?	Are the component MTBFs equal?
S/P?	Are the components configured in series or parallel?
≠COM/CIR?	Number of components in the circuit?
≠PAR CIR?	Number of parallel circuits?
REL?	Component reliability if known.
MTBF?	Component mean time between failure if reliability unknown.
T?	Time interval
≠Com/Ser?	Number of components in the series.

LIFE CYCLE COMPONENT RELIABILITY OUTPUTS

Reliability =	Component/Circuit Reliability
System Reliability =	Total System being considered

APPENDIX B

PROGRAM LISTINGS

RAND

60

```
01◆LBL "RAN          RAND AIRFRAME DEVELOPMENT AND
        D"           PROCUREMENT
02 5
03 STO 01
04 "HRS ENG          OUTPUT LABELS
        R"
05 ASTO 08
06 "HRS TOO
        L"
07 ASTO 12
08 "HRS LAB
        R"
09 ASTO 16
10 "$ MATL"
11 ASTO 20
12 "$ DEV S
        UP"
13 ASTO 24
14 "$ PROG"
15 ASTO 28
16 1.27
17 STO 31
18 "$ FL TS
        T"
19 ASTO 32
20 8.00001
21 STO 34
22 "EM/UN W          EMPTY OR UNIT WEIGHT FORMULAS?
        GT?"
23 PROMPT
24 ASTO Y
25 "EM"
26 ASTO X
27 X=Y?
28 XEQ 09
29 XEQ 10

30◆LBL 11
31 "CARGO?"          CARGO TYPE AIRCRAFT?
32 PROMPT
33 ASTO Y
34 "Y"
35 ASTO X
36 X=Y?
37 SF 02
38 "MAX SPD          MAXIMUM SPEED IN KNOTS?
        KNOTS?"
39 PROMPT
40 STO 03
41 "NUM FLT          NUMBER OF FLIGHT TEST AIRCRAFT?
        TEST?"
42 PROMPT
43 STO 04
```

61

```
44◆LBL 01          FORMULA LOOP
45 CLA
46 RCL IND
         01
47 XEQ 08
48 RCL 02
49 RCL IND
         01
50 XEQ 08
51 Y↑X
52 *
53 RCL 03
54 RCL IND
         01
55 XEQ 08
56 Y↑X
57 *
58 RCL 01
59 32              LENGTHEN EQUATION FOR FLIGHT TEST
60 X=Y?
61 XEQ 03
62 RDN
63 RDN
64 RCL 01
65 16
66 X=Y?
67 XEQ 06          STORE LABOR OUTPUT
68 RDN
69 RDN
70 GTO 02

71◆LBL 02
72 ARCL IND
         01
73 XEQ 08
74 XEQ 88          LABEL OUTPUTS  (OUTPUTS MUST BE MULTIPLIED
75 DSE 34          BY LABOR RATES AND INFLATION FACTORS AS
76 GTO 01          APPLICABLE)
77 STOP

78◆LBL 88          WORKING LABELS
79 1000
80 *
81 FS? 02
82 XEQ 12
83 "├="
84 ARCL X
85 AVIEW
86 FS? 55
87 STOP
88 RCL 01
89 33
90 X=Y?
91 XEQ 05
92 RDN
```

```
 93 RDN
 94 RTN

 95◆LBL 03
 96 RDN
 97 RDN
 98 RCL 04
 99 RCL 33
100 Y↑X
101 *
102 GTO 02

103◆LBL 04
104 .0638
105 GTO 07

106◆LBL 05
107 RDN
108 RDN
109 FS? 02
110 XEQ 04
111 .125

112◆LBL 07
113 CF 02
114 RCL 36
115 *
116 "QC"
117 XEQ 88

118◆LBL 06
119 RDN
120 RDN
121 STO 36
122 GTO 02

123◆LBL 08
124 1
125 ST+ 01
126 RDN
127 RTN

128◆LBL 09
129 .00355          FIXED VARIABLES FOR EMPTY WEIGHT
130 STO 05
131 .787
132 STO 06
133 .98
134 STO 07
135 .0221
136 STO 09
137 .778
138 STO 10
139 .68
140 STO 11
```

```
141 .165
142 STO 13
143 .82
144 STO 14
145 .456
146 STO 15
147 .299
148 STO 17
149 .954
150 STO 18
151 .526
152 STO 19
153 .00417
154 STO 21
155 .818
156 STO 22
157 1.23
158 STO 23
159 2.19
160 STO 25
161 .828
162 STO 26
163 .696
164 STO 27
165 .000293
166 STO 29
167 .644
168 STO 30
169 .767
170 STO 33
171 "EMP WGT
          ?"
172 PROMPT
173 STO 02
174 GTO 11

175◆LBL 10
176 .00445          FIXED VARIABLES FOR UNIT WEIGHT
177 STO 05
178 .758
179 STO 06
180 1.03
181 STO 07
182 .0296
183 STO 09
184 .734
185 STO 10
186 .743
187 STO 11
188 .235
189 STO 13
190 .77
191 STO 14
192 .522
193 STO 15          64
```

```
194  .404
195  STO 17
196  .905
197  STO 18
198  .604
199  STO 19
200  .00761
201  STO 21
202  .761
203  STO 22
204  1.28
205  STO 23
206  3.56
207  STO 25
208  .779
209  STO 26
210  .745
211  STO 27
212  .000617
213  STO 29
214  .584
215  STO 30
216  .805
217  STO 33
218  "UNIT WG
             T?"
219  PROMPT
220  STO 02
221  GTO 11

222◆LBL 12
223  .75
224  *
225  RTN
226  .END.
```

NORTHROP

```
01◆LBL "NOF    NORTHROP FIGHTER/ATTACK MODEL
              "

02 0
03 STO 50
04 3
05 STO 51
06 "DTJ"       SELECT ENGINE TYPE
07 XEQ 04
08 XEQ 09
09 "ABTF"
10 XEQ 04
11 XEQ 09
12 "ABTJ"
13 XEQ 04

14◆LBL 08
15 SF 10
16 3
17 STO 51
18 "AW-A/A-      SELECT AIRCRAFT FUNCTION
      A/G"
19 XEQ 04
20 XEQ 09
21 "AW-SF"
22 XEQ 04
23 XEQ 09
24 "VFR-SF"
25 XEQ 04

26◆LBL 07
27 "N F"        NEW FIGHTER?
28 XEQ 04
29 SF 08
30 "S S"        SINGLE SEAT?
31 XEQ 04

32◆LBL 19
33 "AF LR"      AIRFRAME LEARNING RATE? (DECIMAL)
34 XEQ 01
35 STO 00
36 "EW"         EMPTY WEIGHT?
37 XEQ 02
38 STO 01
39 "%G"         PERCENT GRAPHITE? (DECIMAL)
40 XEQ 02
41 XEQ 03
42 1700
43 *
44 STO 02
45 "%T"         PERCENT TITANIUM? (DECIMAL)
46 XEQ 02
47 XEQ 03
48 10700
49 *                      67
50 ST+ 02
```

```
51  "%O"              PERCENT OTHER ADVANCED MATERIAL?
52  XEQ  02           (DECIMAL)
53  XEQ  03
54  2150
55  *
56  ST+  02
57  RCL  02
58  STO  08
59  "AF  750"         AIRFRAME COST AT 750 AIRCRAFT
60  XEQ  00
61  "EN  LR"          ENGINE LEARNING RATE? (DECIMAL)
62  XEQ  01
63  STO  03
64  FS?  02
65  GTO  11
66  "FMIL"            DRY TURBOJET
67  XEQ  02
68  STO  37
69  .96
70  Y↑X
71  58
72  *
73  FS?  00
74  GTO  10
75  "BPR"             DRY TURBOFAN
76  XEQ  02
77  1
78  +
79  FS?  01
80  GTO  12
81  -.15
82  Y↑X
83  *
84  GTO  10

85◆LBL  12           AFTERBURNER TURBOFAN
86  .52
87  Y↑X
88  *
89  "FMAX"
90  XEQ  02
91  RCL  37
92  -
93  .08
94  Y↑X
95  *
96  GTO  10

97◆LBL  11           AFTERBURNER TURBOJET
98  "FMIL"
99  XEQ  02
100 STO  37
101 .96
102 Y↑X
103 64                          68
```

```
104  *
105  "FMAX"
106  XEQ 02
107  RCL 37
108  -
109  .06
110  Y↑X
111  *

112◆LBL 10
113  "PU 1000        UNIT COST AT 1000 ENGINES
         "
114  XEQ 00
115  "N"
116  XEQ 02
117  STO 38
118  RCL 03
119  1
120  +
121  STO 04
122  Y↑X
123  *
124  .75
125  RCL 03
126  Y↑X
127  *
128  RCL 04
129  /
130  STO 05
131  ST+ 08
132  "P 750"         ENGINE PER AIRCRAFT COST AT 750 AIRCRAFT
133  XEQ 00
134  "AV LR"         AVIONICS LEARNING RATE? (DECIMAL)
135  XEQ 01
136  STO 06
137  FS? 03
138  1500            AW/AG/AA
139  FS? 04
140  900             AW/SF
141  FS? 05
142  600             VFR/SF
143  "AV WT"         UNINSTALLED AVIONICS WEIGHT?
144  XEQ 02
145  *
146  STO 07
147  ST+ 08
148  "E 750"         AVIONICS PER AIRCRAFT COST AT 750 AIRCRAFT
149  XEQ 00
150  RCL 08
151  "F 750"         AVERAGE FLYAWAY COST AT 750 AIRCRAFT
152  XEQ 00
153  RCL 08
154  1.411
155  Y↑X                      RDT&E = .376[F_{750}^{1.411}]
156  .376
```

$$RDT\&E = .376[F_{750}{}^{1.411}]$$

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```
157  *
158  STO 09
159  STO 27
160  "RΣD"              RDT&E OUTPUT 77 $
161  XEQ 00
162  "UF"
163  XEQ 02
164  "NYRS"
165  XEQ 02
166  *
167  STO 11
168  "UR"
169  XEQ 02
170  STO 12
171  *
172  STO 13
173  .0260             FLYING HOUR MAINT.
174  STO 14
175  .6859
176  STO 15
177  FS? 06
178  XEQ 13
179  .182 E06          OTHER RECURRING MAINT.
180  STO 17
181  8.9
182  STO 18
183  .5647
184  STO 19
185  9.96 E06
186  STO 20
187  FS? 07
188  XEQ 14
189  .00142            UNIT EQUIPMENT RELATED MAINT.
190  STO 21
191  1.158
192  STO 22
193  FS? 06
194  XEQ 15
195  "$/GAL"           POL
196  XEQ 02
197  STO 39
198  .0032
199  *
200  RCL 38
201  "F*S"             MILITARY RATED THRUST/ENGINE *
202  XEQ 02            SPECIFIC FUEL CONSUMPTION, UNINSTALLED
203  *
204  STO 40
205  .577
206  Y↑X
207  *
208  RCL 01
209  "L/D"
210  XEQ 02
211  /                          70
```

```
212  STO 41
213  1.01
214  Y↑X
215  *
216  FS? 01
217  XEQ 16
218  FS? 02
219  XEQ 16
220  STO 23
221  "POL$/FH        POL COST/FLYING HOUR 77 $
          "
222  XEQ 00
223  "Q"             NUMBER OF AIRCRAFT OF INTEREST?
224  XEQ 02
225  STO 24
226  750
227  /
228  STO 25
229  RCL 00
230  Y↑X
231  RCL 24
232  RCL 02
233  XEQ 17
234  STO 28
235  STO 26
236  "AQ"            AIRFRAME COST 77 $
237  XEQ 00
238  RCL 25
239  RCL 03
240  Y↑X
241  RCL 24
242  RCL 05
243  XEQ 17
244  STO 29
245  ST+ 26
246  "PQ"            ENGINE COST 77 $
247  XEQ 00
248  RCL 25
249  RCL 06
250  Y↑X
251  RCL 24
252  RCL 07
253  XEQ 17
254  STO 30
255  ST+ 26
256  "EQ"            AVIONICS COST 77 $
257  XEQ 00
258  RCL 26
259  ST+ 27
260  "FQ"            AIRCRAFT COST 77 $
261  XEQ 00
262  RCL 26
263  .37
264  *
265  STO 31
```

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```
266  ST+  27
267  "I  OΣS"           INITIAL OPERATIONS AND SUPPORT COST
268  XEQ  00            77 $
269  RCL  08
270  RCL  15
271  Y↑X
272  RCL  14
273  RCL  24
274  RCL  13
275  XEQ  18
276  STO  32
277  ST+  27
278  "FH  OΣS"          O&S COST /FLYING HOUR 77 $
279  XEQ  00
280  RCL  11
281  .0045
282  RCL  26
283  XEQ  17
284  STO  33
285  ST+  27
286  "CL  IV  M         CLASS IV MODIFICATIONS COST 77 $
     "
287  XEQ  00
288  RCL  08
289  RCL  22
290  Y↑X
291  RCL  11
292  RCL  24
293  RCL  21
294  XEQ  18
295  STO  34
296  ST+  27
297  "UE  OΣS"          UNIT EQUIPMENT O&S COST 77 $
298  XEQ  00
299  RCL  13
300  RCL  24
301  RCL  23
302  XEQ  17
303  STO  35
304  ST+  27
305  "POL  OΣS          POL O&S COST 77 $
     "
306  XEQ  00
307  RCL  08
308  RCL  19
309  Y↑X
310  RCL  18
311  *
312  RCL  20
313  RCL  12
314  /
315  -
316  RCL  17
317  +
318  RCL  11
```

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```
319  RCL 24
320  XEQ 17
321  STO 36
322  ST+ 27
323  "OTH O&S          OTHER O&S COST 77 $
          "
324  XEQ 00
325  RCL 27
326  "TLCC"
327  XEQ 00           TOTAL LIFE CYCLE COST 77 $
328  CF 01
329  CF 02            CLEAR FLAGS
330  CF 03
331  CF 04
332  CF 05
333  CF 06
334  CF 07
335  CF 08
336  CF 09
337  CF 10
338  "END"
339  AVIEW
340  STOP

341*LBL 00            WORKING LABELS
342  "⊦="
343  ARCL X
344  AVIEW
345  STOP
346  RTN

347*LBL 01
348  PROMPT
349  LN
350  2
351  LN
352  /
353  RTN

354*LBL 02
355  "⊦?"
356  PROMPT
357  RTN

358*LBL 03
359  RCL 01
360  *
361  .76
362  Y↑X
363  RTN

364*LBL 04
365  "⊦?"
366  PROMPT          73
367  ASTO Y
```

```
368  "Y"
369  ASTO X
370  X=Y?
371  XEQ 05
372  XEQ 06
373  RTN

374◆LBL 05
375  SF IND 5
                0
376  RCL 51
377  ST+ 50
378  FS? 08
379  GTO 19
380  FS? 10
381  GTO 07
382  GTO 08

383◆LBL 06
384  1
385  ST+ 50
386  RTN

387◆LBL 09
388  1
389  ST- 51
390  RTN

391◆LBL 13
392  .000832
393  STO 14
394  .8912
395  STO 15
396  RTN

397◆LBL 14
398  .14 E06
399  STO 17
400  RTN

401◆LBL 15
402  4.56
403  STO 21
404  .6222
405  STO 22
406  RTN

407◆LBL 16
408  RCL 39
409  1.5
410  *
411  RCL 40
412  .187
413  Y↑X
414  *
```

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```
415  RCL 41
416  .627
417  Y↑X
418  *
419  RTN

420◆LBL 17
421  *
422  *
423  RTN

424◆LBL 18
425  *
426  *
427  *
428  RTN
429  .END.
```

GRUMMAN

```
01◆LBL  "L1"      GRUMMAN WORKING LABELS:
02◆LBL  "15"      INPUT
03 STO  IND
00
04 1
05 ST+  00
06 RDN
07 RTN
08◆LBL  "16"
09 "F?"
10 PROMPT
11 STO  IND
01
12 1
13 ST+  01
14 RDN
15 RTN
16◆LBL  "18"
17 STO  IND
01
18 1
19 ST+  01
20 RDN
21 RTN
22 .END.


01◆LBL  "L2"      REPETITIVE FORMULAS
02◆LBL  "4"
03 1
04 ST+  00
05 RDN
06 RTN
07◆LBL  "7"
08 XEQ  "12"
09 XEQ  "13"
10 XEQ  "13"
11 XEQ  "14"
12 RTN
13◆LBL  "8"
14 1
15 ST+  00
16 ST+  01
17 RDN
18 RTN
19◆LBL  "9"
20 XEQ  "12"
21 XEQ  "13"
22 XEQ  "14"
23 RTN
24◆LBL  "12"
25 RCL  IND
01
26 RCL  IND
00
```

```
27 Y↑X
28 XEQ "8"
29 RTN
30◆LBL "13"
31 RCL IND
01
32 RCL IND
00
33 Y↑X
34 *
35 XEQ "8"
36 RTN
37◆LBL "14"
38 RCL IND
00
39 *
40 XEQ "4"
41 RTN
42◆LBL "27"
43 RCL 44
44 RCL 43
45 *
46 *
47 RCL 30
48 *
49 RCL 02
50 *
51 RTN
52◆LBL "1"
53 RCL 02
54 *
55 RTN
56◆LBL "29"
57 RCL 48
58 GTO "31"
59◆LBL "30"
60 RCL 51
61 GTO "31"
62 .END.

01◆LBL "L3"      REPETITIVE FORMULAS
02◆LBL "10"
03 XEQ "12"
04 XEQ "14"
05 RTN
06◆LBL "11"
07 XEQ "12"
08 XEQ "13"
09 XEQ "13"
10 XEQ "13"
11 XEQ "14"
12 RTN
13◆LBL "17"
14 1
```

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```
15 ST+ 01
16 RDN
17 RTN
18 .END.

01◆LBL "L4"        MULTIPLE SUMMATION
02◆LBL "34"
03 +
04 +
05 +
06 RTN—
07◆LBL "35"
08 +
09 +
10 RTN
11 .END.

