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ASTAR (Automated Simulator Test And Assessment Routine) Operational Evaluation: Conclusions And Recommendations Final Report

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ASTAR

(Automated Simulator Test and Assessment Routine)

OPERATIONAL EVALUATION: CONCLUSIONS AND RECOMMENDATIONS

Final Report
CDRL AOO3

April 13, 1990
(Revised May 11, 1990)
Prepared under Contract Number 61339-89-C-0029
for
Naval Training Systems Center

Institute for Simulation and Training
12424 Research Parkway, Suite 300
Orlando FL 32826

University of Central Florida
Division of Sponsored Research

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The Automated Simulator Test and Assessment Routine (ASTAR) is an automated decision aid designed to assist a training system analyst to predict the effectiveness of a training device during its development (Rose, Martin & Wheaton, 1988). ASTAR was developed to provide a systematic and analytic evaluation procedure to aid training device design and acquisition. The final phase of the ASTAR development process was to conduct "field testing" in order to demonstrate the operational utility of ASTAR. The objective was to compare and contrast ASTAR to other automated Device Effectiveness Technologies (DETs) and formulate a plan to implement ASTAR as a standard evaluation technique within the DoD Instructional System Development (ISD) process. The operational evaluation was accomplished through a series of integrated tests. The tests assessed the operational utility and impact of ASTAR on existing and new training systems. These tests examined performance, utility, and user issues with regard to ASTAR. While the concept of ASTAR was well received by the operational analysts, the current implementation of ASTAR achieved poor user acceptance. ASTAR will require (over)

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19. (Cont.) extensive enhancement before it can gain general user acceptance. A functional description for an improved ASTAR was developed to address the problems of ASTAR. It is recommended that any further developmental action on ASTAR be limited to the design described in the ASTAR Functional Description included in this report, or a totally new effort to develop a technique for estimating training effectiveness.

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EXECUTIVE SUMMARY

PROBLEM

The Automated Simulator Test and Assessment Routine (ASTAR) is an automated decision aid designed to assist a training system analyst to predict the effectiveness of a training device during its development (Rose, Martin & Wheaton, 1988). ASTAR was developed to provide a systematic and analytic evaluation procedure to aid training device design and acquisition. Prior to implementation as a standard evaluation technique, it was necessary to conduct field tests with operational analysts to determine user acceptance of ASTAR.

OBJECTIVE

The objective was to demonstrate the operational utility of ASTAR and formulate a plan to implement ASTAR as a standard evaluation technique within the DoD Instructional System Development (ISD) process.

APPROACH

The operational evaluation was accomplished through a series of integrated tests using operational training systems and their analysts. The tests assessed the operational utility and impact of ASTAR on existing and new training systems. A single test could not adequately or efficiently address the scope of the evaluation criteria required to assess the operational utility of ASTAR. Therefore, several tests were conducted during the course of this project, including three operational tests and a longitudinal test. These tests examined performance, utility, and user issues with regard to ASTAR.

CONCLUSIONS

While the concept of ASTAR was well received by the operational analysts, the current implementation of ASTAR achieved poor user acceptance. ASTAR will require extensive enhancement before it can gain general user acceptance. A functional description for an improved ASTAR was developed which addressed the problems in ASTAR. It is recommended that any further developmental action on ASTAR be limited to consideration of the design specified in the ASTAR Functional Description included in this report, or a totally new effort to develop a technique for estimating training effectiveness.

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TABLE OF CONTENTS

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INTRODUCTION

ASTAR is a computer based decision aid developed by the American Institutes for Research (AIR) under contract to the government. It was designed to training device during its development (Rose, Martin & Wheaton, 1988). ASTAR was developed to provide a systematic and analytic evaluation procedure to aid training device design and acquisition.

> ASTAR is intended to provide training system designers and developers with various kinds of information about the potential effectiveness of a training-device-based system. ASTAR is not designed to produce a single 'Figure of Merit.' The approach to effectiveness analysis is to provide a framework in which device developers can compare devices for effectiveness and diagnose potential problems in a system design. (Rose, Martin & Wheaton, p. 6, 1988)

OBJECTIVE

ASTAR has been the object of an extended development and evaluation process. The final phase of the ASTAR development process was to conduct "field testing" in order to demonstrate the operational utility of ASTAR. The objective was demonstrate the operational utility of ASTAR and formulate a plan to implement ASTAR as a standard evaluation technique within the DoD Instructional System Development (ISD) process.

ORGANIZATION OF REPORT

This report provides brief summaries of the approach, results, and recommendations associated with the ASTAR Operational Evaluation. The results section addresses the utility of the ASTAR concept and the utility of the current program. The section summarizing the recommendations discusses the assessment of the Project Advisory Group (PAG), user recommendations, and implementation recommendations. The appendix documents the functional description for an improved ASTAR program. The appendix includes a number of annexes which provide detailed supporting data.

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METHOD

The operational evaluation was accomplished through a series of integrated tests which utilized operational training systems and their analysts. The tests assessed the operational utility and impact of ASTAR on existing and new training systems. A single test could not adequately or efficiently address the scope of the evaluation criteria required to assess operational utility of a program such as ASTAR. Therefore, several tests were conducted during the course of this project, including three operational tests and a longitudinal test. These tests examined performance, utility, and user issues with regard to ASTAR.

The three operational tests involved a structured evaluation of ASTAR using analysts from NAVTRASYSCEN, the US Army Project Manager for Training Devices (PM TRADE), the Defense Language Institute Foreign Language Center (DLIFLC), Newport News Shipbuilding, and Computer Science Corporation. A minimum of three analysts were used for each training system evaluated. When possible, the subjects selected for research were the actual analysts involved in the original development of the selected training systems. User attitudes of the computerized decision aids were evaluated at the completion of each test.

The focus of the longitudinal test was to evaluate opinions of analysts who had used ASTAR over an extended period of time. The test was by nature unstructured and emphasized lessons learned.

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RESULTS

UTILITY OF THE ASTAR CONCEPT

Intuitive observation indicates that a need exits for DETs in the procurement of effective training devices. To empirically determine if a need exists within the user community a survey was conducted (Bradley, 1990). Unless the potential user community believes that they need these DETs, any implementation plan for ASTAR will not be effective.

The survey was distributed through government organizations and conferences to 183 potential users, with 46% of the surveys returned. The respondents were asked to indicate whether they had a definite need, a possible need, or no need at all for ASTAR. Overall, there was a definite dichotomy of responses. The majority of respondents were either highly interested in ASTAR or expressed no interest at all. The returned surveys indicated that 52.5% of the respondents had a positive interest in ASTAR.

During the operational tests, the analysts expressed a number of positive opinions concerning the utility of the ASTAR concept. The aspects which analysts liked most included:

a. The overall concept of an automated system to perform training effectiveness evaluations of multiple training devices was considered quite worthwhile. It was felt that the use of such a technique could result in cost, time, and manpower savings.

b. Having a tool to provide quantitative data which can be used in the decision making process during the design and development of training systems.

c. Computer documentation of trainer and weapon system hardware, controls and displays, and operator tasks on IBM compatible software.

d. The structured group approach to training device design that ASTAR requires.

The availability of a DET like ASTAR for use in evaluation of training effectiveness in different emerging devices was seen as a valuable tool for the design of training systems. For example, the ability to conduct ASTAR evaluations at three different levels of device development was felt to be of particular benefit. The analysts believed that the proper application of ASTAR should result in considerable savings in time, cost, and man hours during the ISD process.

THE CURRENT ASTAR PROGRAM IS NOT USEFUL

However, the current version of ASTAR was not perceived by analysts as useful. The poor user acceptance was a function of the ASTAR user interface. Negative aspects of ASTAR cited by analysts included:

a. Considerable criticism of the output data, or ASTAR results, as presented in the final summary. It was felt that the lack of definition of the data rendered them meaningless. The general tenor of the comments indicated that the subjects did not know what the data were telling them, and there were no documents or screen presentations to tell them how to interpret the different scores.

b. The tediousness and length of time associated with the entry of almost identical lists of controls and displays. This was believed to be unnecessary, redundant, and inefficient.

c. The lack of organization of the menus prohibited a free flow in and out of the process. In other words, there was no capability to escape from the program at any point and then return at a later time to the same point. The user was forced to work through a time consuming and complex procedure to arrive at a point of interest.

CONCLUSIONS

The following conclusions were drawn from the operational test of ASTAR:

- The lack of user friendliness caused a low rating in terms of user acceptance.

- The users considered the concept of ASTAR to be worthwhile but because of user interface problems the subjects would not want to use ASTAR in its current state. They would prefer to use their current methods of training system design.

- The subjects felt that the proper application of ASTAR would result in considerable savings in time, cost, and man hours during the analysis phases of training development.

- Most of the shortcomings can be alleviated by modifying the programs to incorporate current software practices, data base techniques, and user interface standards. ASTAR will require modification before implementation as a standard evaluation technique.

- ASTAR makes no allowances for the impact of training scenario/training materials in its evaluations. These factors are critical determinants of training effectiveness.

In summary, ASTAR is a relatively old program. It was developed before many of the recent advancements in the design and technology of both software and human/computer interfaces. ASTAR will require extensive enhancement before it can gain general user acceptance.

RECOMMENDATIONS

PROJECT ADVISORY GROUP ASSESSMENT

The Project Advisory Group (PAG) met to review the results of the evaluation. The PAG reviewed:

- a summary of the evaluation tests;
- the PAG Assessment Objectives of ASTAR impact, cost, and development time; and
- the recommended Functional Description.

The conclusions of the PAG were mixed. While the concept and underlying benefit of ASTAR were recognized, the current state of the software overshadowed any benefit to be derived by recommending that ASTAR be distributed or institutionalized. While a significant number of users requested access to it, and its use suggests significant inputs to the operational designs, users' reports show they do not value ASTAR in its present software configuration ASTAR was perceived to be inadequate as it stands. The comments of the PAG were unanimous in suggesting a new start to incorporate the "concept", "approach", or "philosophy" of ASTAR into an improved software package.

USER RECOMMENDATIONS

During the operational tests, the analysts provided a number of suggestions and recommendations for changes to the ASTAR program to improve user acceptance. These comments formed the basis of the functional description for a revised ASTAR, called ASTAR II, contained in the appendix . User recommendations were:

a. ASTAR should be programmed to make it more user friendly and to provide a more meaningful output, e.g. graphics outputs.

b. ASTAR should be programmed to provide:

   (1) Simplified utility menus to allow easy editing, addition, and deletion of controls and displays, and task and subtask data.
   (2) A way to save data on both hard drive and floppy disks.
   (3) Provide input/output capabilities from database and spreadsheet programs;
   (4) Allow revision of data base;
   (5) Allow input to be duplicated;
   (6) Upgrade to mouse input; and
   (7) Allow side-by-side comparison of two systems rather than the current practice of producing analyses for one system at a time.

ASTAR II: THE RECOMMENDED APPROACH

It is recommended that any further developmental action on

ASTAR should incorporate the design specified in the ASTAR Functional Description, or a totally new effort to develop a DET for estimating training effectiveness. The functional description for ASTAR II is the minimal response to the problem areas identified in this evaluation. It would provide a design approach which would satisfy user demands for a modern aid to device development. Once developed and tested, ASTAR II could provide that acceptable assessment routine suitable for integration and acceptance as an industry standard.

ASTAR SUPPORT OF THE INTERSERVICE PROCEDURE FOR INSTRUCTIONAL SYSTEM DEVELOPMENT (IPISD) PROCESS

A useful implementation of an improved ASTAR would be to incorporate the ASTAR evaluation technique into the IPISD. The IPISD is a systems engineering approach to training, which consists of a structured series of analytical steps that break down a weapon system's operational, maintenance, and support requirements into specific tasks, activities, skills, and knowledge. IPISD considers the relative need and appropriate method to train each task, task element, skill, and knowledge to a target student population. Using an iterative building block approach, IPISD determines the training system design requirements for the weapon system. The measures of ASTAR's usefulness must come from successful integration into the procurement cycle. Since IPISD is the approved technique and procedure to be followed in the development and conduct of effectiveness training, it is within this framework that ASTAR must exhibit its worth.

ASTAR II may be useful in three of five IPISD phases. ASTAR will work effectively in four out of the five blocks of the Analyze phase: Select Task/Functions, Construct Performance Measures, Analyze Existing Courses, and Select Instructional Settings. Phase II of the IPISD process, Design, provides much of the qualitative data needed for conducting ratings in the three ASTAR analysis levels. Two of the four blocks within this phase, Develop Objectives and Describe Entry Behavior, provide information to ASTAR. In Phase III, Develop, ASTAR can be used during the Review Existing Materials and Develop Instruction blocks. It is within Phase III that ASTAR makes a direct contribution to the ISD process. Phases IV and V of the IPISD process, Implement and Control, do not relate directly to known uses of the ASTAR technique.

The following summarizes some of the major areas within the IPISD process where ASTAR could be used to assist the training device designer, and where IPISD outputs could be utilized as data inputs to ASTAR:

I. <u>ASTAR uses within IPISD:</u>
   a. Examine training effectiveness of existing materials.
   b. Structure development of training objectives.
   c. Document procedures and major decisions derived.
      1. Document the rationale used in the exclusion and

inclusion of the media alternatives.

2. Document the rationale on a task by task basis by which existing courses are excluded from consideration.

d. Support development of device scripts.

1. Develop task level device configurations for scripts.
2. Develop specific control and display configurations.

e. Iteratively examine alternative tradeoff solutions.

II. <u>Data input provided by IPISD:</u>

a. Edited task lists.
b. Performance level expected from training.
c. Knowledge levels and skills necessary.
d. Entry characteristics of the trainee.
e. Material, procedures, plans, and media necessary to conduct instruction.