01◆LBL "L5"        REPETITIVE FORMULAS
02◆LBL "39"
03 RCL IND
01
04 RCL IND
00
05 *
06 XEQ "8"
07 RTN
08◆LBL "4"
09 1
10 ST+ 00
11 RDN
12 RTN
13◆LBL "8"
14 1
15 ST+ 00
16 ST+ 01
17 RDN
18 RTN
19◆LBL "40"
20 RCL IND
00
21 +
22 XEQ "4"
23 RTN
24◆LBL "41"
25 RCL IND
00
26 —
27 XEQ "4"
28 RTN
29◆LBL "42"
30 XEQ "39"
31 XEQ "39"
32 +
33 RTN
```

```
34◆LBL  "43"
35 XEQ  "39"
36 XEQ  "39"
37 -
38 RTN
39◆LBL  "44"
40 XEQ  "42"
41 XEQ  "39"
42 -
43 XEQ  "40"
44 RTN
45◆LBL  "45"
46 XEQ  "42"
47 XEQ  "40"
48 RTN
49◆LBL  "46"
50 XEQ  "42"
51 XEQ  "41"
52 RTN
53◆LBL  "47"
54 XEQ  "43"
55 XEQ  "39"
56 +
57 XEQ  "40"
58 RTN
59◆LBL  "48"
60 XEQ  "43"
61 XEQ  "40"
62 RTN
63◆LBL  "49"
64 XEQ  "43"
65 XEQ  "41"
66 RTN
67 .END.
```

```
01◆LBL  "L6"      FLAG SET / REPETITIVE FORMULAS
02◆LBL  "36"
03 SF 01
04 SF 03
05 RTN
06◆LBL  "37"
07 RCL IND
01
08 XEQ  "17"
09 +
10 RTN
11 .END.
```

```
01◆LBL  "L7"      REPETITIVE FORMULAS
02◆LBL  "33"
03 *
04 +
05 XEQ  "17"
06 RTN
```

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```
07  .END.

01◆LBL  "L8"        AVIONICS MULTIPLE
02◆LBL  "32"
03  "ECM?"
04  PROMPT
05  ASTO  Y
06  "N"
07  ASTO  X
08  X=Y?
09  GTO "HI"
10  RCL  11
11  1.5
12  *
13  STO  12
14  GTO  "IH"
15  .END.

01◆LBL  "L9"        REPETITIVE FORMULAS
02◆LBL  "21"
03  RCL  IND
00
04  RCL  IND
01
05  *
06  XEQ  "8"
07  +
08  RTN
09◆LBL  "23"
10  RCL  IND
00
11  XEQ  "4"
12  XEQ  "21"
13  XEQ  "21"
14  XEQ  "21"
15  XEQ  "21"
16  XEQ  "21"
17  RTN
18◆LBL  "22"
19  XEQ  "23"
20  XEQ  "21"
21  RTN
22◆LBL  "24"
23  XEQ  "25"
24  XEQ  "21"
25  RTN
26◆LBL  "25"
27  XEQ  "22"
28  XEQ  "21"
29  RTN
30  .END.

01◆LBL  "T"         PROGRESS CURVE APPLICATION
02  RCL  15
```

```
03  RCL  31
04  1
05  +
06  Y↑X
07  1
08  -
09  RCL  31
10  1
11  +
12  /
13  RCL  15
14  RCL  31
15  Y↑X
16  1
17  +
18  2
19  /
20  +
21  RCL  15
22  RCL  31
23  1
24  -
25  Y↑X
26  1
27  -
28  RCL  31
29  *
30  12
31  /
32  +
33  RCL  31
34  2
35  -
36  RCL  31
37  1
38  -
39  *
40  RCL  31
41  *
42  RCL  31
43  3
44  -
45  RCL  15
46  X<>Y
47  Y↑X
48  1
49  -
50  *
51  720
52  /
53  -
54  RCL  18
55  *
56  RTN
```

```
57 .END.

01◆LBL  "R"         RESET EXTENDED MEMORY
02 100
03 STO  00
04 150
05 STO  01
06 RTN
07◆LBL  "O"         LABEL OUTPUT
08 "⊢="
09 ARCL  X
10 AVIEW
11 STOP
12 RTN
13 END


01◆LBL  "AM"        ADVANCED MATERIAL ADJUSTMENT FACTORS
02 174
03 STO  99          SET 174-176 TO 0
04 0
05 STO  IND
99
06 1
07 ST+  99
08 RDN
09 STO  IND
99
10 1
11 ST+  99
12 RDN
13 STO  IND
99
14 XEQ  14
15 XEQ  19
16 XEQ  19
17 XEQ  19
18 XEQ  15
19 .99               ENTER AM TABLE VALUES
20 XEQ  13
21 1.75
22 XEQ  13
23 .85
24 XEQ  13
25 .75
26 XEQ  13
27 1.24
28 XEQ  13
29 1.98
30 XEQ  13
31 1.53
32 XEQ  13
33 1.38
34 XEQ  13
35 1.73                        83
```

```
36 XEQ 13
37 1.73
38 XEQ 13
39 2.65
40 XEQ 13
41 .79
42 XEQ 13
43 2.13
44 XEQ 13
45 3.02
46 XEQ 13
47 11.45
48 XEQ 13
49 .82
50 XEQ 13
51 1.72
52 XEQ 13
53 .95
54 XEQ 13
55 .86
56 XEQ 13
57 1.25
58 XEQ 13
59 2.1
60 XEQ 13
61 1.6
62 XEQ 13
63 1.38
64 XEQ 13
65 1.73
66 XEQ 13
67 1.73
68 XEQ 13
69 2.48
70 XEQ 13
71 .87
72 XEQ 13
73 2.44
74 XEQ 13
75 3.45
76 XEQ 13
77 13.1
78 XEQ 13
79 1.37
80 XEQ 13
81 1.64
82 XEQ 13
83 .95
84 XEQ 13
85 .89
86 XEQ 13
87 1.27
88 XEQ 13
89 1.74
```

```
 90 XEQ 13
 91 1.41
 92 XEQ 13
 93 1.38
 94 XEQ 13
 95 1.73
 96 XEQ 13
 97 1.73
 98 XEQ 13
 99 2.64
100 XEQ 13
101 .8
102 XEQ 13
103 2.18
104 XEQ 13
105 3.09
106 XEQ 13
107 11.73
108 XEQ 13
109 XEQ 06
110 XEQ 07
111 XEQ 08
112 XEQ 18
113 "W"            STORE ALPHA PROMPTS
114 XEQ 09
115 "F"
116 XEQ 09
117 "N"
118 XEQ 09
119 "T"
120 XEQ 09
121 "TI"
122 XEQ 10
123 "S"
124 XEQ 10
125 "G"
126 XEQ 10
127 "GR"
128 XEQ 10
129 "B"
130 XEQ 10
131 XEQ 06
132◆LBL 01        VIEW STRUCTURE PROMPTS
133 XEQ 05
134 XEQ 07
135 CLA
136 ARCL IND
 00
137 AVIEW
138 PSE
139 PSE
140 XEQ 11
141◆LBL 02        INPUT MATERIAL %
142 CLA
```

85

```
143 ARCL IND
 01
144 "┣%=?"
145 PROMPT
146 STO IND
02
147 XEQ 12
148 XEQ 03
149 DSE 03          MATERIALS / STRUCTURE LOOP
150 GTO 02
151 DSE 04          STRUCTURE LOOP
152 GTO 01
153 XEQ 05
154 XEQ 18
155 XEQ 15
156 XEQ 08
157 15.00001
158 STO 07
159 3.00001
160 STO 08
161 XEQ 14
162◆LBL 04          % * TABLE VALUES
163 RCL IND
05
164 RCL IND
02
165 *
166 ST+ IND
06
167 XEQ 03
168 DSE 03          MATERIALS / STRUCTURE LOOP
169 GTO 04
170 5
171 ST- 02
172 XEQ 05
173 1
174 ST+ 06
175 DSE 08          NACELLE REPEAT
176 GTO 04
177 3
178 ST- 06
179 5
180 ST+ 02
181 DSE 04          STRUCTURE LOOP
182 GTO 04
183 GTO 16
184◆LBL 03          WORKING LABELS
185 1
186 ST+ 02
187 ST+ 05
188 RTN
189◆LBL 05
190 5.00001
191 STO 03
```

```
192 RTN
193◆LBL 06
194 100
195 STO 00
196 RTN
197◆LBL 07
198 104
199 STO 01
200 RTN
201◆LBL 08
202 109_
203 STO 02
204 RTN
205◆LBL 09
206 ASTO IND
 00
207 1
208 ST+ 00
209 RTN
210◆LBL 10
211 ASTO IND
 01
212 1
213 ST+ 01
214 RTN·
215◆LBL 11
216 1
217 ST+ 00
218 RTN
219◆LBL 12
220 1
221 ST+ 01
222 RTN
223◆LBL 13
224 STO IND
05
225 1
226 ST+ 05
227 RTN
228◆LBL 14
229 174
230 STO 06
231 RTN
232◆LBL 15
233 129
234 STO 05
235 RTN
236◆LBL 17
237 1
238 ST+ 06
239 RTN
240◆LBL 18
241 4.00001
242 STO 04
```

87

```
243 RTN
244◆LBL  19
245  0
246  STO  IND
06
247  XEQ  17
248  RTN
249◆LBL  16          VIEW OUTPUT
250  XEQ  14
251  RCL  IND         STORE 174-176 IN 40-42
06        --
252  STO  40
253  STOP
254  XEQ  17
255  RCL  IND
06
256  STO  41
257  STOP
258  XEQ  17
259  RCL  IND
06
260  STO  42
261  "AM"
262  PCLPS
263  END'


01◆LBL  "DA"          PERMANENT DATA INPUT
02  99
03  STO  35            STORE IN REGISTERS 99-35
04  CLA
05  "AL"
06  XEQ  01
07  "AT"
08  XEQ  01
09  "AVIW"
10  XEQ  01
11  "AVW"
12  XEQ  01
13  "ATBO"
14  XEQ  01
15  "B/H"
16  XEQ  01
17  "CW"
18  XEQ  01
19  "CFA"
20  XEQ  01
21  "CV"
22  XEQ  01
23  "EPR"
24  XEQ  01
25  "FFY"
26  XEQ  01
27  "FD"
28  XEQ  01
29  "FV"
```

```
30  XEQ 01
31  "FLVA"
32  XEQ 01
33  "H/M"
34  XEQ 01
35  "IFLW"
36  XEQ 01
37  "LW"
38  XEQ 01
39  "L+S"
40  XEQ 01
41  "MM"
42  XEQ 01
43  "MQT"
44  XEQ 01
45  "≠ACT"
46  XEQ 01
47  "≠APU"
48  XEQ 01
49  "≠C/A"
50  XEQ 01
51  "≠CLS"
52  XEQ 01
53  "NOENG"
54  "≠EN"
55  XEQ 01
56  "≠EX"
57  XEQ 01
58  "≠G+S"
59  XEQ 01
60  "≠HS"
61  XEQ 01
62  "≠IT"
63  XEQ 01
64  "≠S"
65  XEQ 01
66  "≠W"
67  XEQ 01
68  "ULF"
69  XEQ 01
70  "≠P"
71  XEQ 01
72  "RMFG"
73  XEQ 01
74  "SS"
75  XEQ 01
76  "TFF"
77  XEQ 01
78  "TGWC"
79  XEQ 01
80  "TGWM"
81  XEQ 01
82  "≠PSN"
83  XEQ 01
84  "TAVSS"
```

```
 85 XEQ 01
 86 "TT"
 87 XEQ 01
 88 "TKA"
 89 XEQ 01
 90 "TWA"
 91 XEQ 01
 92 "UR"
 93 XEQ 01
 94 "WN"
 95 XEQ 01
 96 2
 97 ST- 35
 98 "≠A"
 99 XEQ 01
100 7
101 ST- 35
102 "FH/A"
103 XEQ 01
104 "LC"
105 XEQ 01
106 7
107 ST- 35
108 "INF"
109 PROMPT
110 STO 35
111 "DA"
112 PCLPS
113◆LBL 01        LABEL INPUT REQUESTS
114 "F?"
115 PROMPT
116 STO IND
35
117 1
118 ST- 35
119 RTN
120 .END.
 01◆LBL "UAF      INPUT DATA FOR FIRST PRODUCTION
           D"      SUBPROGRAM
 02 189
 03 PSIZE          SET AVAILABLE STORAGE REGISTERS
 04 "L1"           RECALL REQUIRED WORKING LABELS
 05 GETSUB
 06 XEQ "R"
 07 1.162          STORE DATA
 08 XEQ "15"
 09 -.596
 10 XEQ "15"
 11 .803
 12 XEQ "15"
 13 .65339
 14 XEQ "15"
 15 "WA"
 16 XEQ "16"
```

```
17  "WT/C"
18  XEQ "16"
19  RCL 68
20  XEQ "18"
21  "KFD"
22  XEQ "16"
23  1.111
24  XEQ "15"
25  .777
26  XEQ "15"
27  1.9499
28  XEQ "15"
29  "FWA"
30  XEQ "16"
31  RCL 88
32  XEQ "18"
33  .479
34  XEQ "15"
35  .563
36  XEQ "15"
37  310.51
38  XEQ "15"
39  "TA"
40  XEQ "16"
41  "≠T"
42  XEQ "16"
43  1.083
44  XEQ "15"
45  10.616
46  XEQ "15"
47  "NWA"
48  XEQ "16"
49  1.058
50  XEQ "15"
51  5.8247 E
-05
52  XEQ "15"
53  RCL 57
54  XEQ "18"
55  .489
56  XEQ "15"
57  .736
58  XEQ "15"
59  4.046
60  XEQ "15"
61  1.486 E-
05
62  XEQ "15"
63  RCL 70
64  XEQ "18"
65  RCL 87
66  XEQ "18"
67  "TPS"
68  XEQ "16"
```

91

```
 69  .319
 70  XEQ "15"
 71  .649
 72  XEQ "15"
 73  .94
 74  XEQ "15"
 75  4.0108 E
-02
 76  XEQ "15"
 77  1.21 E-0
6
 78  XEQ "15"
 79  RCL 79
 80  XEQ "18"
 81  RCL 81
 82  XEQ "18"
 83  RCL 98
 84  XEQ "18"
 85  "SF"
 86  XEQ "16"
 87  RCL 63
 88  XEQ "18"
 89  .292
 90  XEQ "15"
 91  1.336
 92  XEQ "15"
 93  1.1635 E
-04
 94  XEQ "15"
 95  RCL 63
 96  XEQ "18"
 97  RCL 65
 98  XEQ "18"
 99  .827
100  XEQ "15"
101  1.569
102  XEQ "15"
103  -1.286
104  XEQ "15"
105  1.2567 E
-05
106  XEQ "15"
107  "MT"
108  XEQ "16"
109  STO 37
110  "TPEN"
111  XEQ "16"
112  RCL 98
113  XEQ "18"
114  1.27
115  XEQ "15"
116  .227
117  XEQ "15"
118  2.2555 E
```

```
-04
119 XEQ "15"
120 RCL 94
121 XEQ "18"
122 RCL 81
123 XEQ "18"
124 .55
125 XEQ "15"
126 1.312
127 XEQ "15"
128 .496_
129 XEQ "15"
130 -2.45
131 XEQ "15"
132 3.312 E-
05
133 XEQ "15"
134 RCL 58
135 XEQ "18"
136 RCL 82
137 XEQ "18"
138 "CSD"
139 XEQ "16"
140 RCL 98
141 XEQ-"18"
142 1.128
143 XEQ "15"
144 2.4574 E
-03
145 XEQ "15"
146 RCL 72
147 XEQ "18"
148 "ANFT"
149 XEQ "16"
150 .782
151 XEQ "15"
152 .233
153 XEQ "15"
154 -2.304
155 XEQ "15"
156 2.4738 E
-05
157 XEQ "15"
158 RCL 84
159 XEQ "18"
160 RCL 71
161 XEQ "18"
162 RCL 98
163 XEQ "18"
164 1.027
165 XEQ "15"
166 1.3729 E
-02
167 XEQ "15"
```

```
168  RCL  73
169  XEQ  "18"
170  .615
171  XEQ  "15"
172  1.951  E-
04
173  XEQ  "15"
174  RCL  93
175  XEQ  "18"
176  .513
177  XEQ  "15"
178  3.1535  E
-02
179  XEQ  "15"
180  RCL  88
181  XEQ  "18"
182  "UAFD"
183  PCLPS          CLEAR PROGRAM
184  .END.
01◆LBL  "UAF       EXECUTE FIRST SUBPROGRAM
            P"
02  XEQ  "R"
03  "L2"            GET WORKING LABELS
04  GETSUB
05  "L3"
06  GETSUB
07  "L4"
08  GETSUB
09  "L6"
10  GETSUB
11  "FTR?"          IDENTIFY AIRCRAFT TYPE
12  PROMPT
13  ASTO  Y
14  "Y"
15  ASTO  X
16  X=Y?
17  SF  01
18  "ATK?"
19  PROMPT
20  ASTO  Y
21  "Y"
22  ASTO  X
23  X=Y?
24  XEQ  "36"
25  "C/T?"
26  PROMPT
27  ASTO  Y
28  "Y"
29  ASTO  X         UPC
30  X=Y?            STRUCTURE
31  SF  02
32  XEQ  "7"          WING MH
33  RCL  IND
          01
```

94

```
34  *
35  STO  30
36  XEQ  "17"
37  XEQ  "9"          FUSELAGE MH
38  STO  02
39  XEQ  "9"          TAIL MH
40  STO  03
41  XEQ  "10"         NACELLE MH
42  STO  04
43  RCL  30
44  RCL  02
45  RCL  03
46  XEQ  "34"
47  STO  54           STRUCTURE MH
48  RCL  30            CONVERT TO CURRENT $ (RATEMFG *)
49  RCL  66
50  *
51  STO  30
52  RCL  02
53  RCL  66
54  *
55  STO  02
56  RCL  03
57  RCL  66
58  *
59  STO  03
60  RCL  04
61  RCL  66
62  *
63  STO  04
64  RCL  30
65  RCL  02
66  RCL  03
67  XEQ  "34"
68  1 E-06
69  *
70  STO  20            CUR $ M. STRUCTURE
71  XEQ  "10"          RAW MATERIAL
72  STO  21
73  XEQ  "7"           CREW SYSTEM
74  STO  05
75  XEQ  "7"           FLIGHT CONTROLS
76  RCL  IND
         01
77  RCL  IND
         00
78  *
79  XEQ  "9"
80  RCL  IND
         01
81  *
82  XEQ  "17"
83  +
84  STO  06
```

95

```
85  XEQ  "9"        LANDING GEAR
86  STO  07
87  XEQ  "7"        ENGINE INSTALLATION
88  STO  63
89  XEQ  "9"        ENVIRONMENTAL CONTROL SYSTEM
90  STO  09
91  XEQ  "11"       ELECTRICAL
92  STO  10
93  XEQ  "10"       HYDRAULIC
94  1
95  RCL -IND
         01
96  -
97  XEQ  "17"
98  .75
99  *
100 1
101 +
102 *
103 STO  11
104 XEQ  "7"        FUEL
105 STO  12
106 XEQ  "10"       ARMAMENT
107 STO  13
108 XEQ  "10"       CARGO HANDLING
109 STO  14
110 STO  32
111 RCL  05
112 RCL  07
113 XEQ  "35"
114 RCL  06
115 RCL  08
116 RCL  09
117 XEQ  "34"
118 RCL  10
119 RCL  11
120 RCL  12
121 XEQ  "34"
122 RCL  13
123 +              SUMMATION SUBSYSTEMS
124 "SUBIF?"
125 PROMPT         INFLATION FACTOR
126 *
127 STO  29        CUR $ M. SUBSYSTEMS
128 RCL  21
129 "RMIF?"
130 PROMPT         RAW MATERIAL INFLATION FACTOR
131 *
132 STO  21        CUR $ M. RAW MATERIAL
133 +
134 RCL  20        CUR $ M. STRUCTURE
135 +              CUR $ M. AIRFRAME
136 XEQ  "10"
137 *
```

96

```
138  STO 23        FINAL ASSEMBLY
139  "UAFP"
140  PCLPS         CLEAR PROGRAM
141  .END.
 01◆LBL "AF"       SECOND SUBPROGRAM  DATA INPUT
 02  "L1"          GET WORKING LABEL
 03  GETSUB
 04  XEQ "R"
 05  -.492         DATA INPUT
 06  XEQ "15"
 07  .8647
 08  XEQ "15"
 09  "PDR"
 10  XEQ "16"
 11  STO 16
 12  "REGR"        LABOR RATE INPUTS
 13  XEQ "16"
 14  "RFLT"
 15  XEQ "16"
 16  "REN"
 17  XEQ "16"
 18  "RMGT"
 19  XEQ "16"
 20  "RMFS"
 21  XEQ "16"
 22  "RFBS"
 23  XEQ "16"
 24  "RTDE"
 25  XEQ "16"
 26  "RTFB"
 27  XEQ "16"
 28  -.171
 29  XEQ "15"
 30  .1505
 31  XEQ "15"
 32  RCL 16
 33  XEQ "18"
 34  "RQCL"
 35  XEQ "16"
 36  "AF"
 37  PCLPS         CLEAR PROGRAM
 38  .END.
 01◆LBL "AFP       EXECUTE SECOND SUBPROGRAM
        "
 02  XEQ "R"
 03  "L2"          GET WORKING LABELS
 04  GETSUB
 05  "L3"
 06  GETSUB
 07  "L4"
 08  GETSUB
 09  "L7"
 10  GETSUB
 11  RCL 54
```

97

```
12  RCL 23
13  1 E06
14  *
15  STO 23          STRMH + FINASSY$
16  RCL 66                   RATEMFG
17  /
18  +
19  STO 28
20  XEQ "10"        SUSTAINING MH
21  *
22  STO 22
23  RCL IND
            01
24  .331
25  *
26  XEQ "17"
27  RCL IND
            01
28  .021
29  XEQ "33"
30  RCL IND
            01
31  .085
32  XEQ "33"
33  RCL 22
34  *
35  STO 24          ENGINEERING CUR $
36  RCL IND
            01
37  .133
38  *
39  XEQ "17"
40  RCL 22
41  *
42  STO 25          PROGRAM MANAGEMENT CUR $
43  RCL IND
            01
44  .209
45  *
46  XEQ "17"
47  RCL 22
48  *
49  STO 26          MANUFACTURING SUPPORT CUR $
50  RCL IND
            01
51  .034
52  *
53  XEQ "17"
54  RCL IND
            01
55  .113
56  XEQ "33"
57  RCL IND
            01
```

$$\text{STRMH} + \frac{\text{FINASSY\$}}{\text{RATEMFG}}$$

98

```
58  .074
59  XEQ  "33"
60  RCL  22
61  *
62  STO  27        TOOLING CUR $
63  RCL  26
64  RCL  25
65  RCL  24
66  XEQ  "34"
67  STO  22        CUR $ SUSTAINING
68  XEQ  55        ADVANCED MATERIAL FACTOR
69  RCL  20
70  1 E06
71  *
72  *
73  STO  20        CUR $ STRUCTURE
74  XEQ  56        ADVANCED MATERIAL FACTOR
75  RCL  22
76  *
77  STO  22        CUR $ SUSTAINING
78  XEQ  57
79  RCL  21        ADVANCED MATERIAL FACTOR
80  1 E06
81  *
82  *
83  STO  21        CUR $ RAW MATERIALS
84  "$APU?"
85  PROMPT
86  STO  15        INPUT APU COSTS
87  STO  33
88  XEQ  "10"      QUALITY CONTROL MH
89  RCL  28
90  *
91  STO  25
92  RCL  IND
            01
93  *
94  XEQ  "17"
95  STO  25        CUR $ QUALITY CONTROL
96  RCL  20
97  RCL  21
98  RCL  22
99  XEQ  "35"
100 STO  53        UPC AIRFRAME
101 +
102 RCL  23
103 RCL  29
104 1 E06
105 *
106 XEQ  "35"
107 STO  02
108 RCL  53
109 100
110 "LR  AF?"
```

```
111  PROMPT
112  LN
113  2
114  LN
115  /
116  Y↑X
117  /
118  STO  53        1ST AIRFRAME UPC
119  RCL  02
120  RCL  23
121  RCL  29
122  1 E06
123  *
124  XEQ  "35"
125  STO  24
126  "AFP"          CLEAR PROGRAM
127  PCLPS

128◆LBL  55         WORKING LABELS FOR SUBPROGRAM
129  1
130  RCL  40
131  XEQ  58
132  RTN

133◆LBL  56
134  1
135  RCL  41
136  XEQ  58
137  RTN

138◆LBL  57
139  1
140  RCL  42
141  XEQ  58
142  RTN

143◆LBL  58
144  X=0?
145  RDN
146  RTN
147  .END.

01◆LBL  "UAV        EXECUTE THIRD SUBPROGRAM
                ..
02   "L1"          GET WORKING LABELS
03   GETSUB
04   "L3"
05   GETSUB
06   100
07   STO  01
08   "ENTWR"       INPUT DATA
09   XEQ  "16"
10   "TIT"
11   XEQ  "16"
12   "MQT"                          100
```

```
13 XEQ "16"
14 "EPR"
15 XEQ "16"
16 "SLM"
17 XEQ "16"
18 100
19 STO 01
20 RCL 89          FIGHTER AVIONICS UPC
21 .9
22 Y↑X
23 RCL 96
24 1.09
25 Y↑X
26 *
27 9.3797
28 *
29 "AVIF?"
30 PROMPT
31 STO 35
32 *
33 150
34 "AVLR?"
35 PROMPT
36 STO 49
37 XEQ 58
38 STO 48          1ST UNIT FIGHTER AVIONICS UPC
39 RCL 89
40 .97
41 Y↑X
42 RCL 96
43 *
44 11.34
45 *
46 RCL 35
47 *
48 150
49 RCL 49
50 XEQ 58
51 STO 51          1ST UNIT ATTACK AVIONICS UPC
52 RCL 89
53 2.34
54 Y↑X
55 RCL 96
56 1.35
57 Y↑X
58 *
59 1.3449 E
        -03
60 *
61 RCL 35
62 *
63 150
64 RCL 49
65 XEQ 58
```

101

```
66  STO 56        1ST UNIT CARGO AVIONICS UPC
67  RCL IND
         01
68  LN
69  8.86
70  *
71  XEQ "17"
72  RCL IND
         01
73  LN
74  34.56
75  *
76  XEQ "17"
77  +
78  RCL IND
         01
79  XEQ "17"
80  -
81  218.7
82  -
83  STO 38        DELTA TECHNOLOGY TIME
84  RCL IND
         01
85  STO 02
86  .7
87  *
88  XEQ "17"
89  RCL IND
         01
90  X↑2
91  *
92  1
93  -
94  RCL 02
95  +
96  2116
97  *              PRESS
98  .647
99  Y↑X
100 XEQ "17"
101 STO 02
102 RCL 37
103 .473
104 Y↑X
105 1.06
106 RCL 38
107 Y↑X
108 *
109 RCL 02
110 *
111 5.7363
112 *              ENGINE $ M.
113 1000
114 "ENLR"
```

```
115 PROMPT
116 XEQ 58
117 STO 49        1ST ENGINE $ M.
118 "UAV"
119 PCLPS         CLEAR PROGRAM

120◆LBL 58         SUBPROGRAM WORKING LABELS
121 LN
122 2
123 LN
124 /
125 Y↑X
126 /
127 RTN
128 .END.
01◆LBL "RDD       RDT&E DATA INPUT
         "
02 XEQ "R"
03 "L1"           GET WORKING LABEL
04 GETSUB
05 RCL 57         INPUT DATA
06 XEQ "18"
07 RCL 67
08 XEQ "18"
09 RCL 68
10 XEQ "18"
11 RCL 81
12 XEQ "18"
13 RCL 62
14 XEQ "18"
15 1.259
16 XEQ "15"
17 .127
18 XEQ "15"
19 1.722
20 XEQ "15"
21 .399
22 XEQ "15"
23 4.756
24 XEQ "15"
25 1.214
26 XEQ "15"
27 .322
28 XEQ "15"
29 1.22
30 XEQ "15"
31 .345
32 XEQ "15"
33 7.604
34 XEQ "15"
35 1.288
36 XEQ "15"
37 .483
```

```
38 XEQ "15"
39 1.709
40 XEQ "15"
41 .516
42 XEQ "15"
43 24.265
44 XEQ "15"
45 .134
46 XEQ "15"
47 1.062
48 XEQ "15"
49 .416
50 XEQ "15"
51 .836
52 XEQ "15"
53 91.669
54 XEQ "15"
55 .085
56 XEQ "15"
57 .89
58 XEQ "15"
59 .448
60 XEQ "15"
61 .8
62 XEQ "15"
63 672.54
64 XEQ "15"
65 "DT"
66 XEQ "16"
67 "EPR"
68 XEQ "16"
69 "EAF"
70 XEQ "16"
71 "SLM"
72 XEQ "16"
73 1.124
74 XEQ "15"
75 .341
76 XEQ "15"
77 .274
78 XEQ "15"
79 1.554
80 XEQ "15"
81 4.492
82 XEQ "15"
83 "RDD"
84 PCLPS           CLEAR PROGRAM
85 .END.
01◆LBL "RDP        RDT&E EXECUTE FIRST SUBPROGRAM
      "
02 170            SET STORAGE REGISTER SIZE
03 PSIZE
04 XEQ "R"
05 "L2"           GET WORKING LABELS
```

104

```
06  GETSUB
07  "L3"
08  GETSUB
09  "L8"
10  GETSUB
11  XEQ  "11"
12  STO  02          TOTAL ENGINEERING LABOR MH
13  4
14  ST-  01
15  XEQ  "11"
16  STO  03          TOTAL TOOLING LABOR MH
17  4
18  ST-  01
19  XEQ  "11"
20  "AFIF?"
21  PROMPT
22  STO  35          AIRFRAME INFLATION FACTOR
23  *
24  STO  04          CUR $ TOTAL OTHER DIRECT CHARGES
25  3
26  ST-  01
27  XEQ  "11"
28  RCL  35
29  *
30  STO.05           CUR $ 1ST AIRFRAME MANUFACTURING MATERIAL
31  4
32  ST-  01
33  XEQ  "11"
34  RCL  35
35  *
36  STO  06          CUR $ FIRST AIRFRAME LABOR
37  1
38  RCL  42          ADVANCED MATERIAL FACTOR
39  X=0?
40  RDN
41  RCL  05
42  *
43  STO  05
44  1
45  RCL  40
46  X=0?
47  RDN
48  RCL  06
49  *
50  STO  06
51  "RENGR?"
52  PROMPT
53  RCL  02
54  *
55  STO  02          CUR $ ENGINEERING LABOR
56  "RTDE?"
57  PROMPT
58  "RTFB?"
59  PROMPT
```

105

```
60  +
61  2
62  /
63  RCL  03
64  *
65  STO  03          CUR $ TOOLING LABOR
66  0
67  STO  21
68  STO  11
69  RCL  05
70  RCL  06
71  +
72  STO  19          FIRST AIRFRAME
73  "RED LR
         AF?"
74  PROMPT
75  STO  05
76  2
77  /
78  STO  06
79  FS?  01
80  GTO  00
81  5
82  STO  10

83◆LBL  06          RDT&E AIRFRAME LOOP
84  RCL  67
85  X>Y?
86  XEQ  01

87◆LBL  02
88  RCL  19
89  RCL  10
90  RCL  06
91  LN
92  2
93  LN
94  /
95  Y↑X
96  *
97  ST+  21
98  1
99  ST-  10
100  DSE  10
101  GTO  02
102  RCL  11
103  X=0?
104  GTO  04
105  SF  07

106◆LBL  03
107  FS?  07
108  XEQ  05
109  RCL  12
```

```
110 RCL 11
111 RCL 05
112 LN
113 2
114 LN
115 /
116 Y↑X
117 *
118 ST+ 21
119 FS? 07
120 STO-12
121 1
122 ST- 11
123 CF 07
124 DSE 11
125 GTO 03

126◆LBL 04
127 RCL 21
128 STO 19
129 RCL 04
130 +
131 RCL 02
132 RCL 03
133 +
134 +
135 STO 36        CUR $ TOTAL RDT&E AIRFRAME
136 FS? 01
137 RCL 48
138 FS? 03
139 RCL 51
140 FS? 02
141 RCL 50
142 STO 50        RECALL AVIONICS UPC
143 1 E-06
144 *
145 STO 10        ADJUST FOR INS AND ECM
146 "INS?"
147 PROMPT
148 ASTO Y
149 "N"
150 ASTO X
151 X=Y?
152 GTO 20
153 RCL 10
154 .255
155 Y↑X
156 RCL 59
157 .232
158 Y↑X
159 *
160 2.718
161 *
162 GTO 21
```

```
163◆LBL 20
164 RCL 10
165 1.67
166 *

167◆LBL 21
168 .387
169 Y↑X
170 RCL 67
171 .731
172 Y↑X-
173 *
174 6.53
175 *
176 STO 11
177 RCL 77
178 1
179 X=Y?
180 XEQ "32"

181◆LBL "HI"
182 RCL 11
183 STO 12

184◆LBL "IH"
185 RCL 11
186 RCL 12
187 +
188 1 E06
189 *
190 STO 39          RDT&E AVIONICS
191 XEQ "11"
192 1.111
193 RCL 38
194 Y↑X
195 *
196 STO 13          FIRST HALF OF ENGINE COSTS
197 .9
198 LN
199 2
200 LN
201 /
202 STO 31
203 RCL 67
204 RCL 75
205 *
206 STO 17
207 "SPFAC?"
208 PROMPT
209 *
210 STO 16
211 0
212 STO 21
213 "RΣD LR
```

108

```
                EN?"
214  PROMPT
215  LN
216  2
217  LN
218  /
219  STO  02

220*LBL  10
221  RCL  49
222  1 E-06
223  *
224  RCL  17
225  RCL  02
226  Y↑X
227  *
228  ST+  21
229  DSE  17
230  GTO  10
231  RCL  21
232  RCL  67
233  RCL  75
234  *
235  /
236  RCL  16
237  *
238  1.5
239  *
240  STO  17        SECOND HALF OF ENGINE FORMULA
241  RCL  13
242  +
243  "ENIF?"
244  PROMPT
245  *
246  1 E06
247  *
248  STO  37        CUR $ RDT&E ENGINES
249  "RDP"
250  PCLPS          CLEAR PROGRAM

251*LBL  01          WORKING LABELS SUBPROGRAM
252  RCL  67
253  RCL  10
254  -
255  STO  11
256  GTO  02

257*LBL  00
258  12
259  STO  10
260  GTO  06

261*LBL  05
262  RCL  19
```

```
263 STO 12
264 RTN
265 .END.
 01◆LBL  "OUT        RDT&E AND PRODUCTION OUTPUT PROGRAM
              "
 02 RCL 52
 03 RCL 67
 04 -                 # OF PRODUCTION AIRCRAFT
 05 STO 15
 06 "L3"             GET WORKING LABELS
 07 GETSUB
 08 "L4"
 09 GETSUB
 10 "T"
 11 GETSUB
 12 RCL 36
 13 .1
 14 *
 15 ST+ 36           INTEGRATED LOGISTICS SUPPORT
 16 RCL 36
 17 "AFM"
 18 XEQ "O"          AIRFRAME RDT&E
 19 RCL 39
 20 "AV"
 21 XEQ "O"          AVIONICS RDT&E
 22 RCL 37
 23 "EN"
 24 XEQ "O"          ENGINE RDT&E
 25 XEQ "35"
 26 RCL 36
 27 "%GΣA?"
 28 PROMPT
 29 STO 05
 30 *
 31 PRX             GENERAL AND ADMINISTRATIVE RDT&E
 32 STO 06
 33 +
 34 RCL 05
 35 1
 36 +
 37 RCL 06
 38 *
 39 "%PR?"
 40 PROMPT
 41 STO 07
 42 *
 43 RCL 05
 44 /
 45 PRX             PROFIT RDT&E
 46 +
 47 "RΣD"
 48 XEQ "O"         TOTAL RDT&E
 49 RCL 33
```

110

```
50   RCL  29
51   1 E06
52   *
53   +
54   100
55   "LR  SUB"
56   XEQ  56
57   STO  31
58   Y↑X
59   /
60   STO -18
61   XEQ  "T"
62   STO  02
63   "SUB  PRD
            "
64   XEQ  "O"          SUBSYSTEM PRODUCTION
65   RCL  53
66   STO  18
67   "LR  AF"
68   XEQ  56
69   STO  31
70   XEQ  "T"
71   STO  03
72   "AF  PRD"
73   XEQ  "O"          AIRFRAME PRODUCTION
74   RCL  50
75   STO  18
76   "LR  AV"
77   XEQ  56
78   STO  31
79   XEQ  "T"
80   STO  04
81   "AV  PRD"
82   XEQ  "O"          AVIONICS PRODUCTION
83   RCL  49
84   STO  18
85   RCL  15
86   4
87   *
88   STO  15
89   "LR  EN"
90   XEQ  56
91   STO  31
92   XEQ  "T"
93   STO  08
94   "EN  PRD"
95   XEQ  "O"          ENGINE PRODUCTION
96   RCL  02
97   RCL  03
98   RCL  04
99   RCL  08
100  XEQ  "34"
101  RCL  02
102  RCL  03
```

111

```
103 +
104 RCL 04
105 2
106 /
107 +
108 RCL 05
109 *
110 STO 06
111 "GΣA"
112 XEQ "O"          GENERAL AND ADMINISTRATIVE PRODUCTION
113 +
114 RCL 05
115 1
116 +
117 RCL 06
118 *
119 RCL 07
120 *
121 RCL 05
122 /
123 "PROF"
124 XEQ "O"          PROFIT PRODUCTION
125 +
126 "TOT PRD
              "
127 XEQ "O"          TOTAL PRODUCTION
128 "OUT"
129 PCLPS            CLEAR PROGRAM

130◆LBL 56           WORKING LABELS SUBPROGRAM
131 "⊢?"
132 PROMPT
133 LN
134 2
135 LN
136 /
137 RTN
138 .END.
                     INITIAL SUPPORT
 01◆LBL "ISD         INPUT DATA FIRST SUBPROGRAM IS
              "
 02 190              SET STORAGE REGISTER SIZE
 03 PSIZE
 04 XEQ "R"
 05 "L1"             GET WORKING LABELS
 06 GETSUB
 07 2.083            INPUT DATA
 08 XEQ "15"
 09 .704
 10 XEQ "15"
 11 -2.489
 12 XEQ "15"
 13 2.906 E-
              03
```

112

```
14 XEQ "15"
15 RCL 57
16 XEQ "18"
17 "≠B"
18 XEQ "16"
19 STO 40
20 RCL 98
21 XEQ "18"
22 .691
23 XEQ "15"
24 .923
25 XEQ "15"
26 1.068 E0
            3
27 XEQ "15"
28 RCL 57
29 XEQ "18"
30 RCL 81
31 XEQ "18"
32 1.896
33 XEQ "15"
34 1.92
35 XEQ "15"
36 1.095 E-
           04
37 XEQ "15"
38 RCL 57
39 XEQ "18"
40 RCL 81
41 XEQ "18"
42 1.156
43 XEQ "15"
44 .286
45 XEQ "15"
46 .195
47 XEQ "15"
48 RCL 87
49 XEQ "18"
50 RCL 70
51 XEQ "18"
52 .639
53 XEQ "15"
54 1.829
55 XEQ "15"
56 1.364
57 XEQ "15"
58 -1.29
59 XEQ "15"
60 1.205 E-
           06
61 XEQ "15"
62 RCL 87
63 XEQ "18"
64 RCL 88
```