Operational analysts involved in DoD ISD activities have expressed a desire for a DET encompassing the concept of training effectiveness prediction within ASTAR. Furthermore, an ASTAR type of DET would provide a valuable tool within the IPISD. However, the current implementation of ASTAR can not meet this need because of poor user acceptance. To achieve user acceptance, ASTAR would, at a minimum, need to be improved to meet the modifications described in the appendix.

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REFERENCES

Bradley, B. (1990). Survey Results (IST-TR-90-06). Technical Interim Report. Orlando, Florida: University of Central Florida/Institute for Simulation and Training.

Rose, A. M., Martin, M. F., & Wheaton, G. R. (1988). Forecasting Training System Effectiveness: Review and Analysis of ASTAR. Final Report. Washington, D.C.: American Institutes for Research.

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APPENDIX

ASTAR FUNCTIONAL DESCRIPTION

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TABLE OF CONTENTS

TABLE OF CONTENTS (CON'T)

LIST OF TABLES

LIST OF FIGURES

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SECTION 1. GENERAL

1.1 PURPOSE OF FUNCTIONAL DESCRIPTION

This Functional Description for the enhancement of the Automated Simulator Test and Assessment Routine (ASTAR) is written to provide:

a. The reprogramming requirements that must be satisfied to enhance the functionality, user friendliness, and user acceptance of the system. This will serve to increase the level of user acceptance.

b. Information on performance requirements, suggested redesign and user impacts.

This Functional Description was developed to meet the format and content requirements of Data Item Description DI-E-30104B.

1.2 PROJECT REFERENCES

This section provides a general summary of ASTAR's approach and the identification of project sponsor, target users, and operating centers where the improved ASTAR program will be used. Additionally, a list of references which are applicable to the history and development of the ASTAR training device design aid is provided.

The ASTAR is an automated decision aid designed to assist an analyst in evaluating the effectiveness of a training device or method. ASTAR uses generally accepted training principles to evaluate the effectiveness of any training method that involves practice on job tasks. ASTAR helps the analyst evaluate a training approach by asking questions about the learning difficulty or transfer of training to the job environment. ASTAR then converts the judgments provided by the analyst about various facets of the training system into a forecast of the system's effectiveness. The analyst responds to a series of questions by assigning the training device under evaluation a subjective rating with a value of between zero and one hundred. This value represents the analysts' perceptions of the effectiveness of the training device on a percentage basis.

The history of ASTAR began in the late 1970s as a manual analysis technique developed by the American Institutes for Research (AIR) for the U. S. Army Research Institute (ARI). Around 1980, AIR was contracted to convert the manual technique to a computer based decision aid. The initial version of the program was sponsored by the ARI and was called the Device Effectiveness Forecasting Technique (DEFT). Early in the 1980s the program was picked up by the Naval Training Systems Center (NAVTRASYSCEN). Around this time the name of the program was changed from DEFT to ASTAR.

The ASTAR and DEFT programs were subjected to a series of development and validation tests during the early to mid 1980s. ASTAR was applied to several systems in various stages of the acquisition process to determine its effectiveness as a decision aid. During these tests, conducted by AIR under contract to NAVTRASYSCEN, ASTAR was demonstrated to have a positive impact on the design process. ASTAR recommendations influenced the final design selection in the Precision Gunnery Trainer System (PGTS) and Combat Talon II Maintenance Trainer programs. Validity statistics were also established during several validation tests conducted in conjunction with NAVTRASYSCEN. These validity statistics, summarized by Rose, Martin and Wheaton (1988) in "Forecasting Training System Effectiveness: Review and Analysis of ASTAR. Final Report" are provided below.

1). A split-plot factorial ANOVA indicated that pretraining in Device 11G2 significantly reduced the amount of time to repair (TTR) malfunctions in the Phalanx ($p < .01$) with the effect being greater for more difficult tasks and for certain subsystems (although interaction effects were not statistically significant). Estimated transfer ratio (TR) ranged from .00 to .63 with an average of .33, where

$$TR = \frac{\text{TTR (in 11G2) - TTR (in Phalanx)}}{\text{TTR (Historical Data)}}$$

(Rose, Martin & Wheaton, 1988, p. 11)

2). The ASTAR scale values for each factor were averaged (e.g., scales 1+ 5/2) to create three variables for predicting transfer ratios. these averages were compared to the empirically derived transfer ratio for each task using a regression analysis ($N = 16$). The resulting multiple correlation ($r = .64$) was described as expressing the goodness of fit between the modeled ASTAR data and the actual performance data. (Rose, Martin & Wheaton, 1988, p. 12)

3). The transfer coefficients developed from ASTAR, FORTE, and field data were correlated two at a time to provide estimates of concurrent and convergent validity. Convergent validity of ASTAR and FORTE was estimated at r - .81 to .99 with a mean of .92. Concurrent validity of ASTAR prediction of transfer was estimated at $r = .45$ to .63 with a mean of .55. (Rose, Martin & Wheaton, 1988, p. 18)

The original validation tests were limited because analyses were predominantly conducted by the developer of the ASTAR, The American Institutes for Research (AIR). In 1989, the University of Central Florida Institute for Simulation and Training

(UCF/IST) was placed under contract by NAVTRASYSCEN to conduct an operational field test of ASTAR. The objective of this evaluation was to determine whether operational analysts could learn and effectively use ASTAR. During the course of the evaluation it was determined that a number of problems existed in the current implementation of the program. The problems did not center on the concepts underlying ASTAR. Instead they were associated with the ease of use and user interface of ASTAR. Current software and human computer interface technology have progressed significantly since the effort to computerize ASTAR was initiated. Hence, user expectations of how the program should operate, based on the current state-of-the-art software, lead to the conclusion that ASTAR could not be implemented in its current form. This functional description addresses the changes that are needed to revise ASTAR to meet current software and interface standards and gain user acceptance. The recommended changes are based on the series of operational tests conducted by UCF/IST.

The intention of the ASTAR program is to develop a training effectiveness prediction decision support aid which could be implemented as a DoD standard analysis technique. ASTAR should be applicable to all government organizations and contractors involved in the development of training devices and training programs for the military.

The following list of references document the original development and test of the ASTAR technique and provide additional supporting data to this functional description. The references are organized alphabetically by author and in order of their publication date within author. Also included, are user manuals and other aids which can assist in the operation of ASTAR.

1.2.1 Technical Documentation

1. American Institutes for Research (1987). Review of the DEFT Technique and Recommendations for the Integration of DEFT into the Training Device Design Process. Washington, D.C.: American Institutes for Research.

2. American Institutes for Research (1988). ASTAR User's Manual. Washington, D.C.: American Institutes for Research.

3. Bird, R., Gibbons, S., & Companion, M. A. (1990). Operational Test #1: M60A1 Main Battle Tank. Technical Interim Report. Orlando, Florida: University of Central Florida/Institute for Simulation and Training.

4. Bradley, B. (1990). Survey Results. Technical Interim Report. Orlando, Florida: University of Central Florida/Institute for Simulation and Training.

5. Bradley, B., & Companion, M. (1989). The Automated Simulator Test and Assessment (ASTAR) Abbreviated User's Manual. Orlando, Florida: University of Central Florida/Institute for Simulation and Training.

6. Bradley, B. & Companion, M. (1989). ASTAR: The Automated Simulator Test and Assessment Routine. Proceedings of the Cost Effectiveness Analysis Workshop. Held in Conjunction with the 11th Interservice/Industry Training Systems Conference.

7. Bradley, B. & Companion, M. (1990). Operational Test #3: Foreign Language Reading Comprehension. Technical Interim Report. Orlando, Florida: University of Central Florida/Institute for Simulation and Training.

8. Companion, M. & Bailey, M. (1990). Operational Test #2: SEAWOLF Internal Auxiliary Launcher. Technical Interim Report. Orlando, Florida: University of Central Florida/Institute for Simulation and Training.

9. Gibbons, S. & Companion, M. (1990). Longitudinal Test: M60A1 Main Battle Tank. Technical Interim Report. Orlando, Florida: University of Central Florida/Institute for Simulation and Training.

10. Martin, M. F. (1987). Implementation of ASTAR: Evaluation Plan for the Combat Talon II Maintenance Trainer. Washington, D.C.: American Institutes for Research.

11. Martin, M. F. & Rose, A. M. (1988). Implementation of ASTAR: Evaluation of the Portable Aircrew Trainer. Washington, D.C.: American Institutes for Research.

12. Martin, M. F., Rose, A. M., & Wheaton, G. R. (1988). Applications for ASTAR in Training System Acquisitions. Washington, D.C.: American Institutes for Research.

13. Rose, A. M. (1987). Implementation of ASTAR: Evaluation Plan for the Portable Aircraft Trainer (PAT). Washington, D.C.: American Institutes for Research.

14. Rose, A. M. & Martin, M. F. (1988). Forecasting Training Effectiveness: DEFT Final Report. Washington, D.C.: American Institutes for Research.

15. Rose, A. M., & Martin, M. F. (1988). Implementation of ASTAR: Evaluation of the Precision Gunnery Training System. Washington, D.C.: American Institutes for Research.

16. Rose, A. M. & Martin, M. F. (1988). Implementation of ASTAR: Evaluation of the Combat Talon II Maintenance Trainer. Washington, D.C.: American Institutes for Research.

17. Rose, A. M., Martin, A. W., & Yates, L. G. (1985) Forecasting Device Effectiveness: Vol. III. Assessment of Device Effectiveness Forecasting Technique. Washington D.C.: American Institutes for Research.

18. Rose, A. M., Martin, M. F., & Wheaton, G. R. (1988). Forecasting Training System Effectiveness: Review and Analysis of ASTAR. Final Report. Washington, D.C.: American Institutes for Research.

19. Rose, A. M. & Wheaton, G. R. (1984). Forecasting Device Effectiveness: Volume II, Procedures. Washington, D.C.: American Institutes for Research.

20. Rose, A. M., Wheaton, G. R. & Yates, L. G. (1985). Forecasting Device Effectiveness: Volume I, Issues. Washington, D.C.: American Institutes for Research.

1.2.2 User Aids

a. American Institutes for Research, ASTAR User's Manual, July 1988

b. Institute for Simulation and Training, The Automated Simulator Test and Assessment Routine (ASTAR) Abbreviated User's Manual, August 1989

1.2.3 Programming and Documentation Standards

Documentation should conform with the intent of DoD Manual 7935. Developers are encouraged to use computer based documentation for both documentation and code. This allows documentation to be archived along with the source code, providing better long term access.

The primary program documentation is the source code. Hence, it should be well documented. To the maximum extent possible, programmer documentation should be built into the source code. The following three items are recommended for inclusion in the program documentation.

1. Program Header- This section of the source code identifies the program's purpose and functions, version, related files/libraries needed for compilation or linking, and external file usage.

2. Module (Subroutine) Header - Where practical, each program module should contain a description of the module's function and methodology, description of the passed parameters, description of common blocks, and

calls by information.

3. A list of modifications made since the previous baseline.

A Software Development Folder should be established at the beginning of the program. All information concerning the development of the program should be included in the software development folder. The software development folder should also include the test plan and test results for the program. If practical, computer copies of the test input and output should be maintained with the source code. The software development folder provides an audit trail for the development and operational verification of the program.

1.2.3.2 **Programming Conventions.** The following practices are recommended:

Modular coding - Small single function modules are the biggest contributor to good program development.

Extensive use of internal documentation - This includes the module header information, as well as liberally applied in-line comments.

Off-the-Shelf Routines - To the extent possible available off-the-shelf routines should be used.

While ADA has been adopted as the DoD Standard Programming Language, it is recommended that this effort utilize the C programming language. The reasons for this recommendation are:

1. ASTAR is essentially a data base management system. ADA is not well suited to this type of application.

2. The availability of off-the-shelf C modules could be utilized to accomplish ASTAR functions thereby reducing development cost and time.

3. Most of the programs that ASTAR might be used in conjunction with, for import or export of data, are written in C. Therefore, use of the C programming language provides a common programming environment.

1.2.3.3 **DoD and other Standards.** The development of the improved ASTAR should meet the intent of DoD-STD-2167A, Defense System Software Development, and DoD-STD-2168, Defense System Software Quality Program. These standards should be tailored to meet the objectives of the ASTAR project. Tailoring shall follow the guidance of MIL-HDBK-287, Tailoring Guide to 2167A, and MIL-HDBK-286, Tailoring Guide to 2168.

The interface development of the improved ASTAR should comply with the guidelines in Section 5.15, User-Computer Interface, of MIL-STD-1472D, Human Engineering Design Criteria for Military Systems, Equipment and Facilities. Further guidance should be taken from Smith and Mosier 1986 "Guidelines for Designing User Interface Software", ESD-TR-86-278.

1.2.3.4 **User Documentation.** Computer-based user documentation is strongly recommended. Not only is this form of documentation much easier to maintain, but in many cases, it is much easier to distribute. The user documentation should include the following information:

1. Where possible, discussion of program assumptions and limitations. This should include limits imposed by dimensioning and memory allocation.

2. Complete description of all user inputs and outputs.

3. List of all error messages, including recommended user actions.

4. Sample data sets and examples.

1.3 TERMS AND ABBREVIATIONS

This section provides a listing of terms, definitions and acronyms which are unique to this document. The list should provide users with a handy reference when these terms are encountered.

a. Acquisition Efficiency - - the quality of training provided by the training device.

b. ASTAR - - Automated Simulator Test and Assessment Routine.

c. DEFT - - Device Effectiveness Forecasting Technique.

d. Transfer Efficiency - - how well a training device promotes transfer of training to the operating equipment.

e. Transfer Problem - - the deficiencies trainees have with respect to operational criterion.

f. Training Problem - - the skill and knowledge deficiencies of trainees relative to criterion performance on a training device.

g. ISD/LSAR DSS - - Joint Service Instructional Systems Development/Logistic Support Analysis Record Decision Support System.

h. Commonality Analysis - - the ASTAR process in which common tasks between a training device and the operational system are identified.

i. Similarity Analysis - - the ASTAR process in which the common displays and controls for the training device and operational system are identified.