113

```
65 XEQ "18"
66 RCL 59
67 XEQ "18"
68 RCL 98
69 XEQ "18"
70 1.196
71 XEQ "15"
72 2.684
73 XEQ "15"
74 289.89
75 XEQ "15"
76 RCL 70
77 XEQ "18"
78 RCL 81
79 XEQ "18"
80 1.294
81 XEQ "15"
82 .723
83 XEQ "15"
84 .53
85 XEQ "15"
86 RCL 69
87 XEQ "18"
88 RCL 63
89 XEQ "18"
90 .39
91 XEQ "15"
92 2.28
93 XEQ "15"
94 2.296
95 XEQ "15"
96 76.73
97 XEQ "15"
98 RCL 69
99 XEQ "18"
100 RCL 65
101 XEQ "18"
102 RCL 98
103 XEQ "18"
104 .667
105 XEQ "15"
106 1.112
107 XEQ "15"
108 -2.602
109 XEQ "15"
110 5.399
111 XEQ "15"
112 RCL 69
113 XEQ "18"
114 RCL 64
115 XEQ "18"
116 RCL 98
117 XEQ "18"
118 1.868
```

```
119 XEQ "15"
120 .299
121 XEQ "15"
122 .506
123 XEQ "15"
124 RCL 82
125 XEQ "18"
126 RCL 79
127 XEQ "18"
128 .692
129 XEQ "15"
130 .619
131 XEQ "15"
132 -2.159
133 XEQ "15"
134 1.227 E0
                4
135 XEQ "15"
136 RCL 79
137 XEQ "18"
138 RCL 81
139 XEQ "18"
140 RCL 98
141 XEQ "18"
142 .92
143 XEQ "15"
144 1.6
145 XEQ "15"
146 73.374
147 XEQ "15"
148 RCL 79
149 XEQ "18"
150 RCL 81
151 XEQ "18"
152 -.654
153 XEQ "15"
154 .982
155 XEQ "15"
156 6.966
157 XEQ "15"
158 2.402 E-
                02
159 XEQ "15"
160 RCL 80
161 XEQ "18"
162 RCL 49
163 .4966
164 *
165 XEQ "18"
166 RCL 98
167 XEQ "18"
168 RCL 75
169 XEQ "18"
170 1.834
```

```
171 XEQ "15"
172 4.779
173 XEQ "15"
174 -8.759
175 XEQ "15"
176 621.79
177 XEQ "15"
178 RCL 75
179 XEQ "18"
180 RCL 78
181 1
182 +
183 XEQ "18"
184 RCL 98
185 XEQ "18"
186 "ISD"              CLEAR PROGRAM
187 PCLPS
188 .END.
 01◆LBL "ISP           EXECUTE FIRST SUBPROGRAM
               "
 02 XEQ "R"
 03 "L2"              GET WORKING LABELS
 04 GETSUB
 05 "L3"
 06 GETSUB
 07 "26"
 08 GETSUB
 09 FS? 02            SELECT SQUADRON MULTIPLES BY
 10 XEQ 51            TYPE AIRCRAFT
 11 XEQ 52
                      STRUCTURE
 12◆LBL 53
 13 XEQ "7"           INITIAL AND PIPELINE SPARES
 14 RCL 52
 15 STO 30
 16 *
 17 STO 15            I&PS STORE
 18 XEQ "9"           BASE LEVEL SUPPORT EQUIPMENT
 19 STO 08
 20 XEQ "26"
 21 ST+ 15            BLS STORE
 22 XEQ "9"           DATA
 23 XEQ "54"
 24 ST+ 15            D STORE
 25 XEQ "9"           CREW
 26 XEQ "55"
 27 STO 17            I&PS
 28 XEQ "11"
 29 STO 08
 30 XEQ "26"
 31 ST+ 17            BLS
 32 XEQ "9"
 33 XEQ "54"
 34 ST+ 17            D          116
```

```
35  XEQ  "9"          LANDING GEAR
36  XEQ  "55"
37  STO  19           I&PS
38  XEQ  "7"
39  STO  08
40  XEQ  "26"
41  ST+  19           BLS
42  XEQ  "7"
43  XEQ  "54"
44  ST+  19           D
45  XEQ  "9"          FLIGHT CONTROLS
46  XEQ  "55"
47  STO  21           I&PS
48  XEQ  "7"
49  STO  08
50  XEQ  "26"
51  ST+  21           BLS
52  XEQ  "9"
53  XEQ  "54"
54  ST+  21           D
55  XEQ  "7"          ENGINE INSTALLATION
56  RCL  IND
         01
57  *
58  XEQ  "55"
59  STO  23           I&PS
60  XEQ  "17"
61  XEQ  "7"
62  XEQ  "54"
63  ST+  23           D
64  "ISP"
65  PCLPS             CLEAR PROGRAM

66◆LBL  51            WORKING LABELS SUBPROGRAM
67  1.587
68  STO  02
69  2.158
70  STO  03
71  GTO  53

72◆LBL  52
73  1.263
74  STO  02
75  1.527
76  STO  03
77  RTN
78  .END.
01◆LBL  "Y"           SECOND SUBPROGRAM DATA
02  XEQ  "R"
03  "L1"              GET WORKING LABELS
04  GETSUB
05  .106              INPUT DATA
06  XEQ  "15"
07  3.932                        117
```

```
08 XEQ "15"
09 6.249 E-
         06
10 XEQ "15"
11 RCL 94
12 XEQ "18"
13 RCL 82
14 XEQ "18"
15 .311
16 XEQ "15"
17 1.136
18 XEQ "15"
19 2.96 E04
20 XEQ "15"
21 RCL 94
22 XEQ "18"
23 RCL 81
24 XEQ "18"
25 2.482
26 XEQ "15"
27 1.086
28 XEQ "15"
29 -5.365
30 XEQ "15"
31 2.687 E-
         04
32 XEQ "15"
33 RCL 82
34 XEQ "18"
35 RCL 60
36 XEQ "18"
37 RCL 98
38 XEQ "18"
39 .2
40 XEQ "15"
41 2.251
42 XEQ "15"
43 7.863 E-
         02
44 XEQ "15"
45 RCL 58
46 XEQ "18"
47 RCL 82
48 XEQ "18"
49 .102
50 XEQ "15"
51 .639
52 XEQ "15"
53 4.081 E0
         5
54 XEQ "15"
55 RCL 58
56 XEQ "18"
57 RCL 81
```

118

```
 58  XEQ "18"
 59  .805
 60  XEQ "15"
 61  1.24
 62  XEQ "15"
 63  -3.758
 64  XEQ "15"
 65  2.528
 66  XEQ "15"
 67  RCL 58
 68  XEQ "18"
 69  RCL 60
 70  XEQ "18"
 71  RCL 98
 72  XEQ "18"
 73  .892
 74  XEQ "15"
 75  1.432
 76  XEQ "15"
 77  3.566
 78  XEQ "15"
 79  .173
 80  XEQ "15"
 81  RCL 82
 82  XEQ "18"
 83  RCL 72
 84  XEQ "18"
 85  RCL 98
 86  XEQ "18"
 87  1.088
 88  XEQ "15"
 89  .7
 90  XEQ "15"
 91  .107
 92  XEQ "15"
 93  21.654
 94  XEQ "15"
 95  RCL 64
 96  XEQ "18"
 97  RCL 72
 98  XEQ "18"
 99  RCL 82
100  XEQ "18"
101  .723
102  XEQ "15"
103  1.106
104  XEQ "15"
105  1.327
106  XEQ "15"
107  .378
108  XEQ "15"
109  RCL 82
110  XEQ "18"
111  RCL 72
```

```
112 XEQ "18"
113 RCL 81
114 XEQ "18"
115 .172
116 XEQ "15"
117 1.463
118 XEQ "15"
119 7.615 E-
             05
120 XEQ "15"
121 RCL 71
122 XEQ "18"
123 RCL 84
124 XEQ "18"
125 .962
126 XEQ "15"
127 -5.54
128 XEQ "15"
129 2.057
130 XEQ "15"
131 RCL 87
132 XEQ "18"
133 RCL 98
134 XEQ."18"
135 .743
136 XEQ "15"
137 .853
138 XEQ "15"
139 2.872 E0
             4
140 XEQ "15"
141 RCL 75
142 XEQ "18"
143 RCL 98
144 XEQ "18"
145 1.502
146 XEQ "15"
147 1.279
148 XEQ "15"
149 .796
150 XEQ "15"
151 RCL 73
152 XEQ "18"
153 RCL 82
154 XEQ "18"
155 2.411
156 XEQ "15"
157 1.182
158 XEQ "15"
159 9.511 E-
             08
160 XEQ "15"
161 RCL 62
162 XEQ "18"
```

```
163 RCL 73
164 XEQ "18"
165 1.432
166 XEQ "15"
167 .305
168 XEQ "15"
169 9.464 E-
        05
170 XEQ "15"
171 RCL 62
172 XEQ "18"
173 RCL 73
174 XEQ "18"
175 "Y"                    CLEAR PROGRAM
176 PCLPS
177 .END.
 01◆LBL "YP"               EXECUTE SECOND SUBPROGRAM
 02 XEQ "R"
 03 "L2"                   GET WORKING LABELS
 04 GETSUB
 05 "26"
 06 GETSUB
 07 XEQ "9"                ENVIRONMENTAL CONTROL SYSTEM
 08 XEQ 55
 09 STO 25                 I&PS
 10 XEQ "9"
 11 STO 08
 12 XEQ "26"
 13 ST+ 25                 BLS
 14 XEQ "7"
 15 XEQ 54
 16 ST+ 25                 D
 17 XEQ "9"                ELECTRICAL
 18 XEQ 55
 19 STO 26                 I&PS
 20 XEQ "9"
 21 STO 08
 22 XEQ "26"
 23 ST+ 26                 BLS
 24 XEQ "7"
 25 XEQ 54
 26 ST+ 26                 D
 27 XEQ "7"                HYDRAULIC
 28 XEQ 55
 29 STO 27                 I&PS
 30 XEQ "7"
 31 STO 08
 32 XEQ "26"
 33 ST+ 27                 BLS
 34 XEQ "7"
 35 XEQ 54
 36 ST+ 27                 D
 37 XEQ "9"                FUEL
 38 XEQ 55                          121
```

```
39  STO  29          I&PS
40  XEQ  "9"
41  XEQ  54
42  ST+  29          D
43  XEQ  "9"
44  STO  08
45  XEQ  "26"
46  ST+  29          BLS
47  XEQ  "9"          ARMAMENT
48  XEQ  55
49  STO  31          I&PS
50  XEQ  "9"
51  STO  08
52  XEQ  "26"
53  ST+  31          BLS
54  XEQ  "9"
55  XEQ  54
56  ST+  31          D
57  RCL  32          CARGO HANDLING
58  1 E06
59  *
60  STO  45          RECALL UPC
61  .025
62  *   .
63  XEQ  "55"
64  STO  32          I&PS
65  RCL  45
66  .02
67  *
68  STO  08
69  XEQ  "26"
70  ST+  32          BLS
71  RCL  45
72  .01
73  *
74  XEQ  "54"
75  ST+  32          D
76  RCL  33          APU
77  STO  45
78  .06
79  *
80  XEQ  "55"
81  STO  33          I&PS
82  RCL  45
83  .01
84  *
85  STO  08
86  XEQ  "26"
87  ST+  33          BLS
88  RCL  45
89  .01
90  *
91  XEQ  "54"
92  ST+  33          D        122
```

```
93  "YP"
94  PCLPS              CLEAR PROGRAM

95♦LBL 54              WORKING LABELS SUBPROGRAM
96  1000
97  *
98  RTN

99♦LBL 55
100 RCL 30
101 *
102 RTN
103 .END.
01♦LBL "AV"            THIRD SUBPROGRAM DATA
02  XEQ "R"
03  "L1"               GET WORKING LABEL
04  GETSUB
05  2                  INPUT DATA
06  XEQ "15"
07  2
08  XEQ "15"
09  -.86
10  XEQ "15"
11  56.414
12  XEQ "15"
13  RCL 96
14  XEQ "18"
15  RCL 97
16  XEQ "18"
17  RCL 98
18  XEQ "18"
19  1.491
20  XEQ "15"
21  .87
22  XEQ "15"
23  1.509
24  XEQ "15"
25  1.044 E-
          03
26  XEQ "15"
27  RCL 96
28  XEQ "18"
29  "≠DAYS"
30  XEQ "16"
31  RCL 64
32  XEQ "18"
33  2.06
34  XEQ "15"
35  -2.353
36  XEQ "15"
37  1.538 E-
          03
38  XEQ "15"
39  RCL 96                          123
```

```
40 XEQ "18"
41 RCL 98
42 XEQ "18"
43 .755
44 XEQ "15"
45 -.429
46 XEQ "15"
47 .384
48 XEQ "15"
49 5.278 E0
           5
50 XEQ "15"
51 "ENTWR"
52 XEQ "16"
53 RCL 95
54 XEQ "18"
55 RCL 90
56 XEQ "18"
57 1.477
58 XEQ "15"
59 5.619
60 XEQ "15"
61 -.8217
62 XEQ "15"
63 2.268 E-
          17
64 XEQ "15"
65 RCL 81
66 XEQ "18"
67 "TIT"
68 XEQ "16"
69 RCL 98
70 XEQ "18"
71 2.002
72 XEQ "15"
73 3.425
74 XEQ "15"
75 2.034 E-
          09
76 XEQ "15"
77 RCL 63
78 XEQ "18"
79 RCL 88
80 XEQ "18"
81 "AV"
82 PCLPS         CLEAR PROGRAM
83 .END.
01◆LBL "AVP      EXECUTE THIRD SUBPROGRAM
        "
02 180           SET STORAGE REGISTER SIZE
03 PSIZE
04 XEQ "R"
05 "L2"          GET WORKING LABELS
06 GETSUB
```

124

```
07  "26"
08  GETSUB
09  "L4"
10  GETSUB
11  XEQ  "12"        AVIONICS
12  XEQ  "12"
13  +
14  .586
15  Y↑X
16  XEQ  "13"
17  XEQ  "14"
18  XEQ  55
19  STO  46          I&PS
20  XEQ  "7"
21  STO  08
22  XEQ  "26"
23  ST+  46          BLS
24  XEQ  "9"
25  XEQ  54
26  ST+  46          D
27  RCL  30          ENGINE
28  RCL  75
29  *                # OF PRODUCTION AIRCRAFT ENGINES
30  RCL  49
31  .4966
32  *                FIRST ENGINE COST
33  .25
34  *
35  *
36  STO  45          I&PS
37  XEQ  "7"
38  RCL  75
39  *
40  STO  08
41  XEQ  "26"
42  ST+  45          BLS
43  XEQ  "7"
44  XEQ  54
45  ST+  45          D
46  XEQ  "9"          INITIAL TRAINING
47  RCL  97
48  1000
49  /
50  1.712
51  Y↑X
52  *
53  XEQ  54
54  FS?  01
55  GTO  d
56  2.5              CARGO MULTIPLE
57  *

58◆LBL  d
59  STO  35          IT
```
125

```
60  FS? 02          IF CARGO SKIP
61  GTO e

62♦LBL "SSE        SPECIAL SUPPORT EQUIPMENT
         "
63  RCL 82
64  1.349
65  Y↑X
66  998.18
67  *
68  RCL 52
69  RCL 67
70  -
71  "≠A/S"
72  PROMPT
73  /
74  *
75  STO 36          SSE

76♦LBL e
77  FS? 01          ZERO UNUSED REGISTERS BY AIRCRAFT TYPE
78  XEQ 56
79  FS? 02
80  XEQ 57
81  "IS"            INITIAL SUPPORT OUTPUT
82  PRA
83  "STR"
84  RCL 15
85  XEQ "O"         STRUCTURE
86  "CR"
87  RCL 17
88  ST+ 15
89  XEQ "O"         CREW
90  "LG"
91  RCL 19
92  ST+ 15
93  XEQ "O"         LANDING GEAR
94  "FC"
95  RCL 21
96  ST+ 15
97  XEQ "O"         FLIGHT CONTROLS
98  "EI"
99  RCL 23
100 ST+ 15
101 XEQ "O"         ENGINE INSTALLATION
102 "ECS"
103 RCL 25
104 ST+ 15
105 XEQ "O"         ENVIRONMENTAL CONTROL SYSTEM
106 "EL"
107 RCL 26
108 ST+ 15
109 XEQ "O"         ELECTRICAL
110 "HYD"
```

126

```
111  RCL 27
112  ST+ 15
113  XEQ "O"        HYDRAULIC
114  "FUEL"
115  RCL 29
116  ST+ 15
117  XEQ "O"        FUEL
118  "CH"
119  RCL 32
120  ST+ 15
121  XEQ "O"        CARGO HANDLING
122  "ARM"
123  RCL 31
124  ST+ 15
125  XEQ "O"        ARMAMENT
126  "APU"
127  RCL 33
128  ST+ 15
129  XEQ "O"        APU
130  "%GΣA?"
131  PROMPT
132  STO 02
133  RCL 15
134  RCL 46
135  +
136  *
137  STO 03
138  ST+ 15
139  "GΣA"
140  XEQ "O"        GENERAL AND ADMINISTRATIVE
141  RCL 02
142  1
143  +
144  RCL 03
145  *
146  "%PROF?"
147  PROMPT
148  *
149  RCL 02
150  /
151  ST+ 15
152  "PROF"
153  XEQ "O"        PROFIT
154  "SSE"
155  RCL 36
156  ST+ 15
157  XEQ "O"        SPECIAL SUPPORT EQUIPMENT
158  "IT"
159  RCL 35
160  ST+ 15
161  XEQ "O"        INITIAL TRAINING
162  "EN"
163  RCL 45
164  ST+ 15                      127
```

```
165  XEQ  "O"        ENGINE
166  "AV"
167  RCL  46
168  ST+  15
169  XEQ  "O"        AVIONICS
170  "TOT IS"
171  RCL  15
172  XEQ  "O"        TOTAL INITIAL SPARES
173  "AVP"
174  PCLPS           CLEAR PROGRAM

175◆LBL  54          WORKING LABELS SUBPROGRAM
176  1000
177  *
178  RTN

179◆LBL  55
180  RCL  30
181  *
182  RTN

183◆LBL  56
184  0
185  STO-32
186  STO  33
187  RTN

188◆LBL  57
189  0
190  STO  31
191  STO  36
192  RTN
193  .END.
```

```
01◆LBL "OSD         CARGO OPERATIONS AND SUPPORT
         "          FIRST SUBPROGRAM DATA
02 XEQ "P"
03 "L1"             GET WORKING LABELS
04 GETSUB
05 RCL 74           INPUT DATA
06 XEQ "18"
07 1.691
08 XEQ "15"
09 RCL 92
10 XEQ "18"
11 8.966 E-
            02
12 XEQ "15"
13 RCL 56
14 XEQ "18"
15 2.339 E-
            02
16 XEQ "15"
17 14.421
18 XEQ "15"
19 RCL 76
20 XEQ "18"
21 6.425 E-
            02
22 XEQ "15"
23 "MLD"
24 XEQ "16"
25 STO 03
26 .613 E-0
            3
27 XEQ "15"
28 1.956
29 XEQ "15"
30 RCL 74
31 XEQ "18"
32 .401
33 XEQ "15"
34 RCL 85
35 XEQ "18"
36 4.648
37 XEQ "15"
38 RCL 55
39 XEQ "18"
40 .148
41 XEQ "15"
42 -.856
43 XEQ "15"
44 RCL 91
45 XEQ "18"
46 1.505 E-
            03
47 XEQ "15"
48 "CSW"
49 XEQ "16"            129
```

```
50  XEQ "18"
51  2.915 E-
           03
52  XEQ "15"
53  24.28
54  XEQ "15"
55  RCL 56
56  XEQ "18"
57  .367 E-0
           3
58  XEQ "15"
59  4.286 E-
           04
60  XEQ "15"
61  .419
62  XEQ "15"
63  "≠PCP"
64  XEQ "16"
65  RCL 61
66  XEQ "18"
67  RCL 85
68  XEQ "18"
69  3.523
70  XEQ "15"
71  1.927
72  XEQ "15"
73  -8.698
74  XEQ "15"
75  4.329 E-
           02
76  XEQ "15"
77  RCL 69
78  XEQ "18"
79  2.096
80  XEQ "15"
81  "MVSQ"
82  XEQ "16"
83  2.357 E-
           09
84  XEQ "15"
85  RCL 56
86  XEQ "18"
87  2.356 E-
           02
88  XEQ "15"
89  10.917
90  XEQ "15"
91  RCL 83
92  1 E-03
93  *
94  RCL 69
95  /
96  XEQ "18"
97  RCL 56
98  XEQ "18"
```

130

```
 99 2.31
100 XEQ "15"
101 -1.32
102 XEQ "15"
103 22.931
104 XEQ "15"
105 RCL 83
106 1 E-03
107 *
108 RCL 69
109 /
110 XEQ "18"
111 RCL 03
112 1 E-03
113 *
114 XEQ "18"
115 "≠LGB"
116 XEQ "16"
117 1.989
118 XEQ "15"
119 -2.274
120 XEQ "15"
121 .348
122 XEQ "15"
123 .131
124 XEQ "15"
125 RCL 99
126 XEQ "18"
127 .133
128 XEQ "15"
129 RCL 56
130 XEQ "18"
131 6.41 E-0
            3
132 XEQ "15"
133 3.469
134 XEQ "15"
135 RCL 76
136 XEQ "18"
137 .974 E-0
            2
138 XEQ "15"
139 RCL 85
140 XEQ "18"
141 .094
142 XEQ "15"
143 .28
144 XEQ "15"
145 RCL 62
146 1 E-03
147 *
148 XEQ "18"
149 "MAL"
150 PROMPT
151 1 E-03
```

```
152  *
153  XEQ  "18"
154  RCL  56
155  XEQ  "18"
156  .239
157  XEQ  "15"
158  1.756
159  XEQ  "15"
160  -.515
161  XEQ  "15"
162  2.898 E-
               03
163  XEQ  "15"
164  "OSD"
165  PCLPS          CLEAR PROGRAM
166  .END.
01◆LBL  "OSP        EXECUTE FIRST SUBPROGRAM
         "
02  XEQ  "R"
03  "L2"             GET WORKING LABELS
04  GETSUB
05  "L3"
06  GETSUB
07  "L5"
08  GETSUB
09  RCL  30          NUMBER OF AIRCRAFT SUPPORTED
10  "%SUP?"
11  PROMPT
12  STO  30
13  *
14  STO  30
15  XEQ  "44"        STRUCTURE
16  STO  17          BASE LEVEL MAINTENANCE
17  XEQ  "48"
18  STO  51          REPLENISHMENT SPARES
19  XEQ  "47"
20  STO  48          DEPOT COMPONENT REPAIR
21  XEQ  "48"        CREW
22  ST+  17          BLM
23  XEQ  "46"
24  ST+  51          RS
25  XEQ  "7"
26  ST+  48          DCR
27  XEQ  "44"        LANDING GEAR
28  "≠L/M?"
29  PROMPT
30  RCL  43
31  *
32  *
33  RCL  30
34  *
35  STO  04          BLM
36  XEQ  "9"
37  ST+  51          RS          132
38  XEQ  "7"
```

```
39  ST+  48        DCR
40  XEQ  "39"      FLIGHT CONTROLS
41  XEQ  "39"
42  -
43  XEQ  "41"
44  ST+  17        BLM
45  XEQ  "48"
46  ST+  51        RS
47  XEQ  "7"
48  ST+  48        DCR
49  "OSP"
50  PCLPS          CLEAR PROGRAM
51  .END.
01+LBL  "APU       SECOND SUBPROGRAM DATA
        "
02  XEQ  "R"
03  "L1"           GET WORKING LABELS
04  GETSUB
05  "L4"
06  GETSUB
07  RCL  87        INPUT DATA
08  XEQ  "18"
09  2.767 E-
           04
10  XEQ "15"
11  RCL  56
12  XEQ  "18"
13  3.63 E-0
           3
14  XEQ  "15"
15  3.868
16  XEQ  "15"
17  RCL  78
18  XEQ  "18"
19  41.73
20  XEQ  "15"
21  RCL  91
22  XEQ  "18"
23  1.257 E-
           04
24  XEQ  "15"
25  41.998
26  XEQ  "15"
27  RCL  78
28  XEQ  "18"
29  RCL  56
30  XEQ  "18"
31  "APUW"
32  PROMPT
33  1 E-03
34  *
35  XEQ  "18"
36  3.785
37  XEQ  "15"
38  -.534
```

```
39 XEQ "15"
40 .704
41 XEQ "15"
42 27.025
43 XEQ "15"
44 RCL 61
45 XEQ "18"
46 .124
47 XEQ "15"
48 RCL 74
49 XEQ "18"
50 .465
51 XEQ "15"
52 RCL 56
53 XEQ "18"
54 9.96 E-0
             3
55 XEQ "15"
56 2.629
57 XEQ "15"
58 "ECSW"
59 PROMPT
60 RCL 87
61 /
62 XEQ "18"
63 21.037
64 XEQ "15"
65 RCL 56
66 XEQ "18"
67 1.866 E-
             03
68 XEQ "15"
69 .468
70 XEQ "15"
71 "CT"
72 PROMPT
73 RCL 75
74 "PCP"
75 PROMPT
76 XEQ "35"
77 XEQ "18"
78 4.507
79 XEQ "15"
80 RCL 85
81 XEQ "18"
82 8.434
83 XEQ "15"
84 .78
85 XEQ "15"
86 RCL 92
87 XEQ "18"
88 3.392 E-
             02
89 XEQ "15"          134
90 RCL 85
```

```
 91  XEQ "18"
 92  5.027
 93  XEQ "15"
 94  RCL 56
 95  XEQ "18"
 96  2.764 E-
             02
 97  XEQ "15"
 98  12.77
 99  XEQ "15"
100  "≠G"
101  XEQ "16"
102  STO 09
103  6.468
104  XEQ "15"
105  RCL 58
106  XEQ "18"
107  3.375 E-
             02
108  XEQ "15"
109  34.368
110  XEQ "15"
111  RCL 58
112  XEQ "18"
113  3.516 E-
             02
114  XEQ "15"
115  RCL 09
116  XEQ "18"
117  1.555
118  XEQ "15"
119  RCL 56
120  XEQ "18"
121  1.17 E-0
              2
122  XEQ "15"
123  6.018
124  XEQ "15"
125  RCL 75
126  XEQ "18"
127  8.442
128  XEQ "15"
129  RCL 85
130  XEQ "18"
131  4.853
132  XEQ "15"
133  RCL 56
134  XEQ "18"
135  3.123 E-
             02
136  XEQ "15"
137  3.26
138  XEQ "15"
139  RCL 62
140  XEQ "18"
```

```
141  1.639 E-
             05
142  XEQ "15"
143  RCL 85
144  XEQ "18"
145  1.977
146  XEQ "15"
147  4.707
148  XEQ "15"
149  RCL 62
150  XEQ "18"
151  3.912 E-
             05
152  XEQ "15"
153  RCL 75
154  XEQ "18"
155  1.658
156  XEQ "15"
157  RCL 85
158  XEQ "18"
159  4.568
160  XEQ "15"
161  8.978
162  XEQ "15"
163  "APU"
164  PCLPS          CLEAR PROGRAM
165  .END.
01♦LBL "APU         EXECUTE SECOND SUBPROGRAM
            P"
02  XEQ "R"
03  "L2"            GET WORKING LABELS
04  GETSUB
05  "L5"
06  GETSUB
07  XEQ "48"        AUXILLIARY POWER UNIT
08  ST+ 17          BLM
09  XEQ "46"
10  ST+ 51          RS
11  XEQ "7"
12  ST+ 48          DCR
13  XEQ "44"        ENVIRONMENTAL CONTROL
14  ST+ 17          BLM
15  XEQ "48"
16  ST+ 51          RS
17  XEQ "48"
18  ST+ 48          DCR
19  XEQ "44"        ELECTRICAL
20  ST+ 17          BLM
21  XEQ "46"
22  ST+ 51          RS
23  XEQ "44"
24  ST+ 48          DCR
25  XEQ "44"        ENGINE INSTALLATION
26  ST+ 17          BLM
```

```
27  XEQ  "48"
28  ST+  51          RS
29  XEQ  "44"
30  ST+  48          DCR
31  "APUP"
32  PCLPS            CLEAR SUBPROGRAM
33  .END.

01♦LBL  "HYD         THIRD SUBPROGRAM DATA
        "
02  XEQ  "R"
03  186
04  PSIZE            SET STORAGE REGISTER SIZE
05  "L1"             GET WORKING LABEL
06  GETSUB
07  "≠HP"            INPUT DATA
08  XEQ  "16"
09  STO  11
10  8.486
11  XEQ  "15"
12  RCL  76
13  XEQ  "18"
14  .882
15  XEQ  "15"
16  RCL  56
17  XEQ  "18"
18  5.111  E-
              02
19  XEQ  "15"
20  9.425
21  XEQ  "15"
22  "≠HSPS"
23  PROMPT
24  RCL  72
25  +
26  XEQ  "18"
27  .881
28  XEQ  "15"
29  RCL  56
30  XEQ  "18"
31  1.233  E-
              02
32  XEQ  "15"
33  .528
34  XEQ  "15"
35  "≠ATM"
36  XEQ  "16"
37  10.59
38  XEQ  "15"
39  "≠PTU"
40  XEQ  "16"
41  1.48
42  XEQ  "15"
43  RCL  78
44  XEQ  "18"
```

137

```
45  17.504
46  XEQ "15"
47  RCL 56
48  XEQ "18"
49  1.946 E-
            02
50  XEQ "15"
51  RCL 86
52  XEQ "18"
53  .513
54  XEQ "15"
55  7.058
56  XEQ "15"
57  "FUSW"
58  XEQ "16"
59  4.001 E-
            05
60  XEQ "15"
61  "≠FUBP?"
62  PROMPT
63  STO 12
64  RCL 86
65  +
66  XEQ "18"
67  5.043 E-
            02
68  XEQ "15"
69  .872
70  XEQ "15"
71  RCL 86
72  RCL 12
73  +
74  XEQ "18"
75  .214
76  XEQ "15"
77  RCL 56
78  XEQ "18"
79  3.73 E-0
            3
80  XEQ "15"
81  RCL 85
82  XEQ "18"
83  2.574
84  XEQ "15"
85  8.097
86  XEQ "15"
87  RCL 61
88  XEQ "18"
89  3.453 E-
            02
90  XEQ "15"
91  RCL 93
92  RCL 91
93  /
94  XEQ "18"
```

```
 95  .929
 96  XEQ "15"
 97  5.539
 98  XEQ "15"
 99  RCL 91
100  XEQ "18"
101  3.594 E-
            04
102  XEQ "15"
103  RCL 85
104  XEQ "18"
105  .484
106  XEQ "15"
107  1.491 E-
            02
108  XEQ "15"
109  RCL 83
110  XEQ "18"
111  9.65 E-0
            6
112  XEQ "15"
113  RCL 85
114  XEQ "18"
115  1.489
116  XEQ "15"
117  4.5
118  XEQ "15"
119  RCL 50
120  .4966
121  *
122  RCL 96
123  RCL 97
124  +
125  /
126  XEQ "18"
127  .107
128  XEQ "15"
129  RCL 56
130  XEQ "18"
131  .121
132  XEQ "15"
133  RCL 58
134  XEQ "18"
135  .449
136  XEQ "15"
137  73.974
138  XEQ "15"
139  RCL 50
140  .4966
141  *
142  XEQ "18"
143  3.486 E-
            05
144  XEQ "15"
145  "≠ANT"
```

```
146  XEQ "16"
147  1.198
148  XEQ "15"
149  RCL 64
150  XEQ "18"
151  .183
152  XEQ "15"
153  4.021
154  XEQ "15"
155  RCL 96
156  RCL 97
157  +
158  XEQ "18"
159  1.271 E-
             02
160  XEQ "15"
161  RCL 50
162  .4966
163  *
164  XEQ "18"
165  1.684 E-
             04
166  XEQ "15"
167  RCL 56
168  XEQ "18"
169  .109
170  XEQ "15"
171  58.813
172  XEQ "15"
173  RCL 56
174  XEQ "18"
175  130
176  XEQ "15"
177  RCL 77
178  XEQ "18"
179  50482
180  XEQ "15"
181  RCL 82
182  XEQ "18"
183  1609
184  XEQ "15"
185  486459
186  XEQ "15"
187  RCL 57
188  1 E-03
189  *
190  XEQ "18"
191  RCL 85
192  XEQ "18"
193  RCL 93
194  1 E-03
195  *
196  RCL 92
197  /
198  XEQ "18"
```

```
199  2.531
200  XEQ "15"
201  -1.861
202  XEQ "15"
203  .569
204  XEQ "15"
205  4497.4
206  XEQ "15"
207  "HYD"            CLEAR PROGRAM
208  PCLPS
209  .END.
01*LBL "HYD         EXECUTE THIRD SUBPROGRAM
          P"
02  XEQ "R"
03  "L2"             GET WORKING LABELS
04  GETSUB
05  "L4"
06  GETSUB
07  "L5"
08  GETSUB
09  XEQ "42"         HYDRAULICS/PNEUMATICS
10  XEQ "39"
11  -
12  XEQ "41"
13  ST+ 17           BLM
14  XEQ "48"
15  ST+ 51           RS
16  XEQ "42"
17  RCL 11
18  +
19  1.026
20  *
21  5.426
22  +
23  ST+ 48           DCR
24  XEQ "47"         FUEL SYSTEM
25  ST+ 17           BLM
26  XEQ "46"
27  ST+ 51           RS
28  XEQ "43"
29  XEQ "39"
30  -
31  XEQ "40"
32  ST+ 48           DCR
33  XEQ "46"         CARGO HANDLING
34  ST+ 17           BLM
35  XEQ "48"
36  ST+ 51           RS
37  XEQ "48"
38  ST+ 48           DCR
39  XEQ "47"         AVIONICS
40  ST+ 17           BLM
41  XEQ "42"
42  XEQ "39"
```

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```
43 -
44 XEQ "41"
45 ST+ 51          RS
46 XEQ "44"
47 ST+ 48          DCR
48 XEQ "42"        BASE LEVEL OPERATIONS
49 XEQ "39"
50 +
51 XEQ "41"
52 RCL 43
53 12
54 /
55 *
56 "NOAC?"
57 PROMPT
58 STO 31
59 *
60 STO 14
61 RCL 56          BASE LEVEL TRAINING
62 54.9
63 *
64 RCL 77
65 21079
66 *
67 +
68 RCL 82
69 1185
70 *
71 +
72 241567
73 -
74 RCL 43
75 12
76 /
77 *
78 RCL 31
79 *
80 STO 15
81 XEQ "7"         DEPOT AIRFRAME
82 RCL 43
83 12
84 /
85 *
86 RCL 31
87 *
88 STO 16
89 "HYDP"          CLEAR PROGRAM
90 PCLPS
91 .END.

01◆LBL "EN"        ENGINE DATA
02 XEQ "R"
03 "L1"            GET WORKING LABELS
```

```
04  GETSUB
05  RCL 98          INPUT DATA
06  XEQ "18"
07  RCL 95
08  XEQ "18"
09  RCL 75
10  XEQ "18"
11  -1.521
12  XEQ "15"
13  -.136
14  XEQ "15"
15  1
16  XEQ "15"
17  1.018 E0
              2
18  XEQ "15"
19  RCL 95
20  XEQ "18"
21  "ENTWR"
22  XEQ "16"
23  RCL 98
24  XEQ "18"
25  RCL 75
26  XEQ "18"
27  -1.322
28  XEQ  15"
29  .884
30  XEQ "15"
31  .667
32  XEQ "15"
33  1
34  XEQ "15"
35  1.348 E0
              5
36  XEQ "15"
37  RCL 95
38  XEQ "18"
39  RCL 49
40  .3499
41  *
42  XEQ "18"
43  RCL 75
44  XEQ "18"
45  -.76
46  XEQ "15"
47  .257
48  XEQ "15"
49  1
50  XEQ "15"
51  3.328 F0
              2
52  XEQ "15"
53  "EN"            CLEAR PROGRAM
54  PCLPS
55  .END.                143
```

```
01◆LBL "ENG        EXECUTE ENGINE AND OPERATIONS AND
          "        SUPPORT OUTPUT
02 XEQ "R"
03 "L2"            GET WORKING LABELS
04 GETSUB
05 "L3"
06 GETSUB
07 "L4"
08 GETSUB
09 "INF?"          INFLATION FACTOR
10 PROMPT
11 STO 02
12 RCL 17
13 XEQ "27"
14 RCL 04
15 XEQ "1"
16 +
17 STO 17          BLM IN CUR $
18 RCL 51
19 XEQ "27"
20 STO 51          RS IN CUR $
21 RCL 48
22 XEQ "27"
23 STO 48          DCR IN CUR $
24 XEQ "7"         ENGINE
25 XEQ "27"
26 ST+ 17          BLM
27 XEQ "11"
28 XEQ "27"
29 ST+ 51          RS
30 XEQ "7"
31 XEQ "27"
32 ST+ 48          DCR
33 RCL 31          PETROLEUM, OIL, AND LUBRICANTS
34 STO 30
35 "G/H?"
36 PROMPT
37 "C/G?"
38 PROMPT
39 1.05
40 *
41 *
42 XEQ "27"
43 "POL"
44 XEQ "O"         POL OUTPUT
45 RCL 17
46 STO 01
47 "BLM"
48 XEQ "O"         BLM OUTPUT
49 RCL 51
50 ST+ 01
51 "RS"
52 XEQ "O"         RS OUTPUT
53 RCL 48
54 ST+ 01                    144
```

```
55  "DCR"
56  XEQ  "O"        DCR OUTPUT
57  RCL  14
58  XEQ  "1"
59  ST+  01
60  "BLO"
61  XEQ  "O"        BLO OUTPUT
62  RCL  15
63  XEQ  "1"
64  ST+  01
65  "BLT"           BLT OUTPUT
66  XEQ  "O"
67  RCL  16
68  XEQ  "1"
69  ST+  01
70  "PDM"
71  XEQ  "O"        DEPOT AIRFRAME OUTPUT
72  RCL  17
73  RCL  48
74  +
75  .01
76  *
77  ST+  01
78  "OM:"
79  XEQ  "O"        OTHER MAINTENANCE OUTPUT
80  RCL  01
81  "TOT OΣS
          "
82  XEQ  "O"        TOTAL OPERATIONS AND SUPPORT OUTPUT
83  "ENG"
84  PCLPS           CLEAR PROGRAM
85  .END.
```

```
01◆LBL "FTR          FIGHTER OPERATIONS AND SUPPORT
        "            FIRST SUBPROGRAM DATA
02 XEQ "R"
03 "L1"              GET WORKING LABELS
04 GETSUB
05 RCL 57            INPUT DATA
06 XEQ "18"
07 RCL 56
08 XEQ "18"
09 RCL 88
10 XEQ "18"
11 1.138
12 XEQ "15"
13 -.693
14 XEQ "15"
15 2.912
16 XEQ "15"
17 1.207 E-
        04
18 XEQ "15"
19 RCL 57
20 XEQ "18"
21 RCL 62
22 XEQ. "18"
23 .518
24 XEQ "15"
25 .781
26 XEQ "15"
27 4.578 E-
        05
28 XEQ "15"
29 RCL 77
30 XEQ "18"
31 RCL 88
32 XEQ "18"
33 RCL 56
34 XEQ "18"
35 1.347
36 XEQ "15"
37 5.107
38 XEQ "15"
39 -.285
40 XEQ "15"
41 1.304 E-
        05
42 XEQ "15"
43 RCL 87
44 XEQ "18"
45 RCL 56
46 XEQ "18"
47 .306
48 XEQ "15"
49 -1.464
50 XEQ "15"
```

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```
51  2.557 E0
            3
52  XEQ "15"
53  RCL 77
54  XEQ "18"
55  RCL 64
56  XEQ "18"
57  .642
58  XEQ "15"
59  .111
60  XEQ "15"
61  2.552
62  XEQ "15"
63  "SS"
64  PROMPT
65  STO 05
66  XEQ "18"
67  RCL 62
68  XEQ "18"
69  .241
70  XEQ "15"
71  .989
72  XEQ "15"
73  2.043 E-
            04
74  XEQ "15"
75  RCL 05
76  XEQ "18"
77  RCL 63
78  XEQ "18"
79  .779
80  XEQ "15"
81  .918
82  XEQ "15"
83  2.655 E-
            04
84  XEQ "15"
85  .348
86  XEQ "15"
87  .257
88  XEQ "15"
89  1.118
90  XEQ "15"
91  RCL 82
92  XEQ "18"
93  RCL 79
94  XEQ "18"
95  RCL 56
96  XEQ "18"
97  .622
98  XEQ "15"
99  .691
100 XEQ "15"
101 -.654
102 XEQ "15"
```