SECTION 2. SYSTEM SUMMARY

2.1 BACKGROUND

The primary goal of training system design methodologies is to produce training systems which maximize training effectiveness within the limitations of the acquisition process. Because of time and resource constraints inherent in the development of training systems many decisions regarding system design are based on analytic information rather than on empirical data from training system evaluations. There are few formalized techniques for analytic evaluations of training systems. As a result, design decisions are often based on the developer's best judgment. The ASTAR technique was developed to address the need for a systematic, analytical evaluation procedure for application during the training device design and development process.

ASTAR is a direct extension of an earlier procedure known as the DEFT. ASTAR is based on a multidimensional view of training system effectiveness that looks at the global training effort. It considers the trainee population capabilities and limitations, and stated training and performance objectives. It then determines how well the entire training system will promote the acquisition of the skills and knowledge required for proficiency on both the training device and operational hardware. This perspective is in contrast to other training effectiveness models that focus exclusively on transfer of training as the sole criterion of effectiveness. ASTAR examines not only what is trained, but also how well the device-based system is designed to promote effective and efficient training and transfer.

This functional description describes a redesign of ASTAR for the purpose of significantly improving the user friendliness. The redesign of ASTAR is based on user feedback gathered during the course of operational evaluation (Gibbons, Bird, and Companion, 1990; Companion & Bailey, 1990; Bradley and Companion, 1990; Gibbons & Companion, 1990). Hereafter in this document the improved ASTAR will be referred to as ASTAR II. The redesign will be structured to require fewer repetitive tasks and permit more flexibility in the entry and editing of data. It is expected that ASTAR II will be able to import or export data with the joint services ISD/LSAR DSS and have the ability to import data from standard data bases or word processing programs. This improvement in user friendliness should result in increased user acceptance and usability.

2.2 OBJECTIVES

ASTAR has been designed to forecast the effectiveness of device-based training systems. It has the ability to evaluate alternative design concepts for a training device in the early stages of acquisition or investigate which of several utilization patterns is most effective for an existing device. It compares the effectiveness of two training devices that are designed to train the same tasks or evaluate the effectiveness of differing device configurations. New device based training system designs can be compared with training on the actual equipment or against existing training systems.

The ASTAR II will provide decision support to the training system designer, and will permit more efficient analyses of alternate training approaches to enhance system design. The improved decision support and data management features will allow the training system analyst to work more productively. The new ASTAR II is expected to increase the usability and user acceptance over the current implementation method.

2.3 EXISTING METHODS AND PROCEDURES

The ASTAR is an automated decision aid designed to assist an analyst in evaluating the relative effectiveness of training devices or methods. ASTAR uses generally accepted training principles to evaluate the effectiveness of any training method that involves practice on job tasks. ASTAR helps the analyst evaluate a training approach by asking questions about the learning difficulty or transfer of training to the job environment. ASTAR then converts the judgments provided by the analyst about various facets of the training system into a forecast of the system's effectiveness. The analyst responds to a series of questions by assigning the training device under evaluation a subjective rating with a value of between zero and one hundred. This value represents the analysts' perceptions of the effectiveness of the training device on a percentage basis.

Using the analyst's ratings, ASTAR computes several "effectiveness" scores which can be used to make comparisons among devices or methods. An "Acquisition Effectiveness" score and a "Transfer Effectiveness" score provide a basis for comparisons of what is learned on the device and what remains to be learned on the job. These scores can be combined to provide a summary score of Training Effectiveness.

Figure 1 depicts the data flow through ASTAR from data acquisition through its processing and eventual output.

2.3.1 Equipment Utilized

ASTAR is an interactive, menu-driven program written to run on an IBM PC, XT, AT, PS\2 or 100% compatible microcomputer equipped with either dual disk drives or a hard disk and one floppy disk drive. The ASTAR programs are contained on one floppy disk. Also required is a second formatted floppy disk on which to input the data base and ratings unique to the training systems being evaluated.

2.3.2 Operation Sequence

Figure 2 presents a overview of the operational flow of the current implementation of ASTAR, Version 2.0. It depicts the

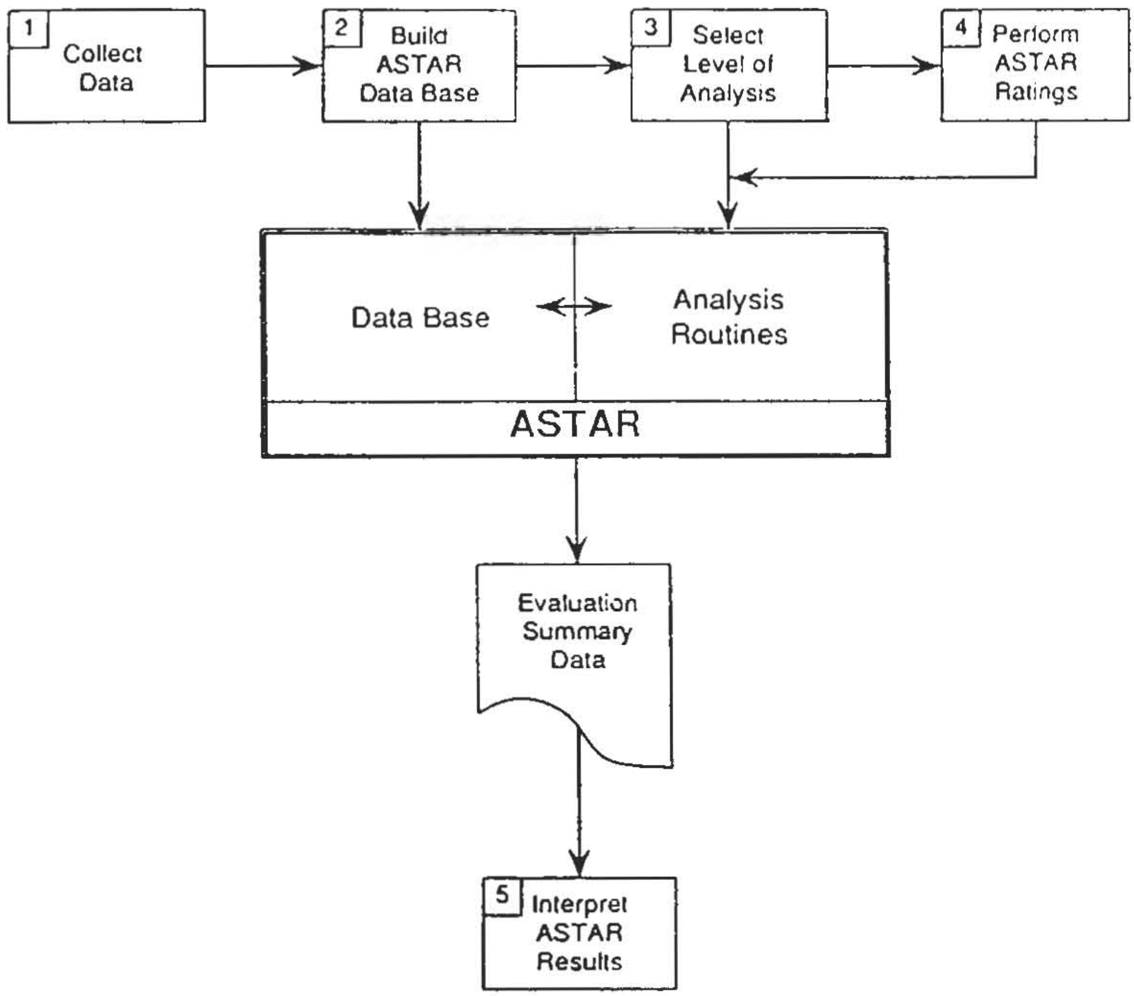

Figure 1. Diagram of current ASTAR data flow.

ASTAR 2.0

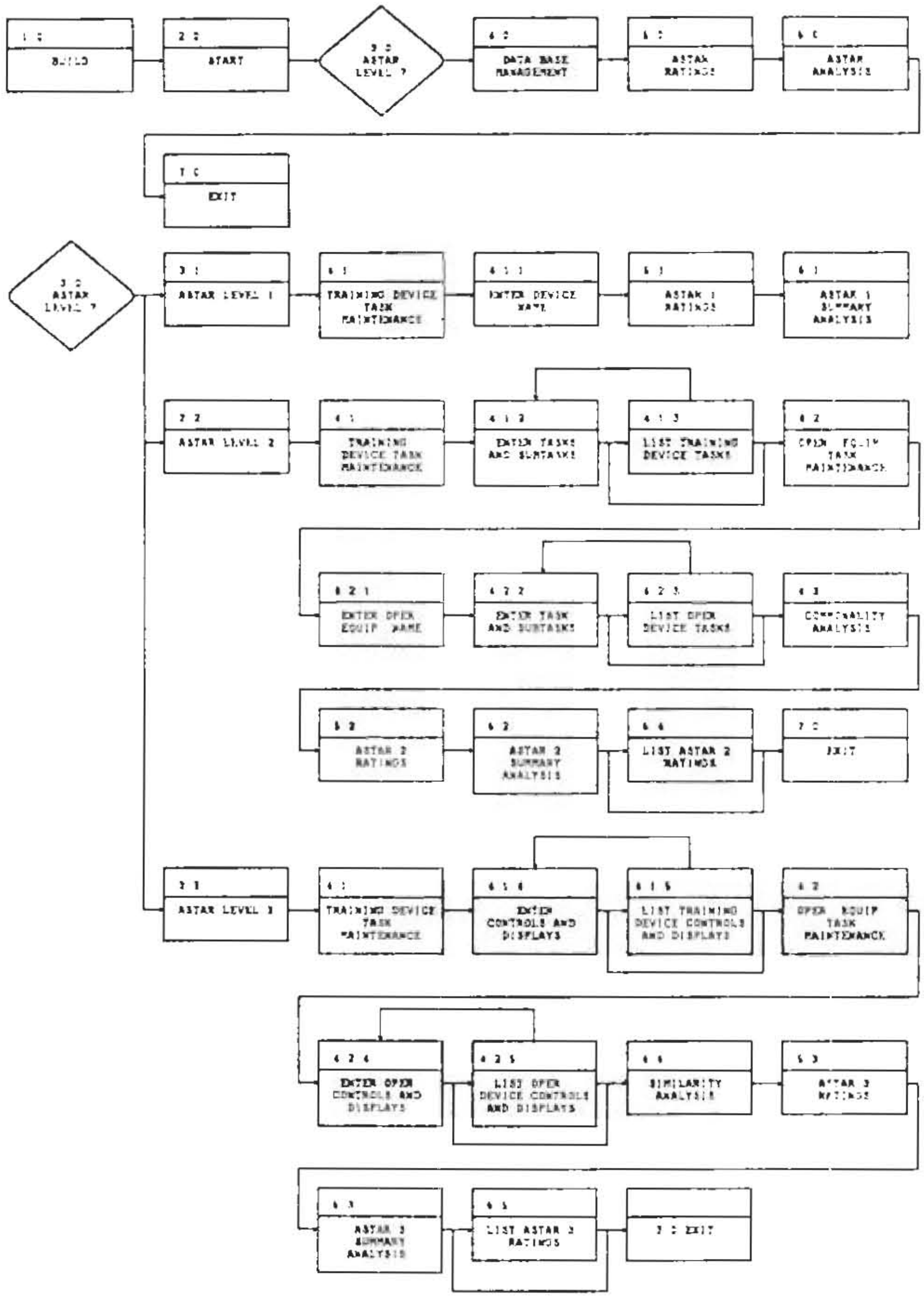

Figure 2. Overview of operation flow in current ASTAR implementation.

interdependencies between the various ASTAR levels as they relate to the creation of the ASTAR data base. Detailed flow diagrams and the source code for the current version of ASTAR are provided in Annexes 2 and 3 respectively. The following paragraphs explain the sequence in which the operational functions are performed.

ASTAR begins operation by asking the user to execute the "BUILD" command. The BUILD command creates a directory on the data disk under the device name specified. Once this set of device files, crated by the BUILD command, is constructed ASTAR will not allow the user to BUILD using the same device name. Once the directory containing the device files is established, program start up procedures can be initiated.

Once the decision is made of which ASTAR level of analysis is to be conducted, the data base management sequence is initiated. Building the ASTAR data base requires the entry of data into the ASTAR system, which in turn provides the basis for the effectiveness evaluation. The amount and level of detail of data required for imputing is dependent on the level of analysis to be conducted.

ASTAR Level 1 utilizes general ratings from the analyst without building a data base of tasks and subtasks as required for ASTAR Levels 2 and 3. The decision of which level to use depends upon the amount of information that the analyst has about the training device/method, the operational equipment and performance, the tasks to be trained, and the trainees themselves.

After completion of the data base maintenance routines, ASTAR ratings are performed; this task requires the user to assign a rating value to a series of questions. The number and kind of judgments the analyst must make vary as a function of the level of analysis that is chosen, i.e. Level 1 requires eight judgments, Level 2 requires 13 judgments per task, and Level 3 requires 35 different ratings for each task in the data base. Once all ratings are made, an evaluation summary screen is displayed.

The analyst is required to interpret ASTAR results in accordance with the unique training objectives of the evaluation. ASTAR provides a Summary of Results Table. Summary results are structured around the four basic components of ASTAR: the training problem, the acquisition efficiency, the transfer problem, and the transfer efficiency. This completes the operational flow from data acquisition through its processing and system outputs; the user now exits the ASTAR program.

2.3.3 Deficiencies

Deficiencies in the existing ASTAR system were determined from subjects' responses during three operational tests and a longitudinal test (Gibbons, Bird, and Companion, 1990; Companion

& Bailey, 1990; Bradley and Companion, 1990; Gibbons & Companion, 1990). Most deficiencies were noted in the area of user friendliness. A summary of the deficiencies in the current version of ASTAR is provided in Annex 1. Specific shortcomings cited by the users are as follows:

a. There exists no input/output capabilities for interfacing with other data base, word processing or spreadsheet programs.

b. Many desirable editing functions are absent or difficult to accomplish, i.e. adding, deleting, and revising task, control, and display data.

c. There is no capability for side-by-side comparison of two or more systems; the current procedure gives output sequentially from one trainer to the next.

d. The final ASTAR results summary screen is unclear. It lacks definition and has no documentation or screen helps to explain how to interpret the scores.

e. It is time consuming and redundant to enter almost identical lists of controls and displays and task lists for both the operational system and the training device.

f. Menu organization prevents easy access in and out of the ASTAR process. There is no capability to escape during program operations and return to that same point at a later time. Presently a lengthy and complex procedure must be followed, which is in itself variable depending on the location of the reenter point.

g. There is no capability to save data on both hard drive and floppy disks.

h. There is no mouse interface.

i. There are no graphics capabilities included for ASTAR outputs.

j. Trainer cost factors are not included in the ASTAR evaluation.

k. There is no capability to enter ratings for all training devices under consideration in parallel. The current system requires the user to run through the entire ASTAR routine one device at a time.

2.3.4 <u>Computational Formulas</u>

Table 1 presents the basic algorithms employed in ASTAR. These computational formulas represent the equations used directly in the ASTAR Level 1 computations. The ASTAR Level 2

TABLE 1
BASIC ASTAR COMPUTATIONAL FORMULAS

Performance Deficit	: Performance Deficit Rating (R1)
Learning Difficulty	: Learning Difficulty Rating (R2)
Training Problem	: (R1) x (R2) / 100 = (S1)
Quality of Training - Acquisition	: Training Acquisition Rating (R3)
Acquisition - Efficiency	: $\sqrt{(R3) / 100} = (S2)$
Acquisition	: (S1) / (S2) = (T1)
Residual Deficit	: Residual Deficit Rating (R4)
Residual Learning Difficulty	: Residual Learning Difficulty Rating (R5)
Physical Similarity	: Physical Similarity Rating (R6)
Functional Similarity	: Functional Similarity Rating (R7)
Transfer Problem	: ((R4) x (R5)) / 100 + ((R6) - (R7)) = (S3)
Quality of Training - Transfer	: Training Transfer Rating (R8)
Transfer Efficiency	: $\sqrt{(R8) / 100} = (S4)$
Transfer	: (S3) / (S4) = (T2)
Sum	: (T1) + (T2)

formulas are functionally identical, but are composite averages across the ratings within each of the eight subject categories, where applicable, and across tasks or subtasks (see Table 2). In the ASTAR Level 3 formulas, Table 3, the ratings are also averaged across each common control and display within the functional and physical similarity categories. These formulas are greatly simplified. The details of the computational formulas can be derived from the ASTAR flow diagrams in Annex 4 and the ASTAR 2.0 source code listings in Annex 2.

2.4 PROPOSED METHODS AND PROCEDURES

The main purpose of the redesign effort is not to change the functionality of ASTAR, but rather to increase the user friendliness. ASTAR II will still be an automated decision aid designed to assist an analyst in evaluating the effectiveness of a training device or method. The ASTAR II continues to help the analyst evaluate a training approach by asking questions about the learning difficulty or transfer of training to the job environment. The program converts the judgments provided by the analyst about various facets of the training system into a forecast of the system's effectiveness. The analyst will respond to the same series of questions, assigning the training device under evaluation a subjective rating with a value of between zero and one hundred. This value will represent the analysts' perceptions of the effectiveness of the training device on a percentage basis.

ASTAR II will have the same functional capabilities. It will use the analyst's ratings to compute "effectiveness" scores which can be used to make comparisons among devices or methods. An "Acquisition Effectiveness" score and a "Transfer Effectiveness" score will still provide a basis for comparisons of what is learned on the device and what remains to be learned on the job. The algorithms employed in the determination of these scores will remain unchanged (see Tables 1, 2 and 3). The structure of the ASTAR II program will permit easy modification of computational formulas if desired by configuration control.

Additionally ASTAR II will have the capability of interfacing with conventional off the shelf data bases and word processors capable of producing ASCII code. A method of interfacing with the existing data structures of the ISD/LSAR DSS will also be provided.

ASTAR II will continue to be an interactive, menu-driven program designed to run on an IBM PC, XT, AT, and PS/2 Personal Computer or 100% compatibles.

2.4.1 Operation Sequence

The operational sequence for the ASTAR II is illustrated in the top level functional flow diagram depicted in Figure 3. ASTAR II is designed to provide a flexible flow through the program. Upon entering the ASTAR program, by typing "ASTAR"

TABLE 2
ASTAR II COMPUTATIONAL FORMULAS

Performance Deficit	: Performance Deficit Rating $(\overline{R1}) = \sum_{t=1}^{t=n} R1/N$
Learning Difficulty	: Learning Difficulty Rating $(\overline{R2}) = \sum_{t=1}^{t=n} R2/N$
Training Problem	: $(\overline{R1}) \times (\overline{R2}) / 100 = (\overline{S1})$
Quality of Training - Acquisition	: Training Acquisition Rating $(\overline{R3}) = \sum_{Q=1}^{Q=4} R3/4$
Acquisition - Efficiency	: $\sqrt{(\overline{R3}) / 100} = (\overline{S2})$
Acquisition	: $(\overline{S1}) / (\overline{S2}) = (\overline{T1})$
Residual Deficit	: Residual Deficit Rating $(\overline{R4}) = \sum_{t=1}^{t=n} R4/N$
Residual Learning Difficulty	: Residual Learning Difficulty Rating $(\overline{R5}) = \sum_{t=1}^{t=n} R5/N$
Physical Similarity	: Physical Similarity Rating $(\overline{R6}) = \sum_{t=1}^{t=n} R6/N$
Functional Similarity	: Functional Similarity Rating $(\overline{R7}) = \sum_{t=1}^{t=n} R7/N$
Transfer Problem	: $((\overline{R4}) \times (\overline{R5})) / 100 + ((\overline{R6}) - (\overline{R7})) = (\overline{S3})$
Quality of Training - Transfer	: Training Transfer Rating $(\overline{R8}) = \sum_{Q=1}^{Q=3} R8/3$
Transfer Efficiency	: $\sqrt{(\overline{R8}) / 100} = (\overline{S4})$
Transfer	: $(\overline{S3}) / (\overline{S4}) = (\overline{T2})$
Sum	: $(\overline{T1}) + (\overline{T2})$

t = task or subtask number
Q = question number

TABLE 3
ASTAR III COMPUTATIONAL FORMULAS

NOTE: These equations are simplified. See Appendices for details.

Performance Deficit	: Performance Deficit Rating $(R1_{tn}) = R1$ for $t = 1$ to n
Learning Difficulty	: Learning Difficulty Rating $(R2_{tn}) = \sum_{q=1}^{q=6} R2$ for $t = 1$ to n
Training Problem	: $\sum_{t=1}^{t=n} (R1_{tn}) \times (R2_{tn}) / 100 = \overline{(S1)}$
Quality of Training - Acquisition	: Training Acquisition Rating $(R3_{tn}) = \sum_{q=1}^{q=11} R3/11$ for $t = 1$ to n
Acquisition - Efficiency	: $\sum_{t=1}^{t=n} \sqrt{(R3_{tn}) / 100} = \overline{(S2)}$
Acquisition	: $\overline{(S1)} / \overline{(S2)} = \overline{(T1)}$
Residual Deficit	: Residual Deficit Rating $(R4_{tn}) = R4$ for $t = 1$ to n
Residual Learning Difficulty	: Residual Learning Difficulty Rating $(R5_{tn}) = \sum_{q=1}^{q=6} R5$ for $t = 1$ to n
Physical Similarity	: Physical Similarity Rating $\overline{(R6)} = \sum_{t=1}^{t=n} \sum_{c=1}^{c=n} \sum_{d=1}^{d=n} R6 / (Nt)(Nc)(Nd)$
Functional Similarity	: Functional Similarity Rating $\overline{(R7)} = \sum_{t=1}^{t=n} \sum_{c=1}^{c=n} \sum_{d=1}^{d=n} R7 / (Nt)(Nc)(Nd)$
Transfer Problem	: $\left[\sum_{t=1}^{t=n} ((R4_{tn}) \times (R5_{tn})) / 100 \right] + (\overline{(R6)} - \overline{(R7)}) = \overline{(S3)}$
Quality of Training - Transfer	: Training Transfer Rating $(R8_{tn}) = \sum_{q=1}^{q=3} R8/3$ for $t = 1$ to n
Transfer Efficiency	: $\sqrt{(R8) / 100} = \overline{(S4)}$
Transfer	: $\overline{(S3)} / \overline{(S4)} = \overline{(T2)}$
Sum	: $\overline{(T1)} + \overline{(T2)}$

t = task or subtask number
q = question number

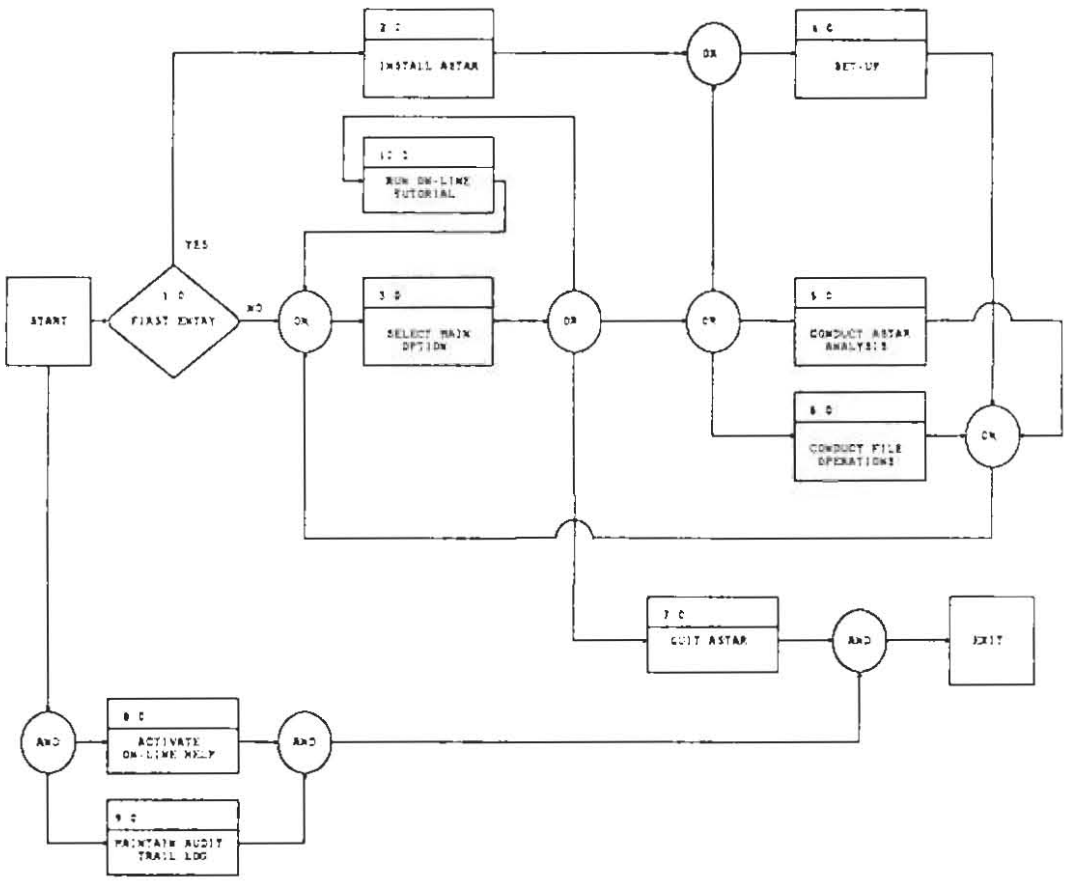

Figure 3. Operational Flow for ASTAR II.

<ENTER>, ASTAR II will take you to the main menu. At the same time the on-line help and audit trail facilities will be automatically activated. These two facilities remain active until ASTAR II is exited. If ASTAR II determines that this is floppy disk or hard disk. The ASTAR II manual can be printed as an option within the installation routine. After the installation it will automatically go into the set up utility where the user specifies monitor, printer and other relevant set up parameters. After the set up is completed the program will transition to the main menu.

ASTAR II provides a number of selections from the main menu. Menu selections include: conduct file operations; conduct an ASTAR Level 1, 2, or 3 analysis; or exit ASTAR II. Infrequent operations can be accessed via function keys rather than main menu selections. Function keys available on the main menu provide access to: help screens; the on-line tutorial; the set up routine; DOS; results analysis; and to a directory of existing data bases. Section 4.1.2 presents a discussion of all function key assignments. When ASTAR II enters the main menu, the "conduct analysis selections" are inactive. They become active only when a system name has been specified and ASTAR II determines that an associated data base exists. If ASTAR II determines that a data base does not exist for that system, it will automatically transition to the file operations menu. If ASTAR II determines that a data base does exist for the system, then it activates all main menu and function key options.