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```
103 2.871
104 XEQ "15"
105 RCL 82
106 XEQ "18"
107 RCL 81
108 XEQ "18"
109 RCL 79
110 XEQ "18"
111 1.067
112 XEQ "15"
113 .361
114 XEQ "15"
115 .05
116 XEQ "15"
117 .182
118 XEQ "15"
119 RCL 63
120 XEQ "18"
121 RCL 56
122 XEQ "18"
123 .454
124 XEQ "15"
125 -.05
126 XEQ "15"
127 .533
128 XEQ "15"
129 RCL 81
130 XEQ "18"
131 4.085
132 XEQ "15"
133 RCL 75
134 XEQ "18"
135 1.633
136 XEQ "15"
137 RCL 80
138 XEQ "18"
139 .366
140 XEQ "15"
141 27.369
142 XEQ "15"
143 RCL 59
144 XEQ "18"
145 RCL 75
146 XEQ "18"
147 .182
148 XEQ "15"
149 1.005
150 XEQ "15"
151 1.061
152 XEQ "15"
153 RCL 80
154 XEQ "18"
155 RCL 75
156 XEQ "18"
157 -2.101
```

```
158 XEQ "15"
159 .598
160 XEQ "15"
161 8.138 E9
            4
162 XEQ "15"
163 "FTR"          CLEAR PROGRAM
164 PCLPS
165 .END.
01◆LBL "FTR       EXECUTE FIRST SUBPROGRAM
            P"
02 XEQ "R"
03 "L2"           GET WORKING LABELS
04 GETSUB
05 XEQ "7"        STRUCTURE
06 STO 17         BASE LEVEL MAINTENANCE (BLM)
07 XEQ "9"
08 STO 51         REPLENISHMENT SPARES (RS)
09 XEQ "7"        CREW
10 ST+ 17         BLM
11 XEQ "9"
12 ST+ 51         RS
13 XEQ "9"
14 STO 48         DEPOT COMPONENT REPAIR (DCR)
15 XEQ "9"        LANDING GEAR
16 ST+ 17         BLM
17 XEQ "9"
18 ST+ 51         RS
19 2
20 ST- 01
21 XEQ "9"
22 ST+ 48         DCR
23 XEQ "7"        FLIGHT CONTROLS
24 ST+ 17         BLM
25 XEQ "7"
26 ST+ 51         RS
27 XEQ "9"
28 ST+ 48         DCR
29 RCL 81         ENGINE INSTALLATION
30 4.085
31 *
32 RCL 75
33 1.633
34 *
35 +
36 RCL 80
37 .366
38 *
39 +
40 27.369
41 -
42 ST+ 17         BLM
43 XEQ "9"
44 ST+ 51         RS          149
```

```
45  XEQ  "9"
46  ST+  48          DCR
47  "FTRP"
48  PCLPS            CLEAR PROGRAM
49  .END.
01◆LBL  "OSD          SECOND SUBPROGRAM DATA
          2"
02  XEQ  "R"
03  "L1"             GET WORKING LABEL
04  GETSUB
05  RCL  82          INPUT DATA
06  XEQ  "18"
07  RCL  81
08  XEQ  "18"
09  RCL  56
10  XEQ  "18"
11  .649
12  XEQ  "15"
13  .295
14  XEQ  "15"
15  -.814
16  XEQ  "15"
17  48.065
18  XEQ."15"
19  RCL  81
20  XEQ  "18"
21  RCL  60
22  XEQ  "18"
23  RCL  82
24  XEQ  "18"
25  .632
26  XEQ  "15"
27  .315
28  XEQ  "15"
29  1.207
30  XEQ  "15"
31  1.789 E-
          03
32  XEQ  "15"
33  RCL  94
34  XEQ  "18"
35  RCL  82
36  XEQ  "18"
37  1.267
38  XEQ  "15"
39  .749
40  XEQ  "15"
41  3.56 E-0
          4
42  XEQ  "15"
43  RCL  58
44  XEQ  "18"
45  RCL  77
46  XEQ  "18"              150
```

```
47  .096
48  XEQ "15"
49  .773
50  XEQ "15"
51  16.077
52  XEQ "15"
53  RCL 58
54  XEQ "18"
55  RCL 82
56  XEQ "18"
57  .115
58  XEQ "15"
59  1.535
60  XEQ "15"
61  1.031 E-
            02
62  XEQ "15"
63  RCL 58
64  XEQ "18"
65  .129
66  XEQ "15"
67  18.863
68  XEQ "15"
69  RCL 72
70  XEQ "18"
71  RCL 56
72  XEQ "18"
73  .06
74  XEQ "15"
75  -.996
76  XEQ "15"
77  5.042 E0
            3
78  XEQ "15"
79  RCL 82
80  XEQ "18"
81  RCL 56
82  XEQ "18"
83  2.115
84  XEQ "15"
85  -.741
86  XEQ "15"
87  2.343 E-
            02
88  XEQ "15"
89  RCL 72
90  XEQ "18"
91  RCL 56
92  XEQ "18"
93  .095
94  XEQ "15"
95  -.594
96  XEQ "15"
97  189.53
98  XEQ "15"
```

```
 99  RCL  84
100  XEQ  "18"
101  RCL  81
102  XEQ  "18"
103  1.247
104  XEQ  "15"
105  .82
106  XEQ  "15"
107  5.746 E-
              05
108  XEQ  "15"
109  RCL  84
110  XEQ  "18"
111  RCL  71
112  XEQ  "18"
113  1.43
114  XEQ  "15"
115  .979
116  XEQ  "15"
117  1.941 E-
              06
118  XEQ  "15"
119  RCL  84
120  XEQ. "18"
121  RCL  71
122  XEQ  "18"
123  .298
124  XEQ  "15"
125  .012
126  XEQ  "15"
127  .877
128  XEQ  "15"
129  RCL  73
130  XEQ  "18"
131  RCL  82
132  XEQ  "18"
133  .632
134  XEQ  "15"
135  .89
136  XEQ  "15"
137  .299
138  XEQ  "15"
139  RCL  97
140  XEQ  "18"
141  RCL  56
142  XEQ  "18"
143  .187
144  XEQ  "15"
145  -1.657
146  XEQ  "15"
147  5.692 E0
              5
148  XEQ  "15"
149  RCL  96
150  XEQ  "18"
```

```
151 RCL 60
152 XEQ "18"
153 1.482
154 XEQ "15"
155 1.338
156 XEQ "15"
157 1.268 E-
           05
158 XEQ "15"
159 RCL 96
160 XEQ "18"
161 RCL 64
162 XEQ "18"
163 2.431
164 XEQ "15"
165 1.084
166 XEQ "15"
167 5.286 E-
           09
168 XEQ "15"
169 "OSD2"          CLEAR PROGRAM
170 PCLPS
171 .END.
01*LBL "OSP         EXECUTE SECOND SUBPROGRAM
          2"
02 XEQ "R"
03 "L2"             GET WORKING LABEL
04 GETSUB
05 XEQ "7"          ENVIRONMENTAL CONTROL SYSTEM
06 ST+ 17           BLM
07 XEQ "7"
08 ST+ 51           RS
09 XEQ "9"
10 ST+ 48           DCR
11 XEQ "9"          ELECTRICAL
12 ST+ 17           BLM
13 XEQ "9"
14 ST+ 51           RS
15 RCL IND
          00
16 RCL IND
          01
17 Y↑X
18 XEQ "8"
19 RCL IND
          00
20 *
21 XEQ "4"
22 ST+ 48           DCR
23 XEQ "9"          HYDRAULIC/PNEUMATIC
24 ST+ 17           BLM
25 XEQ "9"
26 ST+ 51           RS
27 XEQ "9"
```

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```
28 ST+ 48        DCR
29 XEQ  "9"      FUEL SYSTEM
30 ST+ 17        BLM
31 XEQ  "9"
32 ST+ 51        RS
33 XEQ  "9"
34 ST+ 48        DCR
35 XEQ  "9"      ARMAMENT
36 ST+ 17        BLM
37 XEQ  "9"      AVIONICS
38 ST+ -17       BLM
39 XEQ  "9"
40 ST+ 51        RS
41 XEQ  "9"
42 ST+ 48        DCR
43 "OSP2"
44 PCLPS         CLEAR PROGRAM
45 .END.
01◆LBL "FT"      THIRD SUBPROGRAM DATA
02 XEQ "R"
03 "L1"          GET WORKING LABEL
04 GETSUB
05 RCL 59        INPUT DATA
06 XEQ "18"
07 RCL 56
08 XEQ "18"
09 .371
10 XEQ "15"
11 .14
12 XEQ "15"
13 8.052 E0
            2
14 XEQ "15"
15 RCL 60
16 XEQ "18"
17 RCL 82
18 XEQ "18"
19 .079
20 XEQ "15"
21 .912
22 XEQ "15"
23 1.303 E0
            3
24 XEQ "15"
25 RCL 82
26 XEQ "18"
27 RCL 88
28 XEQ "18"
29 RCL 56
30 XEQ "18"
31 3.284
32 XEQ "15"
33 2.043
34 XEQ "15"
```

154

```
35 .642
36 XEQ "15"
37 9.996 E-
            07
38 XEQ "15"
39 "FT"              CLEAR PROGRAM
40 PCLPS
41 .END.
01◆LBL "FTP         EXECUTE THIRD SUBPROGRAM
        "
02 XEQ "R"
03 "L2"              GET WORKING LABEL
04 GETSUB
05 XEQ "9"           BASE LEVEL OPERATIONS (BLO)
06 RCL 43
07 12
08 /
09 *
10 "NOAC?"
11 PROMPT
12 STO 31
13 *
14 STO 14
15 XEQ "9"           BASE LEVEL TRAINING (BLT)
16 RCL 43
17 12
18 /
19 *
20 RCL 31
21 *
22 STO 15
23 XEQ "7"           DEPOT AIRFRAME (PDM)
24 RCL 43
25 12
26 /
27 *
28 RCL 31
29 *
30 STO 16
31 "FTP"             CLEAR PROGRAM
32 PCLPS
33 .END.
```

```
01◆LBL "LN          LEARNING CURVE MODEL
       CURV"
02 "U"
03 ASTO Y
04 "UNIT/CU        SELECT UNIT CURVE OR CUMULATIVE AVERAGE
      M?"          CURVE EQUATIONS
05 PROMPT
06 ASTO X
07 X≠Y?
08 SF 01
09 "# UNITS       TOTAL NUMBER OF UNITS?
      ?"
10 PROMPT
11 STO 01
12 STO 02
13 "UNIT OF       UNIT OF INTEREST?
      INT?"
14 PROMPT
15 STO 03
16 1
17 -
18 STO 04
19 "UNIT 1        FIRST UNIT COST?
      COST?"
20 PROMPT
21 STO 05
22 "% LEARN       LEARNING RATE? (DECIMAL)
      ?"
23 PROMPT
24 LN
25 2
26 LN
27 /
28 STO 06
29 RCL 05
30 RCL 03
31 XEQ 05
32 STO 08
33 FS? 01
34 GTO 01
35 XEQ 04        UNIT COST OUTPUT
36 0
37 STO 07

38◆LBL 02        UNIT CURVE SUMMATION LOOP
39 RCL 05
40 RCL 01
41 XEQ 05
42 ST+ 07
43 DSE 01
44 GTO 02
45 RCL 07
46 XEQ 03        TOTAL COST OUTPUT
```

At line 28: $UC = K(X)^{\frac{LN\%}{LN\,2}}$

At line 41: $TC = \sum_{i=1}^{N} K(X_i)^{\frac{LN\%}{LN\,2}}$

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```
47◆LBL 01          CUMULATIVE CURVE
48 RCL 08
49 RCL 03
50 *               UC= TC_X-TC_(X-1)
51 RCL 05
52 RCL 04
53 XEQ 05
54 RCL 04
55 *
56 -
57 XEQ 04          UNIT COST OUTPUT
58 RCL 05
59 RCL 02          TC_X= X(Ȳ_X)
60 XEQ 05
61 RCL 02          Y_X= K(X^(LN%/LN 2))
62 *
63 XEQ 03          TOTAL COST OUTPUT

64◆LBL 03          WORKING LABELS
65 "TOT COS
         T"
66 XEQ 06
67 RTN

68◆LBL 04
69 "UN COST
         "
70 XEQ 06
71 RTN

72◆LBL 05
73 RCL 06
74 Y↑X
75 *
76 RTN

77◆LBL 06
78 "⊦="
79 ARCL X
80 AVIEW
81 FS? 55
82 STOP
83 RTN
84 END
```

The equations shown on the right:

$$UC = TC_X - TC_{(X-1)}$$

$$TC_X = X(\bar{Y}_X)$$

$$Y_X = K(X^{\frac{LN\%}{LN\ 2}})$$

```
01◆LBL "LSC      LRU/SRU LOGISTICS SUPPORT COSTS
         "
02 63
03 STO 61
04 "BSC"          OUTPUT LABELS
05 XEQ 03
06 "BSTK"
07 XEQ 03
08 "DSC"
09 XEQ 03
10 "DSTK"
11 XEQ 03
12 "SIC"
13 XEQ 03
14 "TPC"
15 XEQ 03
16 "BMHC"
17 XEQ 03
18 "BMMH"
19 XEQ 03
20 "PMSH"
21 XEQ 03
22 "SMMC"
23 XEQ 03
24 "DMHC"
25 XEQ 03
26 "DMMH"
27 XEQ 03
28 "DMMC"
29 XEQ 03
30 "SDTC"
31 XEQ 03
32 "CSC"
33 XEQ 03
34 "QSC"
35 XEQ 03
36 "IMCC"
37 XEQ 03
38 "TOC"
39 XEQ 03
40 "LCC"
41 XEQ 03

42◆LBL A
43 0
44 STO 59
45 "DEVC"         INPUT DATA
46 XEQ 01
47 "SYSI"
48 XEQ 01
49 "SEC"
50 XEQ 01
51 "M"
52 XEQ 01
```

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```
 53  "AOH"
 54  XEQ 01
 55  "POH"
 56  XEQ 01
 57  "PIUP"
 58  XEQ 01
 59  "UC"
 60  XEQ 01
 61  "W"
 62  XEQ 01
 63  "MTBD"
 64  XEQ 01
 65  "MTBR"
 66  XEQ 01
 67  "NRTS"
 68  XEQ 01
 69  "RTS"
 70  XEQ 01
 71  "COND"
 72  XEQ 01
 73  "PAMH"
 74  XEQ 01
 75  "RMH"
 76  XEQ 01
 77  "SMI"
 78  XEQ 01
 79  "SMH"
 80  XEQ 01
 81  "BCMH"
 82  XEQ 01
 83  "BMH"
 84  XEQ 01
 85  "BMC"
 86  XEQ 01
 87  "BRCT"
 88  XEQ 01
 89  "DMH"
 90  XEQ 01
 91  "DMC"
 92  XEQ 01
 93  "PA"
 94  XEQ 01
 95  "PP"
 96  XEQ 01
 97  "PCB"
 98  XEQ 01
 99  "OST"
100  XEQ 01
101  "DRCT"
102  XEQ 01
103  "BLR"
104  XEQ 01
105  "DLR"
106  XEQ 01
107  "PSC"
```

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```
108 XEQ 01
109 "SA"
110 XEQ 01
111 "IMC"
112 XEQ 01
113 "RMC"
114 XEQ 01

115◆LBL B
116 CLA
117 RCL 12
118 RCL 21
119 *
120 RCL 11
121 RCL 27
122 *
123 +
124 STO 55          PIPELINE TIME IN MONTHS
125 RCL 05
126 RCL 09
127 RCL 03
128 *
129 /
130 STO 54
131 RCL 55
132 *
133 STO 36
134 SQRT
135 1.5
136 *
137 ST+ 36
138 RCL 36
139 XEQ "IN"
140 STO 36          BASE SPARES
141 RCL 12
142 RCL 19
143 *
144 RCL 18
145 +
146 RCL 05
147 RCL 03
148 RCL 10
149 *
150 /
151 *
152 STO 43          PEAK DIRECT BASE MAINTENANCE
153 RCL 36          SHOP MANHOURS
154 RCL 03
155 *
156 RCL 07
157 *
158 STO 35          BASE SPARES COST
159 RCL 54
160 RCL 03                    160
161 RCL 11
```

```
162  RCL  28
163  *
164  *
165  *
166  XEQ  "IN"
167  STO  38          DEPOT SPARES
168  RCL  07
169  *
170  STO  37          DEPOT SPARES COST
171  RCL  04
172  RCL  03
173  /
174  STO  54
175  RCL  04
176  RCL  10
177  /
178  STO  55
179  RCL  14
180  RCL  15
181  RCL  18
182  +
183  +
184  RCL  12
185  RCL  19
186  *
187  +
188  RCL  10
189  /
190  STO  42
191  0
192  RCL  16
193  X=Y?
194  GTO  04
195  RCL  17
196  RCL  16
197  /
198  ST+  42

199*LBL  04
200  RCL  54
201  ST*  42          DIRECT MANHOURS PER BASE PER YEAR
202  RCL  42
203  RCL  03
204  RCL  06
205  RCL  29
206  *
207  *
208  *
209  STO  41          BASE MAINTENANCE MANHOURS
210  RCL  55
211  RCL  06
212  RCL  12
213  RCL  20
214  *
215  *
```

161

```
216  *
217  STO  44          BASE MAINTENANCE MANHOUR COST
218  RCL  55
219  RCL  11
220  RCL  22
221  *
222  *
223  STO  46          DEPOT MAINTENANCE MANHOURS
224  RCL  06
225  RCL  30
226  *       -
227  *
228  STO  45          DEPOT MAINTENANCE MANHOUR COST
229  RCL  06
230  ST*  55
231  RCL  55
232  RCL  13
233  *
234  XEQ  "IN"
235  STO  50          CONDEMNATION SPARES
236  RCL  11
237  ST*  55
238  RCL  55
239  RCL  23
240  *
241  STO  47          DEPOT MAINTENANCE MATERIAL COST
242  RCL  55
243  2.7
244  RCL  31
245  RCL  08
246  *
247  *
248  *
249  STO  48          SECOND DESTINATION TRANSPORTATION COST
250  RCL  50
251  RCL  07
252  *
253  STO  49          CONDEMNATION SPARES COST
254  RCL  06
255  RCL  34
256  *
257  RCL  33
258  +
259  RCL  24
260  RCL  25
261  1
262  +
263  +
264  *
265  RCL  03
266  RCL  32
267  RCL  06
268  *
269  *                              162
270  RCL  24
```

```
271  RCL  26
272  +
273  1
274  +
275  *
276  +
277  STO  51        INVENTORY MANAGEMENT COST
278  RCL  02
279  RCL  35
280  RCL  37
281  +    _
282  +
283  STO  39        SUPPORT INVESTMENT COST
284  STO  40        TOTAL PROCUREMENT COST
285  STO  53
286  RCL  01
287  ST+  40
288  ST+  53
289  RCL  41
290  RCL  44
291  RCL  45
292  RCL  47
293  +
294  +
295  +    -
296  RCL  48
297  RCL  49
298  RCL  51
299  +
300  +
301  +
302  ST+  53
303  STO  52        TOTAL OWNERSHIP COST
304  RCL  00
305  ST+  53        LIFE CYCLE COST
306  35
307  STO  60
308  35.05301
309  STO  62
310  63
311  STO  61