The File Operations function encompasses the ASTAR II data base management utilities. A data base must be established prior to conducting any ASTAR II analysis. The file operation utilities permit a data based to be created or modified. Data bases may be created either through an internal data base program or by importing files from other modules. Other utilities provided under the file operation function include: exporting data; deleting and copying files; and printing reports.

The ASTAR II analysis function parallels the current ASTAR implementation. This function permits ASTAR II Level 1, 2 or 3 ratings to be input into the data base. The rating procedure is the same as for the current implementation of ASTAR. The primary functional difference is that ASTAR II permits multiple systems to be rated simultaneously. At the subfunction level, ASTAR II also provides extensive branching so that the program may be entered or exited randomly rather than in a sequential mode without data corruption. Upon entering the ratings, ASTAR II provides access to the analysis results. The results summaries are a subfunction of the ASTAR II analysis function.

The basic functional flow within ASTAR II is similar to the current implementation of ASTAR, but all functions are now internal to the main program. The build function is a separate program in the current ASTAR. Section 4.0 provides a detailed description of the operational sequence for ASTAR II.

2.4.2 <u>Summary of Improvements</u>

The following sections provide a summary of the improvement incorporate in the design of the ASTAR II. Each of the described areas responds to deficiencies identified during the operational tests conducted as part of the ASTAR Operational Evaluation.

2.4.2.1 **Programming.** The programming environment for ASTAR II will be the C programming language. This will provide a flexible software environment that should support the improved functionality summarized below. The use of the C programming language will also provide a reduced development time because of the availability of off-the-shelf routines. These routines should be used wherever possible; specifically for data base development, data import/export utilities, and graphic output routines.

2.4.2.2 **Functionality.** In the area of functionality, ASTAR II will exhibit the same baseline functionality present in the original ASTAR. The revision will reorganize the basic operation of all of the ASTAR functions and also improve the effectiveness of many baseline functions. New areas of functionality will include the following:

- import/export data base routines,
- on-line helps,
- hard copy outputs,
- graphics capability,
- the ability to evaluate multiple devices simultaneously,
- broader hardware capability,
- and a recommended on-line tutorial.

ASTAR II will upgrade the following ASTAR capabilities:

- internal data base routines
- user interface, and
- add a number of evaluation output options.

2.4.2.3 **Compatibility.** ASTAR II will be compatible with other software. It will retain its own internal data base development and management routine and also be able to import and export data to programs such as the joint services ISD/LSAR DSS and other standard data bases and word processors capable of generating and accepting ASCII code.

2.4.2.4 **User Configuration.** ASTAR II will be based on a single user configuration which provides a utility to merge and combine the ratings from different files (analysts). A system which automatically combines the ratings of multiple users, rating the identical training device design, would be more efficient for the method of group analysis employed by the present ASTAR system. This multiple user system is elegant but potentially increases the hardware requirements. Thus, an intermediate configuration based on the single user, but which provides a utility to merge and combine ratings from different files (analysts), is proposed.

2.4.2.5 **Help Options.** ASTAR II will include a number of additional help features designed to provide the analyst with complete information required to complete an analysis. On-line help in the form of simple text messages will be accessible at critical instances of operation. Computational helps will provide information about the ASTAR equations; this is intended to help increase user understanding and acceptance. Assistance will be available when making ratings, i.e., providing additional anchor point examples. Query routines will be established which allow the user to access ratings from related questions or from a different ASTAR II analysis level. Prompts which clearly identify the source and type of errors will also be provided.

2.4.2.6 **Data Base Management.** The internal data base management function will include a utility module to handle the setup of the data base structure and configure the data base file formats. The list entry procedures for tasks, controls and displays will be upgraded and simplified. New data base management routines will provide a number of additional features. For example, data entry and editing routines will allow users to exit and move around freely within the system without disrupting the program, i.e., random access permitted. An automated replication procedure for control and display lists for each task will be provided. Non-appropriate controls and displays will be deleted by mouse or cursor highlighting within ASTAR II.

External data base management will provide an import/export capability to any source that can provide ASCII format information. Specific interfaces will be provided to ISD/LSAR DSS, standard word processing, spread sheets and other common data bases. The imported data must be modifiable so that as the ISD progresses and more data becomes available, data can be integrated into the imported file without having to recreate the entire file. Data items available in the ISD/LSAR DDS which correspond with ASTAR information requirements are as follows:

- weapon system name,
- subsystem name if applicable,
- task name,
- task ISD code,
- task element name (subtask),
- task element number (subtask),
- skill/knowledge name and number,
- and task criticality.

Use of text editors and word processors for the creation of data files or modifications of the data base items will be possible. This form of input will require a template to specify the correct data structure and format.

2.4.2.7 **Ratings Entry.** ASTAR II will permit ratings for multiple training devices to be entered on the same screen; permitting anchoring or reference across systems and removing the repetitive aspects of the current model. Also a function key will be available to enter the same rating for all devices if appropriate.

ASTAR II will provide a consistent method of data entry. The <SHIFT-TAB> will be active and permit transition between data fields of multiple device designs. A standard three digit default value will be assigned to data fields. The <ENTER> command will signal that the data fields for the devices have been completed, and that the next query screen question to be answered is accessed.

2.4.2.8 **Outputs.** The number and types of ASTAR outputs will be increased, and existing outputs enhanced to provide more useful information to the user. The outputs will be available on screen, printer or disk. Screen based outputs will include: ratings; tabular scores; and graphics. The display of ratings made on tasks and subtasks will be available to the user in both tabular and graphic formats. Display of both summary task and subtask scores will be available in tabular and graphic formats of each measured parameter. All sub-scores presently available in ASTAR Level 1 will be included in Levels 2 and 3 analyses. Graphical output of scores will be available in the form of bar graphs and line charts. It would be desirable to have 3-D outputs available to provide for better visualization of problems.

The following outputs will be available via hard copy printouts: all ASTAR graphics and tabular outputs; task lists; and controls and display lists. Through a menu of print options the user will be able to print out an individual chart, a subset of charts, or a total output data package. Disk based outputs will be available for all ASTAR tabular outputs discussed above. A file structure will make available, as disk outputs, these reports and results for importing into documents or exporting to other programs such as the ISD/LSAR DSS.

2.4.2.9 **User Interfaces.** The user interface, cited as the major deficiency of the ASTAR program, will be significantly modified during this functional redesign effort. The user interface will be structured require fewer repetitive tasks and provide flexible data entry and data management procedures. The interface will be menu driven and use cursor, mouse, and key letter strokes to select menu options. The interface of the ISD/LSAR DSS will be used as general guidance for the new ASTAR II integration. Key features design of the ASTAR II interface which will correct the deficiencies cited in Section 2.3.3. A summary list of these features is provided below:

a. On-line help;

b. Random access entry and exit;

c. Multiple system evaluations;

d. One time entry of task, control, and display lists;

e. On-screen task, control, and display list editing;

f. On-screen, cursor driven commonality and similarity matching;

g. Overall reduced keying requirements;

h. Data import and export capability;

i. Selection and deselection of tasks, controls, displays, etc. by mouse; and

j. Conduct of ASTAR II commonality and similarity analysis matching using a mouse.

2.4.2.10 **Computational Formulas.** Computational formulas will be available to the user in a read only manner. The ASTAR II program will be structured so that the computational formulas can be updated as new information becomes available. However, modification will be by DoD configuration control only. The computational formulas present in ASTAR will not be changed in ASTAR II. However, where necessary, basic subscores not currently computed in ASTAR Level 3 will be added.

2.4.2.11 **Set up.** A set up module will allow each user to specify the display configuration, number of analysts, data paths, etc. This will be used by the ASTAR II program to familiarize itself with the hardware configurations present in the host environment. It will also permit additional control of the analysis to be placed directly into the user's hands.

2.4.2.12 **User Training.** Existing training manuals will be updated and provided off line to the users. A desirable option available in the new system will be the addition of an on-line tutorial, supplemented by a disk based "read me" file which would provide supplemental hard copy material. The program would be self-contained on disk with no more than a single sheet of overview and installation procedures. All required training material and help features will be contained in the program as accessible hard copy printouts.

2.4.3 **Summary of Impacts**

The anticipated impacts of the ASTAR II system are discussed in the following sections.

2.4.3.1 **User Organization Impacts.** There are no organizational impacts anticipated. ASTAR has not been fielded as a standard tool and thus a change in its presentation format does not effect any existing organization.

2.4.3.2 **User Operational Impacts.** User operational impact will be minimal in terms of operational procedure changes. ASTAR

II should permit an easy transition from current procedures. The new features in ASTAR II are designed to minimize the operational impact by making ASTAR II user friendly. No new data requirements will be imposed by ASTAR II. ASTAR II should facilitate data retention because it is computer based.

2.4.3.3 **User Development Impacts**. There will be minimal user development impact in terms of effort required prior to implementation of the revised system. Training in the application of the technique will still be required. There will be changes in training content to accommodate new and revised procedures. The preferred method of training will be through an on-line tutorial, supplemented by a user's manual and general classroom training as necessary.

2.5 ASSUMPTIONS AND CONSTRAINTS

Two primary assumptions are associated with the development of ASTAR II: (1) government and contractor personnel who are engaged in training effectiveness evaluations will have access to microcomputer systems capable of hosting ASTAR II; and (2) the potential user population possesses some degree of computer literacy.

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SECTION 3. DETAILED CHARACTERISTICS

3.1 PERFORMANCE REQUIREMENTS

The following paragraphs describe the performance goals and requirements for the ASTAR II program.

3.1.1 **Accuracy and Validity**

The primary accuracy requirements for ASTAR II concern the computational algorithms. The calculations for ASTAR II must be accurate to two decimal places, i.e., rounding occurs based on the third decimal point. The accuracy requirements for data input into ASTAR II are primarily a function of the user. The user shall be able to review and modify data as needed. The program must accept the keyed data without error. Data imported into ASTAR II is primarily text based information. This type of information must be imported with at least 98% accuracy. The exception is for the importing of rating data during a merge routine. In this case transmission accuracy must be 100%.

3.2.2 **Timing**

The timing within ASTAR II will vary as a function of the host hardware and the module. The basic timing requirements will comply with MIL-STD-1472C. These timing values will apply for a 80286 or higher microprocessor. For 8088 and 8086 microprocessor, the timing delay for queries shall not exceed 5 seconds. The output timing should not exceed 10 seconds from output request to presentation of output summary in either graphic or tabular format.

3.2 FUNCTIONAL AREA SYSTEM FUNCTIONS

There are nine major functional areas within ASTAR II. These functions were depicted previously in Figure 3. The following paragraphs describe the characteristics of each major function.

3.2.1 **Installation**

This function installs ASTAR II on either a floppy disk or hard disk drive as specified by the user. During the installation routine the user is given the option to print out a hard copy of the users manual, which is stored on the distribution disk.

3.2.2 **Set Up**

The set up function permits the user to specify the hardware configuration of the system ASTAR II is installed on. The user can select or change the monitor and printer configuration. The user also specifies whether a mouse is present in the system. Another subfunction that is recommended for ASTAR II and should be selected by the user through the set up utility is an automatic save feature, which will save all data in memory to disk every fifteen minutes.

3.2.3 **Select Option**

The select option is the main menu function for ASTAR II. From the main menu, the user may select the level of ASTAR II analysis, select file operations or exit ASTAR II. Other subfunctions are provided via function keys. Sub-functions accessible through function keys are:

- the help routines,
- the on-line tutorial,
- the set up utility,
- jump to the view results routine,
- view a directory of existing data bases,
- escape to DOS and return, and
- quit.

3.2.4 **File Operations**

The file operation function is the data base creation and management function. Through this function the user creates a data base structure; sets the number of devices; names of the devices for evaluation; accesses data import and export utilities; merges data bases from multiple raters; copies and deletes data bases; manages the data base, which includes conducting similarity and commonality analyses; and requests reports of the data to be printed.

3.2.5 **ASTAR II Analysis**

The ASTAR II analysis function has two primary components; the rating subfunction and the results/output subfunction. The rating subfunction is used to assign ratings for each device based on ASTAR II evaluation categories. The number of ratings that are assigned is determined by the level of ASTAR II analysis. The results/output subfunction permits the user to view the results of the ASTAR II analysis. This subfunction permits the user to examine both raw data and ASTAR II assessments. ASTAR II assessments may access both summary and subscores to aid in interpretation. The results may be viewed in appropriate tabular or graphic formats.

3.2.6 **On-line Help**

The on-line help utility provides context dependent help at all points within ASTAR II. This function resides on-line while ASTAR II is active. It is always accessed by pressing the F1 function key. The on-line help provides brief text messages to clarify the operation of keys, option, or information relevant to the interpretation of ASTAR II scores.

3.2.7 **Audit Trail Log**

The audit trail log maintains a continuous time and date tagged log of operations conducted on an ASTAR II data base. It logs day of creation, dates accessed, operations conducted, analyses conducted, notes if the data base was created by merging files, etc. This function should not be readily accessible to the user. The only access currently specified is a printout capability provided as part of the file operations report function.

3.2.8 On-Line Tutorial

The on-line tutorial is the primary training vehicle for ASTAR II. It is accessed through a function key on the main ASTAR II menu. It provides an interactive tutorial which describes and leads the user through exercises using ASTAR II.

3.2.9 Quit ASTAR

The quit function lets the user exit ASTAR II. The Quit function saves and closes all files as appropriate and downloads any memory resident routines. It also serves to deactivate and close the on-line help and audit trail log.

3.3 INPUTS - OUTPUTS

The following section describes each data element in the data inputs to and outputs from ASTAR II. Samples of suggested ASTAR II output formats are provided in Annex 6.

3.3.1 Inputs

1. Data Element Name: Task Number

   Definition: User assigned number identifying a unique task or subtask

   Format: #.#

   Input Medium: Keyboard, Disk

   Range of Values: 1.0 - 25.25

   Unit of Measurement: N/A

   Data Item Names: Task, Subtask

   Miscellaneous: When tasks/subtasks are imported from other programs, the range of values and number of levels may exceed the above specification. The import routine will need to permit the task numbers to be edited and/or automatically renumbered in the ASTAR II format. Only a maximum of four levels will be permitted after editing. ASTAR II will parse the data so that Level 1 task numbers, 1.0, 2.0, etc., will be treated as tasks, Level 2 task numbers, 1.1, 10.4, etc., will be treated as subtasks, Level 3 task numbers, 1.1.1, 3.2.6, etc., will be reidentified as skills, and Level 4 task numbers, 1.3.5.6, etc., will be reidentified as knowledge.

2. Data Element Name: Task Name

   Input Medium: Keyboard, Disk

   Definition: Text label describing the task

   Format: Text String

   Range of Values: 1 to 50

   Unit of Measurement: Character

   Data Item Names: N/A

   Miscellaneous: See miscellaneous under task number

3. Data Element Name: Control Name

   Definition: Text description of device control

   Input Medium: Keyboard, Disk

   Format: Text

   Range of Values: 1 to 50

   Unit of Measurement: Character

   Data Item Names: N/A

4. Data Element Name: Display Name

   Definition: Text description of device display

   Input Medium: Keyboard, Disk

   Format: Text

   Range of Values: 1 to 50

   Unit of Measurement: Character

   Data Item Names: N/A

5. Data Element Name: Skill

   Definition: Text description of skill to be trained

   Input Medium: Keyboard, Disk

   Format: Text

Range of Values: 1 to 50

Unit of Measurement: Character

Data Item Names: N/A

Miscellaneous: When the task list is imported from another program, any subtask at the level three task number, e.g., 1.2.3, will be relabeled a skill.

6. Data Element Name: Knowledge

Definition: Text description of knowledge to be acquired

Input Medium: Keyboard, Disk

Format: Text

Range of Values: 1 to 50

Unit of Measurement: Character

Data Item Names: N/A

Miscellaneous: When the task list is imported from another program, any subtask at the level four task number, e.g., 1.2.3.4, will be relabeled a knowledge.

7. Data Element Name: Rating

Definition: User assigned rating to each device based on ASTAR II questions

Input Medium: Keyboard, Disk

Format: ###

Range of Values: 0 to 100, default (no rating) = -999. On data items with a range of 0 - 100, a 0 rating is assigned an internal value of 1.

Unit of Measurement: digit

Data Item Names:

ASTAR Level	Category	Question	Legal Values
1	Performance Deficit	1	0 - 100
1	Learning Difficulty	1	0 - 100
1	Quality of Trng - Acq	1	0 - 100
1	Residual Deficit	1	0 - 100
1	Residual Lrng Difficulty	1	0 - 100
1	Physical Similarity	1	0 - 100
1	Functional Similarity	1	0 - 100
1	Quality of Trng - Trans	1	0 - 100

2	Performance Deficit	1	0 - 100
2	Learning Difficulty	1	0 - 100
2	Quality of Trng - Acq	1	0 - 100
2	Quality of Trng - Acq	2	0 - 100
2	Quality of Trng - Acq	3	0 - 100
2	Quality of Trng - Acq	4	0 - 100
2	Residual Deficit	1	0 - 100
2	Residual Lrng Difficulty	1	0 - 100
2	Physical Similarity	1	0 - 100
2	Functional Similarity	1	0 - 100
2	Quality of Trng - Trans	1	0 - 100
2	Quality of Trng - Trans	2	0 - 100
2	Quality of Trng - Trans	3	0 - 100
3	Performance Deficit	1	0,1,2,3,4
3	Learning Difficulty	1	0,1
3	Learning Difficulty	2	0,1
3	Learning Difficulty	3	0,1
3	Learning Difficulty	4	0,1
3	Learning Difficulty	5	0,3
3	Learning Difficulty	6	0,3
3	Quality of Trng - Acq	1	0 - 100
3	Quality of Trng - Acq	2	0 - 100
3	Quality of Trng - Acq	3	0 - 100
3	Quality of Trng - Acq	4	0 - 100
3	Quality of Trng - Acq	5	0 - 100
3	Quality of Trng - Acq	6	0 - 100
3	Quality of Trng - Acq	7	0 - 100
3	Quality of Trng - Acq	8	0 - 100
3	Quality of Trng - Acq	9	0 - 100
3	Quality of Trng - Acq	10	0 - 100
3	Quality of Trng - Acq	11	0 - 100
3	Residual Deficit	1	0,1,2,3,4
3	Residual Lrng Difficulty	1	0,1
3	Residual Lrng Difficulty	2	0,1
3	Residual Lrng Difficulty	3	0,1
3	Residual Lrng Difficulty	4	0,1
3	Residual Lrng Difficulty	5	0,3
3	Residual Lrng Difficulty	6	0,3
3	Physical Similarity	1	0 - 100
3	Functional Similarity	1	0 - 100
3	Quality of Trng - Trans	1	0 - 100
3	Quality of Trng - Trans	2	0 - 100
3	Quality of Trng - Trans	3	0 - 100
3	Quality of Trng - Trans	4	0 - 100
3	Quality of Trng - Trans	5	0 - 100
3	Quality of Trng - Trans	6	0 - 100
3	Quality of Trng - Trans	7	0 - 100
3	Quality of Trng - Trans	8	0 - 100

Miscellaneous: For ASTAR Level 2, ratings for each data item are made on a task and subtask basis (for those tasks and subtasks matched on the commonality analysis). For ASTAR Level 3, ratings for each data item are made on a task and subtask basis (for those tasks and subtasks matched on the commonality analysis). For ASTAR Level 3, ratings for physical similarity are also made for those controls and displays matched during the similarity analysis.

8. Data Element Name: Device Name

   Definition: Text label for training device or operational system

   Input Medium: Keyboard, Disk

   Format: Text

   Range of Values: 1 to 20 devices
1 to 50 characters per name

   Unit of Measurement: Character

   Data Item Names: N/A

3.3.2 <u>Output</u>

1. Data Element Name: Task List

   Output Medium: Screen, Disk, Printer

   Definition: List of tasks ordered by task/subtask number

   Format: #.# Text

   Range of Values: 0 - 50

   Unit of Measurement: N/A

   Data Item Names: Task Number, Task Name

   Miscellaneous: N/A

2. Data Element Name: Control List

   Output Medium: Screen, Disk, Printer

   Definition: List of controls ordered by control number

   Format: C# Text

   Range of Values: 0 - 200

   Unit of Measurement: N/A

   Data Item Names: Control Number, Control Name

   Miscellaneous: N/A

3. Data Element Name: Display List

   Output Medium: Screen, Disk, Printer

   Definition: List of displays ordered by display number

   Format: D# Text

   Range of Values: 0 - 200

   Unit of Measurement: N/A

   Data Item Names: Display Number, Display Name

   Miscellaneous: N/A

4. Data Element Name: Skill List

   Output Medium: Screen, Disk, Printer

   Definition: List of skills ordered by skill number

   Format: S# Text

   Range of Values: 0 - 200

   Unit of Measurement: N/A

   Data Item Names: Skill Number, Skill Name

   Miscellaneous: N/A

5. Data Element Name: Knowledge List

   Output Medium: Screen, Disk, Printer

   Definition: List of knowledge items ordered by knowledge item number

   Format: K# Text

   Range of Values: 0 - 200

   Unit of Measurement: N/A

   Data Item Names: Knowledge Number, Knowledge Name

   Miscellaneous: N/A

6. Data Element Name: Ratings

   Output Medium: Screen, Printer

   Definition: Ratings assigned to each device based on ASTAR II questions

Format: ###, graphic

Range of Values: 0 - 100. For data items with a rating range of 0 - 100 a rating of 0 is assigned a value of 1.

Unit of Measurement: N/A

Data Item Names:

ASTAR Level	Category	Question	Legal Values
1	Performance Deficit	1	0 - 100
1	Learning Difficulty	1	0 - 100
1	Quality of Trng - Acq	1	0 - 100
1	Residual Deficit	1	0 - 100
1	Residual Lrng Difficulty	1	0 - 100
1	Physical Similarity	1	0 - 100
1	Functional Similarity	1	0 - 100
1	Quality of Trng - Trans	1	0 - 100
2	Performance Deficit	1	0 - 100
2	Learning Difficulty	1	0 - 100
2	Quality of Trng - Acq	1	0 - 100
2	Quality of Trng - Acq	2	0 - 100
2	Quality of Trng - Acq	3	0 - 100
2	Quality of Trng - Acq	4	0 - 100
2	Residual Deficit	1	0 - 100
2	Residual Lrng Difficulty	1	0 - 100
2	Physical Similarity	1	0 - 100
2	Functional Similarity	1	0 - 100
2	Quality of Trng - Trans	1	0 - 100
2	Quality of Trng - Trans	2	0 - 100
2	Quality of Trng - Trans	3	0 - 100
3	Performance Deficit	1	0,1,2,3,4
3	Learning Difficulty	1	0,1
3	Learning Difficulty	2	0,1
3	Learning Difficulty	3	0,1
3	Learning Difficulty	4	0,1
3	Learning Difficulty	5	0,3
3	Learning Difficulty	6	0,3
3	Quality of Trng - Acq	1	0 - 100
3	Quality of Trng - Acq	2	0 - 100
3	Quality of Trng - Acq	3	0 - 100
3	Quality of Trng - Acq	4	0 - 100
3	Quality of Trng - Acq	5	0 - 100
3	Quality of Trng - Acq	6	0 - 100
3	Quality of Trng - Acq	7	0 - 100
3	Quality of Trng - Acq	8	0 - 100
3	Quality of Trng - Acq	9	0 - 100
3	Quality of Trng - Acq	10	0 - 100
3	Quality of Trng - Acq	11	0 - 100
3	Residual Deficit	1	0,1,2,3,4
3	Residual Lrng Difficulty	1	0,1
3	Residual Lrng Difficulty	2	0,1

3	Residual Lrng Difficulty	3	0,1
3	Residual Lrng Difficulty	4	0,1
3	Residual Lrng Difficulty	5	0,3
3	Residual Lrng Difficulty	6	0,3
3	Physical Similarity	1	0 - 100
3	Functional Similarity	1	0 - 100
3	Quality of Trng - Trans	1	0 - 100
3	Quality of Trng - Trans	2	0 - 100
3	Quality of Trng - Trans	3	0 - 100
3	Quality of Trng - Trans	4	0 - 100
3	Quality of Trng - Trans	5	0 - 100
3	Quality of Trng - Trans	6	0 - 100
3	Quality of Trng - Trans	7	0 - 100
3	Quality of Trng - Trans	8	0 - 100

Miscellaneous: For ASTAR II Level 2, ratings for each data item are made on a task and subtask basis (for those tasks and subtasks matched on the commonality analysis). For ASTAR II Level 3, ratings for each data item are made on a task and subtask basis (for those tasks and subtasks matched on the commonality analysis). For ASTAR II Level 3, ratings for physical similarity are also made for those controls and displays matched during the similarity analysis.

Numeric (tabular) outputs may be device (within or across devices) by ASTAR II level by data item, or device by ASTAR II level by data item question. Output may be average across tasks or subtasks, or for individual tasks or subtasks.

Graphic outputs may be device (within or across devices) by ASTAR II level by data item, or device by ASTAR II level by data item question averaged across tasks or subtasks. For individual tasks or subtasks, graphic outputs may be within a device for ASTAR II level by data item, or ASTAR II level by data item question. For individual tasks to subtasks, graphic outputs across devices may be for ASTAR II level, a range of tasks or subtasks, data items or data item questions.

7. Data Element Name: Analysis Scores

Output Medium: Screen, Disk, Printer

Definition: Computed scores and summary scores derived from ratings by ASTAR computational formulas

Format: Numeric, Tabular Numeric, Graphic

Range of Values: See Data Item Names:

Unit of Measurement: N/A

Data Item Names:

Data Item	Score Range
Performance Deficit	0 - 100
Learning Difficulty	0 - 100
Quality of Training - Acquisition	0 - 100
Residual Deficit	0 - 100
Residual Learning Difficulty	0 - 100
Physical Similarity	0 - 100
Functional Similarity	0 - 100
Quality of Training - Transfer	0 - 100
Training Problem	0 - 100
Acquisition Efficiency	.1 - 1.0
Acquisition	0 - 1000
Transfer Problem	0 - 100
Transfer Efficiency	.1 - 1.0
Transfer	0 - 1000
Sum	0 - 2000

Miscellaneous: Output grouping can vary widely depending on user selected options. Tabular outputs may be across devices or for a single device. They may be at either the task or subtask level, and may be within a single level of ASTAR II analysis or across levels. They may also include all of the data items listed above or a specified subset. [Note: performance deficit, learning difficulty, residual deficit, and residual learning difficulty are not available as subscores in an ASTAR II Level 3 analysis.] The default tabular format is:

```
Performance Deficit
Learning Difficulty
     Training Problem
Quality of Training - Acquisition
     Acquisition Efficiency
          Acquisition
Residual Deficit
Residual Learning Difficulty
Physical Similarity
Functional Similarity
     Transfer Problem
Quality of Training - Transfer
     Transfer Efficiency
          Transfer
               Sum
```

Graphic outputs may only be displayed across devices within an ASTAR II level. Graphic outputs for a single device must be across ASTAR II levels. They may be at either the task or subtask level. They may also include all of the data items listed above or a specified subset. [Note: performance deficit, learning difficulty, residual deficit, and residual learning difficulty are not available as subscores in an ASTAR II Level 3 analysis.]