312♦LBL  02        WORKING LABELS
313  RCL  IND
              60
314  ARCL  IND
              61
315  "⊢ = $"
316  ARCL  X
317  AVIEW
318  STOP
319  CLA
320  1
321  ST+  60
322  ST+  61                      163
```

```
323 ISG 62
324 GTO 02
325 STOP

326◆LBL 01
327 "⊢?"
328 PROMPT
329 STO IND
              59
330 1
331 ST+ 59
332 CLA
333 RTN

334◆LBL 03
335 ASTO IND
              61
336 1
337 ST+ 61
338 RTN

339◆LBL "IN"
340 STO 56
341 FRC
342 0
343 X=Y?
344 GTO 05
345 RCL 56
346 INT
347 1
348 +
349 RTN

350◆LBL 05
351 RCL 56
352 RTN
353 .END.
```

```
01◆LBL "ORL      OPTIMAL REPAIR LEVEL ANALYSIS
        A"
02 1
03 STO 00
04 "BRCYT"        INPUT DATA
05 XEQ 01
06 "LWR"
07 XEQ 02
08 1
09 ST+ 00
10 "DSST"
11 XEQ 01
12 "NTDPR"
13 XEQ 02
14 "MCFA"
15 XEQ 01
16 "MCFP"
17 XEQ 01
18 "NRA"
19 XEQ 01
20 "NNRA"
21 XEQ 01
22 "MTBCT"
23 XEQ 01
24 "MTBF"
25 XEQ 01
26 "NB"
27 XEQ 01
28 "NB"
29 XEQ 04
30 "OST"
31 XEQ 04
32 "IL"
33 XEQ 01
34 "FRCPP"
35 XEQ 01
36 "PSLR"
37 XEQ 04
38 "PSMR"
39 XEQ 04
40 "PWR"
41 XEQ 04
42 "QPA"
43 XEQ 01
44 "MCA"
45 XEQ 01
46 "MHCT"
47 XEQ 01
48 "MCP"
49 XEQ 01
50 "DRPT"
51 XEQ 01
52 "FSAC"
53 XEQ 01
```

165

```
 54  "CRM"
 55  XEQ 01
 56  "SSR"
 57  XEQ 04
 58  "RMW"
 59  XEQ 01
 60  "TDOCP"
 61  XEQ 01
 62  "UC"
 63  XEQ 01
 64  "U/B"
 65  XEQ 01
 66  "OH/M"
 67  XEQ 01
 68  "UW"
 69  XEQ 01
 70  "PTR"
 71  XEQ 02
 72  "PTT"
 73  XEQ 02
 74  "DT"
 75  XEQ 02
 76  "TCP"
 77  XEQ 02
 78  RCL 39            CALCULATE DISCARD OPTION
 79  RCL 40
 80  RCL 27
 81  *
 82  *
 83  RCL 12
 84  /
 85  STO 50
 86  STO 51
 87  RCL 19
 88  12
 89  RCL 38
 90  XEQ 06
 91  ST+ 51
 92  RCL 25
 93  RCL 34
 94  *
 95  RCL 23
 96  RCL 21
 97  +
 98  +
 99  STO 52
100  RCL 26
101  RCL 35
102  *
103  RCL 24
104  RCL 22
105  +
106  +
107  STO 53               166
108  RCL 15
```

```
109  RCL  14
110  /
111  RCL  52
112  *
113  RCL  16
114  RCL  14
115  /
116  RCL  53
117  *
118  +
119  STO  54
120  RCL  41
121  120
122  RCL  50
123  XEQ  06
124  ST+  51
125  RCL  15
126  RCL  14
127  /
128  RCL  17
129  *
130  RCL  16
131  RCL  14
132  /
133  RCL  18
134  *
135  +
136  STO  55
137  RCL  50
138  *
139  STO  56
140  3
141  *
142  SQRT
143  RCL  56
144  +
145  RCL  38
146  *
147  ST+  51
148  RCL  51
149  "DISCARD        DISCARD OPTION OUTPUT
          "
150  XEQ  03
151  RCL  07         CALCULATE INTERMEDIATE REPAIR OPTION
152  RCL  37
153  *
154  RCL  14
155  /
156  STO  51
157  RCL  19
158  1
159  -
160  RCL  43
161  *                        167
```

```
162 1
163 +
164 STO 57
165 RCL 03
166 40
167 *
168 RCL 49
169 +
170 RCL 47
171 RCL 45
172 RCL 57
173 XEQ 06
174 ST+ 51
175 RCL 01
176 RCL 50
177 *
178 STO 57
179 RCL 55
180 RCL 50
181 *
182 STO 58
183 3
184 *
185 SQRT
186 RCL 58
187 +
188 1
189 RCL 20
190 -
191 *
192 RCL 33
193 *
194 RCL 57
195 3
196 *
197 SQRT
198 RCL 57
199 +
200 RCL 38
201 *
202 +
203 RCL 20
204 RCL 33
205 *
206 RCL 50
207 *
208 12
209 *
210 SQRT
211 4.4
212 *
213 +
214 ST+ 51
```

168

```
215 RCL 50
216 12
217 RCL 19
218 RCL 29
219 XEQ 06
220 RCL 03
221 *
222 ST+ 51
223 RCL 50
224 12
225 RCL 19
226 RCL 36
227 XEQ 06
228 RCL 54
229 *
230 ST+ 51
231 RCL 10
232 RCL 11
233 +
234 RCL 32
235 RCL 19
236 *
237 *
238 ST+ 51
239 RCL 50
240 RCL 19
241 12
242 RCL 33
243 XEQ 06
244 ST+ 51
245 STO 57
246 RCL 30
247 RCL 19
248 1
249 -
250 *
251 RCL 09
252 +
253 RCL 11
254 1
255 -
256 RCL 14
257 /
258 *
259 STO 58
260 RCL 28
261 RCL 19
262 1
263 -
264 *
265 RCL 08
266 +
267 RCL 10
```

169

```
268  RCL  14
269  /
270  *
271  RCL  58
272  +
273  ST+  51
274  ST+  57
275  RCL  51
276  "INTERME        OUTPUT INTERMEDIATE REPAIR OPTION
        DIATE"
277  XEQ  03
278  RCL  50        CALCULATE DEPOT REPAIR OPTION
279  RCL  31
280  RCL  38
281  *
282  *
283  ST+  57
284  RCL  06
285  RCL  37
286  *
287  RCL  14
288  /
289  ST+  57
290  RCL  19
291  1
292  -
293  RCL  42
294  *
295  1
296  +
297  STO  51
298  RCL  02
299  40
300  *
301  RCL  48
302  +
303  RCL  46
304  RCL  44
305  RCL  51
306  XEQ  06
307  ST+  57
308  RCL  50
309  12
310  RCL  19
311  2
312  XEQ  06
313  RCL  41
314  RCL  54
315  *
316  *
317  ST+  57
318  RCL  50
319  RCL  05
```

170

```
320 RCL 38
321 *
322 *
323 ST+ 57
324 RCL 56
325 3
326 *
327 SQRT
328 RCL 56
329 +
330 RCL 38
331 *
332 ST+ 57
333 RCL 50
334 12
335 RCL 19
336 RCL 29
337 XEQ 06
338 RCL 02
339 *
340 ST+ 57
341 RCL 57
342 "DEPOT"        OUTPUT DEPOT REPAIR OPTION
343 XEQ 03

344◆LBL 01         WORKING LABELS
345 "⊦?"
346 XEQ 05
347 RTN

348◆LBL 02
349 ASTO 04
350 "⊦D?"
351 XEQ 05
352 CLA
353 ARCL 04
354 "⊦I?"
355 XEQ 05
356 RTN

357◆LBL 03
358 "⊦="
359 ARCL X
360 AVIEW
361 STOP
362 RTN

363◆LBL 04
364 ASTO 04
365 "⊦C?"
366 XEQ 05
367 CLA
368 ARCL 04
```

171

```
369 "⊢OS?"
370 XEQ 05
371 RTN

372◆LBL 05
373 PROMPT
374 STO IND
          00
375 1
376 ST+ 00
377 RTN

378◆LBL 06
379 *
380 *
381 *
382 RTN
383 .END.
```

```
01◆LBL "LCC        COMPONENT/SYSTEM RELIABILITY
       REL"
02  "≠LEV"         NUMBER OF LEVELS?
03  XEQ 88
04  STO 08

05◆LBL 06
06  "≠CIR/LE       NUMBER OF CIRCUITS/LEVEL?
       V"
07  XEQ 88
08  STO 09

09◆LBL 07
10  XEQ 08

11◆LBL 10
12  DSE 09         CIRCUIT LOOP
13  GTO 07
14  DSE 08         LEVEL LOOP
15  GTO 06
16  "SYSTEM        SYSTEM OUTPUT
       REL="
17  ARCL X
18  AVIEW
19  FS? 55
20  STOP
21  "END"
22  AVIEW
23  STOP

24◆LBL 08          COMPONENT LOOP
25  "Y"
26  ASTO Y
27  "COM MTB       COMPONENT MEAN TIME BETWEEN FAILURES
       F="           EQUAL?
28  XEQ 88
29  ASTO X
30  X=Y?
31  SF 01
32  1
33  STO 04
34  STO 05
35  STO 07
36  "S"
37  ASTO Y
38  "S/P"          COMPONENTS IN SERIES OR PARALLEL?
39  XEQ 88
40  ASTO X
41  X=Y?
42  GTO 01

43◆LBL A
44  SF 02
45  "≠COM/CI       NUMBER OF COMPONENTS IN THE CIRCUIT?
       R"
```

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```
46  XEQ  88
47  STO  01
48  STO  06
49  "≠PAR CI      NUMBER OF PARALLEL CIRCUITS?
        R"
50  XEQ  88
51  STO  02

52◆LBL  03          PARALLEL CIRCUIT LOOP
53  XEQ  02
54  1
55  X<>Y
56  -
57  ST*  05
58  FS?  01
59  XEQ  87
60  DSE  01
61  GTO  03
62  RCL  05

63◆LBL  04
64  1
65  X<>Y
66  -
67  ST*  07
68  RCL  06
69  STO  01
70  DSE  02
71  GTO  03
72  RCL  07
73  XEQ  89

74◆LBL  B
75◆LBL  01
76  "≠COM/SE        NUMBER OF COMPONENTS IN SERIES?
        R"
77  XEQ  88
78  STO  03

79◆LBL  02          SERIES CIRCUIT LOOP
80  "REL"           COMPONENT RELIABILITY IF KNOWN?
81  XEQ  88
82  X>0?
83  GTO  11
84  "MTBF"          MTBF IF RELIABILITY UNKNOWN?
85  XEQ  88
86  1/X
87  "T"             TIME PERIOD?
88  XEQ  88
89  *
90  CHS
91  E↑X

92◆LBL  11                        174
93  FS?  02
```

```
 94  RTN
 95  ST* 04
 96  FS? 01
 97  XEQ 86
 98  DSE 03
 99  GTO 02
100  RCL 04

101◆LBL 05          OUTPUT RELIABILITY
102  XEQ 89

103◆LBL C
104  RCL 07
105  RCL 04
106  *
107  XEQ 89

108◆LBL 86          WORKING LABELS
109  RCL 03
110  Y↑X
111  GTO 05

112◆LBL 87
113  RCL 01
114  Y↑X
115  GTO 04

116◆LBL 88
117  "⊢?"
118  PROMPT
119  RTN

120◆LBL 89
121  CF 01
122  CF 02
123  "RELIABI
       LITY="
124  ARCL X
125  AVIEW
126  FS? 55
127  STOP
128  GTO 10
129  END
```

APPENDIX C

EXAMPLE PROGRAM RUNS

```
    XEQ "RAND"      RAND EXAMPLE
EM/UN WGT?
UN
            RUN
UNIT WGT?
 104,322.000
        0      RUN
CARGO?
Y       -
            RUN
MAX SPD KNOT
S?
 491.0000
            RUN
NUM FLT TEST
?
 100.0000
            RUN
HRS EN=12,56
5,047.86
            RUN
HRS TO=10,69
8,291.7.
            RUN
HRS LA=32,73
5,811.48
            RUN
$ MATL=445,1
29,157.7
            RUN
$ DEV =104,7
16,301.2
            RUN
$ PROG=2,191
,198,907.
            RUN
$ FL T=42,04
8,591.29
            RUN
QC=2,784,726
.363
            RUN
```

```
        XEQ  "NOR"    NORTHROP EXAMPLE
DTJ?
N
                RUN
ABTF?
Y
                RUN
AW-A/A-A/G?
Y
                RUN
N F?
N
                RUN
S S?
Y
                RUN
AF LR
  .8000         RU
                  N
EW?
  20,000.0000
                RUN
%G?
  .3500         RU
                  N
%T?
  .0100         RU
                  N
%O?
  .3500         RU
                  N
AF 750=3,819
,126.892
                RUN
EN LR
  .9000         RU
                  N
FMIL?
  11,000.0000
                RUN
BPR?
  1.0000        R
                UN
FMAX?
  19,000.0000
                RUN
PU 1000=1,29
4,040.200
                RUN
N?
  2.0000        R
                UN
P 750=2,869,
571.696
                RUN
```

178

```
AV LR
 .9200      RU
             N
AV WT?
 1,500.0000
           RUN
E 750=2,250,
000.000

           RUN
F 750=8,938,
698.588
           RUN
R&D=2,417,88
6,289.
           RUN
UF?
 .8000      RU
             N
           RUN
NYRS?
 15.0000
           RUN
UR?        .
 300.0000
           RUN
$/GAL?
 .4400      RU
             N
F*S?
 7,500.0000
           RUN
L/D?
 11.7650
           RUN
POL$/FH=422.
6274
           RUN
Q?
 729.0000
           RUN
AQ=2,809,714
,498.
           RUN
PQ=2,100,967
,693.
           RUN
EQ=1,645,863
,157.
           RUN
FQ=6,556,545
,348.
           RUN
```

```
I OΣS=2,425,
921,779.
          RUN
FH OΣS=3,998
,364,793.
          RUN
CL IV M=354,
053,448.8
          RUN
UE OΣS=1,392
,428,007.
          RUN
POL OΣS=1,10
9,143,393.
          RUN
OTH OΣS=1,58
9,953,473.
          RUN
TLCC=1.9844E
10
          RUN
END
```

```
          XEQ  "AM"        GRUMMAN EXAMPLE
W                          ADVANCED MATERIAL
TI%=?
   0.0000        R         C-141A ALL ARE 0
                UN
S%=?
   0.0000        R
                UN
G%=?
   0.0000  ‾     R
                UN
GR%=?
   0.0000        R
                UN
B%=?
   0.0000        R
                UN
F
TI%=?
   0.0000        R
                UN
S%=?
   0.0000 .      R
                UN
G%=?
   0.0000        R
                UN
GR%=?
   0.0000        R
                UN
B%=?
   0.0000        R
                UN
N
TI%=?
   0.0000        R
                UN
S%=?
   0.0000        R
                UN
G%=?
   0.0000        R
                UN
GR%=?
   0.0000        R
                UN
B%=?
   0.0000        R
                UN
T
TI%=?
   0.0000        R
                UN
```

```
S%=?
  0.0000      R
              UN
G%=?
  0.0000      R
              UN
GR%=?
  0.0000      R
              UN
B%=?
  0.0000      R
              UN

    XEQ "DA"
AL?
 145.0000
              RUN
AT?
  2.0000      R
              UN
AVIW?
 1,567.0000
              RUN
AVW?
 2,102.0000
              RUN
ATBO?
 3,000.0000
              RUN
B/H?
 160.0000
              RUN
CW?
 66,090.0000
              RUN
CFA?
 721.0000
              RUN
CV?
 6,500.0000
              RUN
EPR?
 16.0000
              RUN
FFY?
 63.0000
              RUN
FD?
  3.4800      R
              UN
≠W?
 10.0000
              RUN
```

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```
S%=?
 0.0000      R
             UN
G%=?
 0.0000      R
             UN
GR%=?
 0.0000      R
             UN
B%=?
 0.0000      R
             UN
    XEQ "DA"        PERMANENT DATA INPUT
AL?
 145.0000
             RUN
AT?
 2.0000      R
             UN
AVIW?
 1,567.0000
             RUN
AVW?
 2,102.0000
             RUN
ATBO?
 3,000.0000
             RUN
B/H?
 160.0000
             RUN
CW?
 66,090.0000
             RUN
CFA?
 721.0000
             RUN
CV?
 6,500.0000
             RUN
EPR?
 16.0000
             RUN
FFY?
 63.0000
             RUN
FD?
 3.4800      R
             UN
≠W?
 10.0000
             RUN
```

```
FV?
 16,000.0000
          RUN
FLVR?
 14.0000
          RUN
H/M?
 3.7100      R
          UN
IFLW?
 150,020,000
      0    RUN
LW?
 235,810.000
      0    RUN
L+S?
 305.7000
          RUN
MM?
 .8600     RU
          N
MQT?
 63.2500
          RUN
≠ACT?
 29.0000
          RUN
≠APU?
 1.0000      R
          UN
≠C/A?
 5.0000      R
          UN
≠CLS?
 48.0000
          RUN
≠EN?
 4.0000      R
          UN
≠EX?
 13.0000
          RUN
≠G+S?
 0.0000      R
          UN
≠HS?
 33.0000
          RUN
≠IT?
 12.0000
          RUN
≠S?
 8.0000      R
          UN
```

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```
ULF?
 3.7500      R
              UN
≠P?
 5.0000      R
              UN
RMFG?
 15.0000
              RUN
SS?
 10.0000
              RUN
TFF?
 168.0000
              RUN
TGWC?
 316,600.000
        0     RUN
TGWM?
 323,100.000
        0     RUN
≠PSN?
 162.0000
              RUN
TAVSS?
 25.0000
              RUN
TT?
 84,000.0000
              RUN
TKA?
 252.0000
              RUN
TWA?
 13,051.0000
              RUN
UR?
 1,120.0000
              RUN
WN?
 160.7000
              RUN
≠A?
 289.0000
              RUN
FH/A?
 93.3000
              RUN
LC?
 180.0000
              RUN
INF
 1.0000      R
              UN
```

```
    XEQ  "UAFD"        SUBPROGRAM DATA INPUT
WA?
 3,228.0000
            RUN
WT/C?
 .1200      RU
                 N
KFD?
 1.0000       R
               UN
FWA?
 5,645.0000
            RUN
TA?
 899.0000
            RUN
≠T?
 3.0000       R
               UN
NWA?
 1,150.0000
            RUN
TPS?
 1.0000       R
               UN
SF?
 0.0000       R
               UN
MT?
 21,000.0000
            RUN
TPEN?
 1.0000       R
               UN
CSD?
 1.0000       R
               UN
ANFT?
 1.0000       R
               UN

   XEQ  "UAFP"        EXECUTE FIRST SUBPROGRAM UPC
FTR?                  TYPE AIRCRAFT
N
            RUN
ATK?
N
            RUN
C/T?
Y
            RUN
```

```
SUBIF?              INFLATION FACTORS
   1.0000     R
              UN
RMIF?
   1.0000     R
              UN


     XEQ  "AF"      SUBPROGRAM DATA INPUT
PDR?
   4.0000     R
              UN
REGR?
  20.6400
              RUN
RFLT?
  19.6600
              RUN
REN?
  17.3400
              RUN
RMGT?
  18.3200
              RUN
RMFS?
  16.7600
              RUN
RFBS?
  13.5100
              RUN
RTDE?
  19.5300
              RUN
RTFB?
  15.7500
              RUN
RQCL?
  16.3800
              RUN
     XEQ  "AFP"     EXECUTE SECOND SUBPROGRAM UPC
$APU?
  15,000.0000
              RUN
LR AF?
   .7500      RU
              N
     XEQ  "UAV"     EXECUTE THIRD SUBPROGRAM UPC
ENTWR?
   4.5200     R
              UN
TIT?
   2,210.0000
              RUN
```