8. Data Element Name: Device Name

Output Medium: Screen, Disk, Printer

Definition: Label for Training Device or Operational System

Format: Text

Range of Values: 1 - 20 devices
1 - 50 characters per device

Unit of Measurement: N/A

Data Item Names: Training Device, Operational System

Miscellaneous: N/A

9. Data Element Name: Audit Trail Log

Output Medium: Printer

Definition: A time and date tagged listing of operations conducted within an ASTAR II data base.

Format: Text

Range of Values: TBD

Unit of Measurement: N/A

Data Item Names: N/A

Miscellaneous: N/A

3.4 DATA BASE CHARACTERISTICS

All data items described in section 3.3.1, Inputs, will be used in the ASTAR II data base. In addition to these externally entered items, ASTAR II will internally generate several items to be included in the data base. The internally generated items are identified below.

1. Data Element Name: Control Number

Definition: Internally generated sequential number assigned to control names

Input Medium: Internal

Format: "C"#

Range of Values: 1 to 200

Unit of Measurement: N/A

Data Item Names: N/A

2. Data Element Name: Display Number

   Definition: Internally generated sequential number assigned to display names

   Input Medium: Internal

   Format: "D"#

   Range of Values: 1 to 200

   Unit of Measurement: N/A

   Data Item Names: N/A

   Data Item Names: N/A

3. Data Element Name: Skill Number

   Definition: Internally generated sequential number assigned to skill items

   Input Medium: Internal

   Format: "S"#

   Range of Values: 1 to 200

   Unit of Measurement: N/A

   Data Item Names: N/A

4. Data Element Name: Knowledge

   Definition: Internally generated sequential number assigned to knowledge items

   Input Medium: Internal

   Format: "K"#

   Range of Values: 1 to 200

   Unit of Measurement: N/A

   Data Item Names: N/A

   Miscellaneous:

5. Data Element Name: Audit Trail Log

Definition: A time and date tagged listing of operations conducted within an ASTAR data base.

Input Medium: Internal

Format: Test

Range of Values: TBD (maximum size of file)

Unit of Measurement: N/A

Data Item Names: Date, Time, ASTAR II operations

6. Data Element Name: Analysis Scores

Definition: Computed scores and summary scores derived from ratings by ASTAR II computational formulas

Input Medium: Internal

Format: Numeric (specific format depends on data item)

Range of Values: See Data Item Names:

Unit of Measurement: N/A

Data Item Names:

Data Item	Score Range
Performance Deficit	0 - 100
Learning Difficulty	0 - 100
Quality of Training - Acquisition	0 - 100
Residual Deficit	0 - 100
Residual Learning Difficulty	0 - 100
Physical Similarity	0 - 100
Functional Similarity	0 - 100
Quality of Training - Transfer	0 - 100
Training Problem	0 - 100
Acquisition Efficiency	.1 - 1.0
Acquisition	0 - 1000
Transfer Problem	0 - 100
Transfer Efficiency	.1 - 1.0
Transfer	0 - 1000
Sum	0 - 2000

3.5 FAILURE CONTINGENCIES

Backup disks of the ASTAR II software and data bases should be kept available in the unlikely event of a software failure. A hardware failure can be overcome by using another IBM or IBM compatible PC. If both software and system hardware failures are encountered, users would be instructed to return to manual methods.

3.6 SECURITY

ASTAR II itself will require no special security provisions. However, in some instances, classified task, control and display information might be entered into the ASTAR II data base. In such instances, normal national security regulations regarding "need to know" and levels of user clearance would prevail. The highest, most restrictive level of classification would be applied to the ASTAR disk holding the classified data base.

If data is exported to another program, such as ISD/LSAR DSS, special provisions should be observed. To maintain the integrity of the data base, it is important that the importing of data be limited to those users of an appropriate level of responsibility.

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SECTION 4. DESIGN DETAILS

The section of the functional description provides a description of the ASTAR II system and identifies the ASTAR II system functions. A demonstration disk of the ASTAR II user interface is attached to the inside back cover of this document. This demonstration disk illustrates the ASTAR screen formats and flow of functions. A set of hard copy printouts of the ASTAR II screens shown in the demonstration disk is provided in Annex 5.

4.1 SYSTEM DESCRIPTION

4.1.1 System Functional Features

The following paragraphs summarize the design features of ASTAR II. As applicable, the design features address the comments, suggestions and problems with the current ASTAR that were derived during the various operational tests. A summary of these comments is provided in Annex 1. Following each design feature, the item(s) in Annex 1 addressed by that feature are identified by number(s). A demonstration disk of the ASTAR II user interface is provided with the final version of the Functional Description.

4.1.1.1 **Programming Environment.** ASTAR II should be programmed in C. This provides a flexible software environment which should support the functionality envisioned for ASTAR II. The utilization of C also provides a reduced development time because of the availability of off-the-shelf C routines. Off-the-shelf routines should be used wherever possible; specifically for data base development, data import/export utilities, and graphic output routines.

4.1.1.2 **Compatibility.** ASTAR II should be data compatible to other data bases, word processors, spreadsheets, ISD/LSAR DSS, etc. (3)

The recommendation is for ASTAR II to be data compatible with other software. ASTAR II should retain an internal data base development and management routine, but it should also be able to import and export data to other programs. The ASTAR II should be able to import data from standard data bases, word processors or spreadsheets. Standard word processors could be used as editors during the import/export of data. This option requires specification of a template for the ASTAR data base. ASTAR should also be able to import/export data to the joint services ISD/LSAR DSS. Initially, this would require passing data in ASCII format.

4.1.1.3 **User Configuration.** ASTAR II should be a single user system. To accommodate multiple analysts ASTAR II will provide a utility to merge and combine the ratings from different files or analysts. (1,5)

4.1.1.4 **Help.** ASTAR II will include a number of new help features as described in the following paragraphs.

4.1.1.4.1 On Line Help. The ASTAR II will incorporate on-line facilities. They should be simple text messages. They will be context dependent as appropriate. (10,11)

4.1.1.4.2 Computational Formula Help. The help information will provide information about the ASTAR II computational formulas to aid the user in interpreting the ASTAR II analyses. (9)

4.1.1.4.3 Rating Help.

- Examples: The help function will provide additional examples and/or examples of anchor points for the rating scales. (2)

- Query: The help will include a query routine which permits the user to access ratings from related questions or a different level of ASTAR II analysis, skills and knowledge lists, or other data. (35)

- Monitoring: The help routine will monitor the ratings for ASTAR II Levels 2 and 3 and compare the average for each index to the ASTAR II Level 1 ratings. Large discrepancies (TBD %) between the ratings will be flagged to the user. (28,34,35)

4.1.1.4.4 Prompts. Error prompts will conform to current standards for human computer interface design. Error messages will identify the source/type of error. (27,36)

4.1.1.5 **Data Base.** The data base is one of the key areas identified for enhancement within ASTAR II. There will be both internal data base capability and the ability to import data from external sources.

4.1.1.5.1 Internal Data Base Management.

- Utilities: A utility will be available within the internal data base module. The utilities should handle the setup of the data base structure and configure the data base file formats. The functions should include:

  - name file and devices
  - specify number of devices to be included
  - data path
  - merge ratings from multiple analysts
  - copy and delete files

  (2,4,5)

- Features: The internal data base will provide both data entry and data editing capability. The data base will provide list entry capabilities for tasks, controls, displays, skills and knowledge (the last two are optional data items). The tasks should be matched using mouse or cursor highlighting. Controls and display list will be replicated under each task automatically and non-appropriate controls and displays deleted. Control and display matching will be by mouse or cursor highlighting. Both the data entry and editing routines will permit random access, i.e., enter/exit and move around freely within the system without disrupting the program. (1,2,4,5,6,13,23,30)

4.1.1.5.2 External Data Base Management.

- Interfaces: Import/export capability will be provided to any source which can provide ASCII format information. Specific interfaces should be provided to ISD/LSAR DSS, standard word processing, spreadsheets and other common data bases. The word processors could be used as an editor for import of data from external sources. It should be possible to designate portions of the task list for ASTAR II analysis. A renumbering routine to be more compatible with ASTAR II formats will be provided. (3)

- ILS/LSAR DSS. Several items should be accessible from the ILS/LSAR DSS. These include:

  - weapon system name
  - subsystem name if applicable
  - task name
  - task ISD code (task number)
  - task element name (subtask)
  - task element number (subtask)
  - skill/knowledge number
  - skill/knowledge name

  (40)

  The imported data must be modifiable so that as the ISD process progresses and more data becomes available it can be integrated into the imported file without having to recreate the entire file. This also is required as you progress from ASTAR II Level 1 to ASTAR II Level 3.

- Other Sources: Text editors, i.e., word processors, should be usable for the creation of data files or the modification of data from data bases. This form of input will require a template to specify the correct data structure/format. (3)

4.1.1.6 **Entry of Ratings.**

4.1.1.6.1 <u>Multiple Systems</u>. ASTAR II will permit ratings for each training device to be entered on the same screen. This permits reference or anchoring across systems and removes the repetitive aspects of the current system. A function key should be available to enter the same rating for all training devices if appropriate. (7)

4.1.1.6.2 <u>Query</u>. ASTAR II will permit on-line query of ratings on related questions or a different level of ASTAR II. It is desirable to provide the ASTAR II Level 1 ratings automatically as a reference. (35)

4.1.1.6.3 <u>Consistent Entry</u>. ASTAR will provide a consistent method of entry. The <ENTER> command will be used when all entries have been made on the page. The TAB key should be used to shift between the data field for each training device. The <SHIFT-TAB> should also be active to permit transition between data fields in either direction. A standard 3 digit default value should be assigned to each field until data is actually entered. (12)

4.1.1.7 **Outputs.** The outputs from ASTAR should be available on screen, by printer or on disk.

4.1.1.7.1 <u>Screen Based Outputs</u>. An enhanced set of screen based outputs will be available within ASTAR II. The outputs should include both tabular and graphic formats.

- Ratings: Display of the ratings on a task and subtask basis should be available to the user. These ratings should be available in either tabular or graphic format. (12,37,38,39)

- ASTAR II Scores: Display of both summary and subtask scores will be available to the user. The scores will be available by task or subtask and by performance category in either tabular of graphic format. All sub scores available in ASTAR II Level 1 will be available for Levels 2 and 3, if available. (12,37,38,39)

- Graphic Outputs: Graphic outputs of scores should be available in the form of bar graph or line charts. It is desirable for 3-D outputs to be available to provide for visualization of problems. 3-D graphics provide significantly improved outputs over 2-D graphics. (8,12,37,38,39)

4.1.1.7.2 Printer Based Outputs. All ASTAR II outputs, both graphics and tabular will be available in hard copy format. Hard copy of the tasks, control, display, skill, knowledge lists will be available. It will also be possible to obtain hard copy of the rating information and the audit trail log. The user should be able to print out an individual chart, a subset of charts, or a total data output package.

4.1.1.7.3 Disk Based Outputs. All ASTAR II tabular outputs should be available as disk outputs, either floppy or hard disk. The disk based outputs would be used to import the results into documents or export to other programs such as ILS/LSAR DSS. (14)

4.1.1.8 **User Interface.** The user interface will be significantly modified to improve the user friendliness of ASTAR II. The design will be structured to provide less repetitive tasks and permit more flexible and editable data entry. The interface will be menu driven using either cursor or mouse selection.

Key features of the interface will include:

- on line help
- random access entry/exit
- multiple system evaluations
- one time entry of task list
- on screen task list editing
- on screen, cursor driven commonality/similarity matching
- overall reduced keying requirements
- data import/export
- function key access

(1,3,5,6,7,8,11,12,13,25,26,27,28,33,34,35,36)

Several advanced features should be examined as part of the design effort. These features include a flow diagram type of menu interface with "click-on" direct access to various ASTAR II functions: commonality and similarity analysis matching by mouse selections of items; selection/deselection of tasks by mouse; and query of 3-D graphs by mouse.

4.1.1.9 **Computational Formulas.**

4.1.1.9.1 Availability of Formulas. The computational formulas should be available to the user in a "read only" manner. (9)

4.1.1.9.2 Modifiability of Formulas. The program should be structured so that the computational formulas can be updated as new information becomes available, but modification will be by the DoD configuration control only.

4.1.1.9.3 Display of Contributions. The contribution of the various indexes within the formulas will be computed and displayed to the user. (9,37,38)

4.1.1.10 **Setup.** A set up module should be provided which can be used to specify the display configuration, printer, data paths, etc.

4.1.1.11 **Training Materials.** The training materials will be provided in the form of manuals and as an on-line tutorial. The manual will be delivered on the distribution disk and printed out during the installation routine. The program will be self-contained on disk with no more than a single sheet of overview and installation instructions. (29,21,32)

4.1.2 Function Key Assignments

ASTAR II will utilize function keys to access operations and access utilities. The function keys utilities are designed to make the user interface more flexible and informative. The active function keys for each screen will be displayed on the bottom two lines of the display. Table 4 summarizes the function key assignments for ASTAR II. It identifies the operations assigned to each key. The function numbers refer to the functional flow numbering scheme described in Section 4.2. A brief description of the function key operations is provided below.