187

```
MQT?
 63.2500
              RUN
EPR?
 16.0000
              RUN
SLM?
 .7700      RU
              N
AVIF?
 1.0000      R
              UN
AVLR?
 .9000      RU
              N
ENLR
 .9000      RU
              N


   XEQ  "RDD"      DATA INPUT RDT&E
DT?
 3.0000      R
           . UN
EPR?
 16.0000
              RUN
EAF?
 498.0000
              RUN
SLM?
 .7700      RU
              N


   XEQ  "RDP"      EXECUTE RDT&E SUBPROGRAM
AFIF?
 1.0000      R
              UN
RENGR?
 20.6400
              RUN
RTDE?
 19.5300
              RUN
RTFB?
 15.7500
              RUN
RΣD LR AF?
 .7500      RU
              N
INS?
N
              RUN          188
```

```
SPFAC?
 1.5000      R
              UN
RΣD LR EN?
 .9000      RU
              N
ENIF?
 1.0000      R
              UN
     XEQ "OUT"        EXECUTE RDT&E AND PRODUCTION OUTPUT
AFM=516,005,           SUBPROGRAM
256.9
              RUN
AV=59,326,64
9.82
              RUN
EN=165,866,6
95.6
              RUN
%GΣA?
 .1040      RU
              N
 53,664,546.
   72        ***
%PR?
 .0600      RU
              N
 34,180,188.
   22        ***
RΣD=829,043,
337.2
              RUN
LR SUB?
 .8900      RU
              N
SUB PRD=332,
851,611.0
              RUN
LR AF?
 .7500      RU
              N
AF PRD=1,821
,939,554.
              RUN
LR AV?
 .9000      RU
              N
AV PRD=202,3
43,956.8
              RUN
LR EN?
 .9000      RU
              N
```

```
EN PRD=749.4
61,160.3
          RUN
GΣA=234,620,
166.9
          RUN
PROF=149,434
,998.7
          RUN
TOT PRD=3,49
0,651,448.
          RUN
    XEQ "ISD"        DATA INPUT FIRST SUBPROGRAM IS
≠B?
 12.0000
          RUN
    XEQ "ISP"        EXECUTE FIRST SUBPROGRAM IS
A/S/B=?
Y
          RUN
≠Ba?
 12.0000
          RUN
S/B?
  1.0000      R
              UN
A/S?
 16.0000
          RUN


    XEQ "Y"          DATA INPUT SECOND SUBPROGRAM IS


    XEQ "YP"         EXECUTE SECOND SUBPROGRAM IS

    XEQ "AV"         DATA INPUT THIRD SUBPROGRAM IS
≠DAYS?
 18.0000
          RUN
ENTWR?
  4.5200      R
              UN
TIT?
 2,210.0000
          RUN
    XEQ "AVP"        EXECUTE THIRD SUBPROGRAM IS
IS                   INITIAL SPARES OUTPUT
STR=333,911,
154.8
          RUN
```

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```
CR=9,854,782
.509
            RUN
LG=31,690,88
5.57
            RUN
FC=19,123,95
0.77
            RUN
EI=146,692,7
34.5        ‒
            RUN
ECS=19,909,6
51.94
            RUN
EL=34,804,07
8.83
            RUN
HYD=16,807,5
97.91
            RUN
FUEL=3,301,3
33.904
            RUN
CH=3,134,342
.099
            RUN
ARM=0.0000
            RUN
APU=411,700.
2000
            RUN
%GΣA?
 .1040      RU
            N
GΣA=77,083,2
70.34
            RUN
%PROF?
 .0600      RU
            N
PROF=49,096,
495.88
            RUN
SSE=0.0000
            RUN
IT=80,757,12
1.90
            RUN
EN=240,827,4
08.4
            RUN
AV=121,548,8
48.0
            RUN
```

```
TOT IS=1,188
,955,958.
            RUN
    XEQ "OSB"       DATA INPUT FIRST SUBPROGRAM CARGO
MLD?                OPERATIONS AND SUPPORT
  1,620.0000
            RUN
CSW?
  4,651.0000
            RUN
*PCP?     __
  2.0000     R
            UN
MVSQ?
  259.98+07
            RUN
*LGB?
  8.0000     R
            UN
MAL
  48,850.0000
            RUN
    XEQ "OSP"       EXECUTE FIRST SUBPROGRAM C O&S
%SUP?    .
  .8740      RU
            N
*L/M?
  38.0000
            RUN
    XEQ "APU"       DATA INPUT SECOND SUBPROGRAM C O&S
APUW
  547.0000
            RUN
ECSW
  2,648.0000
            RUN
CT
  2.0000     R
            UN
PCP
  2.0000     R
            UN
*G?
  5.0000     R
            UN
   XEQ "APUP"       EXECUTE SECOND SUBPROGRAM C O&S


   XEQ "HYD"        DATA INPUT THIRD SUBPROGRAM C O&S
*HP?
  6.0000     R
            UN
```

```
≠HSPS
  3.0000      R
             UN
≠ATM?
  0.0000      R
             UN
≠PTU?
  0.0000      R
             UN
FUSW?
  1,402.0000
             RUN
≠FUBP?
  20.0000
             RUN
≠ANT?
  22.0000
             RUN

    XEQ "HYDP"        EXECUTE THIRD SUBPROGRAM C O&S
NOAC?
  227.0000
             RUN


    XEQ "EN"          DATA INPUT ENGINE
ENTWR?
  4.5200      R
             UN
    XEQ "ENG"         EXECUTE ENGINE AND CARGO OPERATIONS
INF?                  AND SUPPORT OUTPUT
  1.0000      R
             UN
G/H?
  1,940.0000
             RUN
C/G?
  .4200      RU
             N
POL=3,261,52
2,099.
             RUN
BLM=1,449,24
2,263.
             RUN
RS=591,439,3
76.5
             RUN
DCR=1,253,18
3,061.
             RUN
BLO=1,373,65
2,932.
             RUN
BLT=979,177,        193
552.5
             RUN
PDM=228,381,
170.6
             RUN
```

```
OM=27,024,25
3.24
            RUN
TOT OSS=5,90
2,100,610.
            RUN
```

```
XEQ "LN CURV       LEARNING CURVE EXAMPLE
       "
UNIT/CUM?          UNIT CURVE
U
          RUN
* UNITS?
  15.0000
          RUN
UNIT OF INT?
  10.0000
          RUN
UNIT 1 COST?
  75,000.0000
          RUN
% LEARN?
  .9500      RU
              N
UN COST=63,2
50.0222
          RUN
TOT COST=981
,903.7907
              .

XEQ "LN CURV       CUMULATIVE AVERAGE CURVE
       "
UNIT/CUM?
C
          RUN
* UNITS?
  15.0000
          RUN
UNIT OF INT?
  10.0000
          RUN
UNIT 1 COST?
  75,000.0000
          RUN
% LEARN?
  .9500      RU
              N
UN COST=58,7
94.3795
          RUN
TOT COST=920
,706.2378
```

```
        XEQ  "LSC"       LRU/SRU LOGISTICS SUPPORT COST EXAMPLE
DEVC?                    INPUT DATA
  50,000.0000
              RUN
SYSI?
  900,000.000
        0     RUN
SEC?
  150,000.000
        0     RUN
M?
  20.0000
              RUN
AOH?
  600,000.000
        0     RUN
POH?
  115,000.000
        0     RUN
PIUP?
  15.0000
              RUN
UC?
  1,100.0000
              RUN
W?
  40.0000
              RUN
MTBD?
  170.0000
              RUN
MTBR?
  102.0000
              RUN
NRTS?
  .0500        RU
               N
RTS?
  .9500        RU
               N
COND?
  .0100        RU
               N
PAMH?
  .5000        RU
               N
RMH?
  .5000        RU
               N
SMI?
  0.0000        R
               UN
SMH?
  0.0000        R
               UN        196
```

```
BCMH?
 .2000      RU
              N
BMH?
 .3600      RU
              N
BMC?
 105.0000
            RUN
BRCT?
 .1300      RU
              N
DMH?
 5.0000      R
             UN
DMC?
 150.0000
            RUN
PA?
 3.0000      R
             UN
PP?
 15.0000
            RUN
PCB?
 15.0000
            RUN
OST?
 .5300      RU
              N
DRCT?
 1.9400      R
             UN
BLR?
 21.3800
            RUN
DLR?
 30.1700
            RUN
PSC?
 1.4300      R
             UN
SA?
 8.7500      R
             UN
IMC?
 1,200.0000
            RUN
RMC?
 150.0000
            RUN
BSC = $198,0      OUTPUT
00.0000
            RUN
```

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```
BSTK = $9.00
00
              RUN
DSC = $72,60
0.0000
              RUN
DSTK = $66.0
000
              RUN
SIC = $420,6
00.0000
              RUN
TPC = $1,320
,600.000
              RUN
BMHC = $2,90
8,937.647
              RUN
BMMH = $453.
5294
              RUN
PMSH = $30.5
539
            . RUN
BMMC = $8,80
1,470.588
              RUN
DMHC = $665,
514.7057
              RUN
DMMH = $1,47
0.5882
              RUN
DMMC = $661,
764.7059
              RUN
SDTC = $681,
352.9412
              RUN
CSC = $971,3
00.0000
              RUN
QSC = $883.0
000
              RUN
IMCC = $115,
425.0000
              RUN
TOC = $14,80
5,765.59
              RUN
              RUN
LCC = $16,17
6,365.59
              RUN
```

```
    XEQ "ORLA"     OPTIMUM REPAIR LEVEL EXAMPLE
BRCYT?
  .3300       RU
                  N
LWRD?
 18.0500
               RUN
LWRI?
 13.0300
               RUN
DSST?    --
  .5000       RU
                  N
NTDPRD?
 10.0000
               RUN
NTDPRI?
 10.0000
               RUN
MCFA?
 46.6000
               RUN
MCFP?
 46.6000
              · RUN
NRA?
  0.0000        R
                  UN
NNRA?
 30.0000
               RUN
MTBCT?
 63,155.0000
               RUN
MTBF?
 164,203.000
         0    RUN
NB?
  1.0000        R
                  UN
NBC?
  1.0000        R
                  UN
NBOS?
  0.0000        R
                  UN
OSTC?
  1.0000        R
                  UN
OSTOS?
  1.0000        R
                  UN
IL?
 10.0000
               RUN            199
```

```
FRCPP?
 .0100       RU
              N
PSLRC?
 .2861       RU
              N
PSLROS?
 1.0000       R
             UN·
PSMRC?
 .0630       RU
              N
PSMROS?
 1.0000       R
             UN
PWRC?
 1.2850       R
             UN
PWROS?
 1.0000       R
             UN
QPA?
 10.0000
            RUN
MCA?
 104.2000
            RUN
MHCT?
 1.5000       R
             UN
MCP?
 104.2000
            RUN
DRPT?
 1.4800       R
             UN
FSAC?
 36.5900
            RUN
CRM?
 4.0000       R
             UN
SSRC?
 .0513       RU
              N
SSROS?
 1.0000       R
             UN
RMW?
 .0100       RU
              N
TDOCP?
 160.0000
            RUN         200
```

```
UC?
 363.0000
          RUN
U/B?
 12.0000
          RUN
OH/M?
 348.0000
          RUN
UW?
 .5000   -  RU
             N
PTRD?
 .1500      RU
             N
PTRI?
 .3300      RU
             N
PTTD?
 1.0000      R
            UN
PTTI?
 1.0000      R
            UN
DTD?        -
 .0500      RU
             N
DTI?
 .0500      RU
             N
TCPD?
 200.0000
          RUN
TCPI?
 200.0000
          RUN
DISCARD=29,5
71.6076
          RUN
INTERMEDIATE
=43,519.9089
          RUN
DEPOT=33,981
.1351
          RUN
DEPOT=33,981
.1351?
```

```
XEQ "LCC REL    RELIABILITY EXAMPLE
           ..
≠LEV?
 5.000000
          RUN
≠CIR/LEV?
 1.000000
          RUN
COM MTBF=?
Y         __
          RUN
S/P?
P
          RUN
≠COM/CIR?
 2.000000
          RUN
≠PAR CIR?
 1.000000
          RUN
REL?
 0.000000
          RUN
MTBF?   -
 500.000000
          RUN
·T?
 1.000000
          RUN
RELIABILITY=
0.999996
          RUN
≠CIR/LEV?
 3.000000
          RUN
COM MTBF=?
N
          RUN
S/P?
S
          RUN
≠COM/SER?
 2.000000
          RUN
REL?
 .999996
          RUN
REL?
 0.000000
          RUN
MTBF?
 500.000000
          RUN        202
```

```
T?
 1.000000
            RUN
RELIABILITY=
0.997998
            RUN
            RUN
COM MTBF=?
Y
            RUN
S/P?            -
S
            RUN
≠COM/SER?
 3.000000
            RUN
REL?
 0.000000
            RUN
MTBF?
 500.000000
            RUN
T?
 1.000000
            RUN
RELIABILITY=
0.994018
            RUN
            RUN
COM MTBF=?
Y
            RUN
S/P?

S
            RUN
≠COM/SER?
 1.000000
            RUN
REL?
 0.000000
            RUN
MTBF?
 500.000000
            RUN
T?
 1.000000
            RUN
RELIABILITY=
0.998002
            RUN
≠CIR/LEV?
 1.000000
            RUN            203
```

```
COM MTBF=?
N
          RUN
S/P?
P
          RUN
≠COM/CIR?
 3.000000
          RUN
≠PAR CIR?
 1.000000
          RUN
REL?
 .998002
          RUN
REL?
 .997998
          RUN
REL?
 .994018
          RUN
RELIABILITY=
1.000000
          RUN
          RUN
≠CIR/LEV?
 2.000000
          RUN
COM MTBF=?
N
          RUN
S/P?
S
          RUN
≠COM/SER?
 2.000000
          RUN
REL?
 1.000000
          RUN
REL?
 0.000000
          RUN
MTBF?
 500.000000
          RUN
T?
 1.000000
          RUN
RELIABILITY=
0.998002
          RUN
COM MTBF=?
Y
          RUN
```

```
S/P?
S
            RUN
≠COM/SER?
 2.000000
            RUN
REL?
 0.000000
            RUN
MTBF?
 500.000000
            RUN
T?
 1.000000
            RUN
RELIABILITY=
0.996008
            RUN
≠CIR/LEV?
 1.000000
            RUN
COM MTBF=?
N
          . RUN
S/P?
P
            RUN
≠COM/CIR?
 2.000000
            RUN
≠PAR CIR?
 1.000000
            RUN
REL?
 .998002
            RUN
REL?
 .996008
            RUN
RELIABILITY=
0.999992
            RUN
SYSTEM REL=0
.999992
```

APPENDIX D

OUTPUT COMPARISON

RAND   C-141A   Airframe R&D and Production

	Model	Original	Actual
Hrs En	12,565,047.86	17,166,982	13,000,000
Hrs Tool	10,698,291.74	14,266,000	10,700,000
Hrs Lab	32,735,811.48	43,508,000	30,000,000
$ Matl	445,129,157.70	595,939,000	387,345,000
$ Dev	104,716,301.20	136,771,000	47,485,000
$ Prog	2,191,198,907.00	2,921,599,000	1,849,211,000
$ Fl Tst	42,048,591.29	49,506,000	40,391,000
QC	2,784,726.36	3,698,000	1,610,000

NORTHROP   A-10   Aircraft R&D, Production, and Operations and Support

	Model	Original	
AF_{750}	3,819,126.89	3,819,000.00	
Pu_{1000}	1,294,040.20	1,294,000.00	
P_{750}	2,869,571.70	2,870,000.00	
E_{750}	2,250,000.00	2,250,000.00	
F_{750}	8,938,698.59	8,939,000.00	
R&D	2,417,886,289.00	2,379,000,000.00	Math Error
POL_{FH}	422.63	423.00	
A_{729}	2,809,714,498.00	2,810,000,000.00	
P_{729}	2,100,967,693.00	2,101,000,000.00	
E_{729}	1,645,863,157.00	1,646,000,000.00	
F_{729}	6,556,545,348.00	6,557,000,000.00	
I O&S	2,425,921,779.00	2,426,000,000.00	
FH O&S	3,998,364,793.00	3,998,000,000.00	
CL IV M	354,053,448.80	354,000,000.00	
UE O&S	1,392,428,007.00	1,118,000,000.00	Math Error
POL O&S	1,109,143,393.00	1,109,000,000.00	
OTH O&S	1,589,953,473.00	1,590,000,000.00	
TOT LCC	19,844,000,000.00	19 5,310,000,000.00	Notation Error

GRUMMAN   C-141A   Aircraft R&D, Production, Initial Spares,
                     and Operations and Support

	Model	Original
AFM	516,005,256.90	561,755,000.00
AV	59,326,649.82	61,939,000.00
EN	165,866,695.60	163,511,000.00
G&A	53,664,546.72	58,423,000.00
PR	34,180,188.22	37,211,000.00
TOT	829,043,337.20	882,838,100.00
AFM	1,821,939,554.00	1,860,443,000.00
AV	202,343,956.80	226,629,000.00
EN	749,461,160.30	716,906,000.00
G&A	234,620,166.90	205,271,000.00
PR	149,434,998.70	130,742,000.00
TOT	3,490,651,448.00	3,139,990,200.00
STR	333,911,154.80	351,224,100.00
CR	9,854,782.51	13,141,200.00
LG	31,690,885.57	35,718,300.00
FC	19,123,950.77	21,043,600.00
EI	146,692,734.50	109,067,700.00
ECS	19,909,651.94	22,760,600.00
EL	34,804,078.83	41,549,500.00
HYD	16,807,597.91	21,783,500.00
FUEL	3,301,333.90	6,454,700.00
CH	3,134,342.10	2,772,500.00
APU	411,700.20	2,416,500.00
G&A	77,083,870.34	79,956,000.00
PR	49,096,495.88	50,926,000.00
IT	80,757,121.90	80,374,000.00
EN	240,827,408.40	199,887,100.00
AV	121,548,848.00	140,874,400.00
TOT	1,188,955,958.00	1,099,575,600.00
POL	3,261,522,099.00	3,261,522,000.00
BLM	1,449,242,263.00	1,485,428,000.00
RS	591,439,376.50	605,432,000.00
DCR	1,253,183,061.00	1,277,842,000.00
BLO	1,373,652,932.00	1,373,653,000.00
BLT	979,177,552.50	979,178,000.00
PDM	228,381,170.60	228,381,000.00
OM	27,024,253.24	26,306,000.00
TOT	5,902,100,610.00	5,976,218,500.00

LSC

	Model	Original
BSC	198,000.00	198,000.00
BSTK	9.00	9.00
DSC	72,600.00	72,600.00
DSTK	66.00	66.00
SIC	420,600.00	420,600.00
TPC	1,320,600.00	1,320,600.00
BMHC	2,908,937.65	2,908,937.65
BMMH	453.53	453.53
PMSH	30.55	30.55
BMMC	8,801,470.59	8,801,470.59
DMHC	665,514.71	665,514.71
DMMH	1,470.59	1,470.59
DMMC	661,764.71	661,764.71
SDTC	681,352.94	681,352.94
CSC	971,300.00	971,300.00
QSC	833.00	383.00
IMCC	115,425.00	115,425.00
TOC	14,805,765.59	14,805,765.59
LCC	16,178,365.59	16,176,365.59

ORLA

	Model	Original
DISCARD	29,571.61	29,571.01
INTERMEDIATE	43,519.91	43,415.44
DEPOT	33,981.14	33,969.68

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