FUNCTION KEY	OPERATION	DESCRIPTION
F1	HELP	Dedicated key to accesses the on-line help routine.
F2	TUTORIAL	On the main menu, the F2 key is used to access the on-line tutorial.
	FIND	During the ASTAR II rating process, F2 accesses a utility that permits you to find and jump to a specific point in the data base, e.g., go to task 2.0, quality of transfer question 6. This permits the user to jump randomly from point to point in the rating data base.
	INSERT	During the data base editing routines, pressing F2 puts the edit routine in an insert mode.
F3	QUERY	During the ASTAR II rating operation, F3 permits the user to query the data base for information on related ASTAR II rating.

TABLE 4
ASTAR II FUNCTION KEY ASSIGNMENTS

FUNCTION	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10
	FUNCTION KEYS									
1.0 (NONE)										
2.0	HELP					PRINT MANUAL			DOS	QUIT
3.0										
3.1	HELP	TUTORIAL		SET-UP	RESULTS	DIRECTORY			DOS	QUIT
ALL OTHERS	HELP	TUTORIAL				DIRECTORY			DOS	QUIT
4.0	HELP							MAIN MENU	DOS	QUIT
5.0										
ALL OTHERS	HELP	FIND	QUERY		RESULTS		SAVE	MAIN MENU	DOS	QUIT
5.6	HELP	FIND	QUERY	REPEAT RATING	RESULTS	TASK/SUBTASK	SAVE	MAIN MENU	DOS	QUIT
5.7	HELP		QUERY		ANALYSIS	PRINT		MAIN MENU	DOS	QUIT
6.0										
ALL OTHERS	HELP					DIRECTORY	SAVE	MAIN MENU	DOS	QUIT
6.8.6	HELP	INSERT	MODIFY	DELETE			SAVE	MAIN MENU	DOS	QUIT
6.9	HELP					PRINT	SAVE	MAIN MENU	DOS	QUIT
7.0 (NONE)										
8.0 (NONE)										
9.0 (NONE)										
10.0	HELP							MAIN MENU		QUIT

Function Key Assignments

Table 4

FUNCTION KEY	OPERATION	DESCRIPTION
	MODIFY	During the data base editing routines, pressing F3 puts the edit routine in an modify mode.
F4	SET UP	From the main menu, pressing F4 accesses the set up function.
	REPEAT RATING	During the ASTAR II rating operation, pressing F4 inserts the same assigned rating for all training devices.
	DELETE	During the data base editing routines, pressing F4 puts the edit routine in a delete mode.
F5	RESULTS	On the main menu, the F5 key permits the user to jump to the output options for ASTAR II. This is used when the data base already exists and the user simply wants to view the output of the ASTAR II analysis.
	ANALYSIS	When viewing outputs from the ASTAR II analysis, either tabular or graphic, pressing F5 returns the user to the ASTAR II rating operation.
F6	PRINT MANUAL	During the installation routine, pressing F6 will print a copy of the ASTAR II manual from disk.
	DIRECTORY	On the main and file operation menus, pressing F6 permits the user to access a listing of available ASTAR II data bases.
	TASK/SUBTASK	While in the ASTAR II rating operation, pressing F6 permits the user to toggle between the task and subtask level of analysis.
	PRINT	On the screen and printer output menus, pressing F6 sends the selected data to the printer.
F7	SAVE	F7 is used to save the data files without exiting ASTAR II.
F8	MAIN MENU	F8 is used to jump to the main menu from any point within ASTAR II without loss of data.

FUNCTION KEY	OPERATION	DESCRIPTION
F9	DOS	F9 is used to temporarily exit to DOS. When the DOS activities are complete typing "EXIT" and pressing <ENTER> returns the point of exit within ASTAR II.
F10	QUIT	F10 is used to quit from any point within ASTAR II. The quit function saves the current ASTAR II files, with the user's consent, before exiting back to DOS.

4.1.3 Color Usage

The following chart describes the preliminary color usage scheme for ASTAR II. The reader is directed to the available demonstration disk of the ASTAR II interface for a detailed example of the ASTAR II screen formats and color codes.

USAGE	TEXT/CHARACTER	BACKGROUND
Normal	Bright White	Medium Blue
Highlight	Bright Yellow	Medium Blue
Inverse	Dark Blue	Light Gray
Inverse Highlight	Bright Yellow	Light Gray
Function Keys	Dark Blue	Light Gray
Query	Bright White	Cyan
Help	Bright Yellow	Cyan
Data Entry	Bright White	Light Gray
Bar Cursor	(See Inverse/Inverse Highlight)	
Blinking Line Cursor	Bright White	
Error Message	Bright White	Red
Error Label	Bright White(blinking)	Red

4.2 SYSTEM FUNCTIONS

The following section delineates the functions and subfunctions within ASTAR II. A description of the top level functions is provided, accompanied by a functional flow diagram depicting subfunction breakdown and the sequencing of operations. Detailed functional flow diagrams are provided for subfunctions as necessary to illustrate the functional operation of ASTAR II. The level of detail to which the functional flow diagrams are developed reflects the complexity within the function or subfunction. The functional flow diagrams are developed to the minimum level of detail required to describe the basic functionality within ASTAR II. Figure 4 identifies the symbology utilized in the development of the functional flow diagrams.

4.2.1 Functional Descriptions

4.2.1.1 **Top Level Functional Description.** The top level functional flow diagram illustrates the overall design of ASTAR

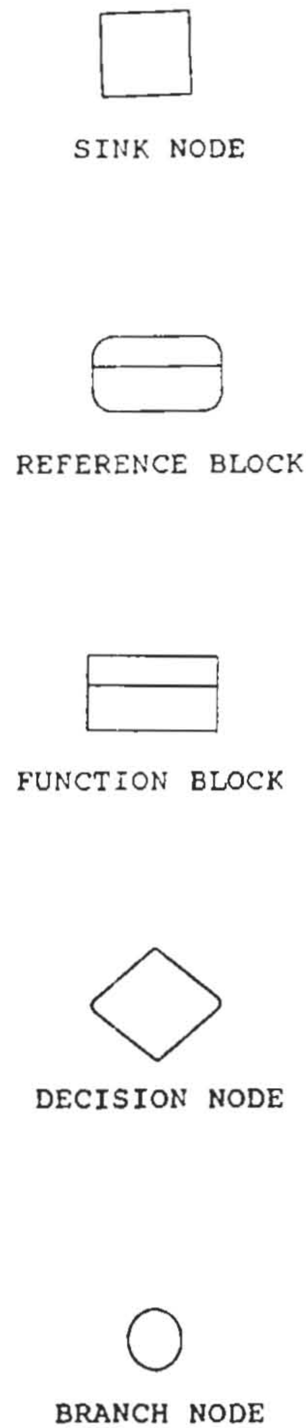
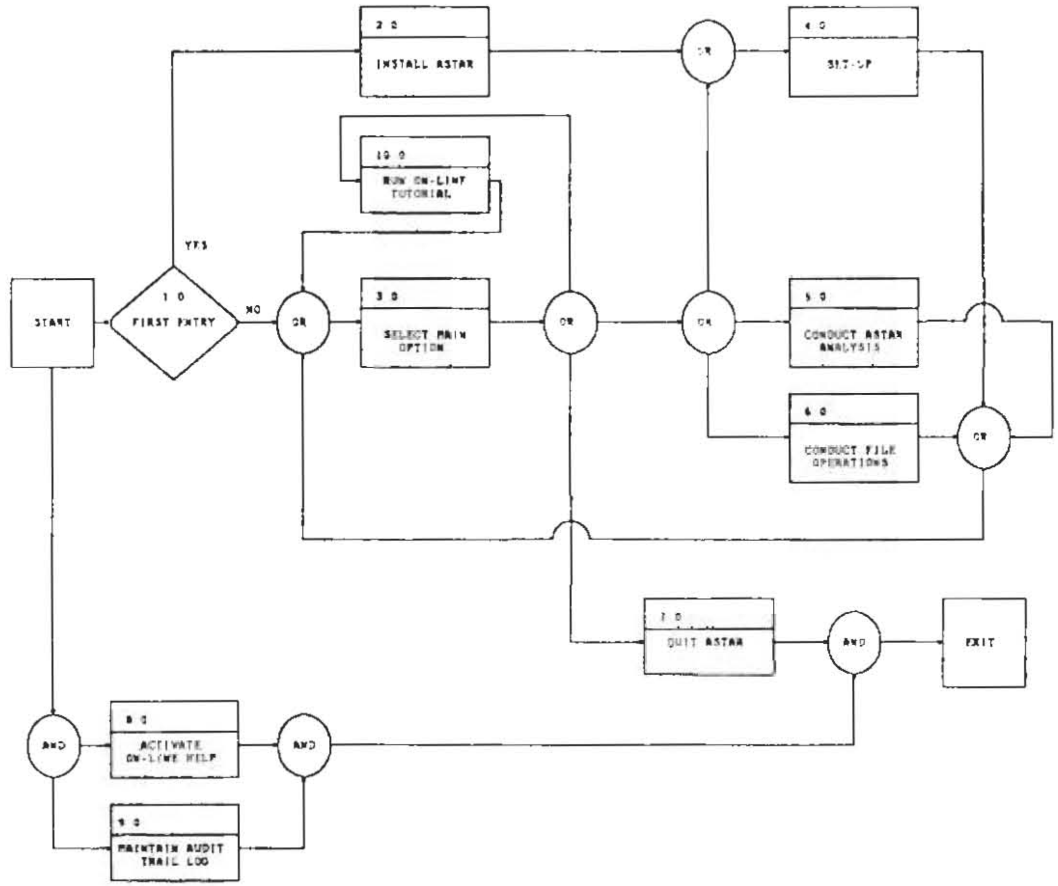


Figure 4. Functional Flow Diagram Symbology.

Top Level ASTAR II



II. There are nine top level functions in the ASTAR design as described below. (Function 1.0 is a decision to install ASTAR II and is not described below.)

2.0 **Installation**
This function installs ASTAR II on either a floppy disk or hard disk as specified by the user. During the installation routine, the user is given the option to print out a hard copy of the users manual, which is stored on the distribution disk.

3.0 **Select Option**
The select option is the main menu function for ASTAR II. From the main menu, the user may select the level of ASTAR subfunctions are provided via function keys. Sub-functions accessible through function keys are:

- the help routines,
- the on-line tutorial,
- the set up utility,
- jump to the view results routine,
- view a directory of existing data bases,
- escape to DOS and return, and
- quit.

4.0 **Set Up**
The set up function permits the user to specify the hardware configuration of the system ASTAR II is installed on. The user can select or change the monitor and printer configuration. The user also specifies whether a mouse is present in the system. Another subfunction that is provided in ASTAR II, selectable through the set up utility, is an automatic save feature, This feature will save all data in memory to disk every fifteen minutes.

5.0 **ASTAR II Analysis**
The ASTAR II analysis function has two primary components; the rating subfunction and the results/output subfunction. The rating subfunction is used to assign ratings for each device based on ASTAR II evaluation categories. The number of ratings that are assigned is determined by the level of ASTAR II analysis. The results/output subfunction permits the user to view the results of the ASTAR II analysis. This subfunction permits the user to examine both raw data and ASTAR II assessments. ASTAR assessments may access both summary and subscores to aid in interpretation. The results may be viewed in either a tabular or graphic format as appropriate.

6.0 **File Operations**
The file operation function is the data base creation and management function. Through this function the user creates a data base structure; sets the number of devices; names the devices for evaluation; accesses data import and export utilities; merges data bases from multiple raters; copies

and deletes data bases; manages the data base, which includes conducting similarity and commonality analyses; and requests reports of the data.

7.0 **Quit ASTAR II**
The quit function lets the user exit ASTAR II. It saves and closes all files as appropriate and downloads any memory resident routines. It also serves to deactivate and close the on-line help and audit trail log.

8.0 **On-line Help**
The on-line help utility provides context dependent help at all points within ASTAR II. This function resides on-line while ASTAR is active. It is always accessed by pressing the F1 function key. The on-line help provides brief text messages to clarify the operation of keys, option, or information relevant to the interpretation of ASTAR scores.

9.0 **Audit Trail Log**
The audit trail log maintains a continuous time and date tagged log of operations conducted on an ASTAR II data base. It logs day of creation, dates accessed, operations conducted, analyses conducted, notes if the data base was created by merging files, etc. This function should not be readily accessible to the user. The only access currently specified is a printout capability provided as part of the report function under file operations.

10.0 **On-Line Tutorial**
The on-line tutorial is the primary training vehicle for ASTAR II. It is accessed through a function key on the main ASTAR II menu. It provides an interactive tutorial which describes and leads the user through exercises using ASTAR II.

4.2.1.2 **ASTAR II Functional Flow Diagrams.** The following functional flow diagrams provide a more detailed breakdown of the top level functions described above. The level of breakdown varies across function and subfunction sufficient to depict the full functionality with ASTAR II. The level of detail beyond that provided involves implementation decisions and will be completed during the ASTAR II development effort.

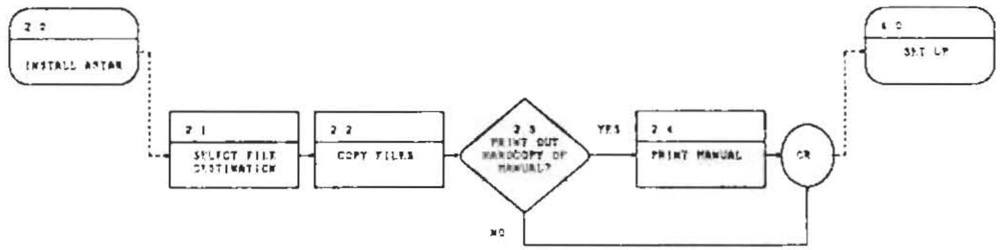
4.2.2 Accuracy and Validity

The requirements for accuracy and validity for data and calculations are as specified in Section 3.1.1.

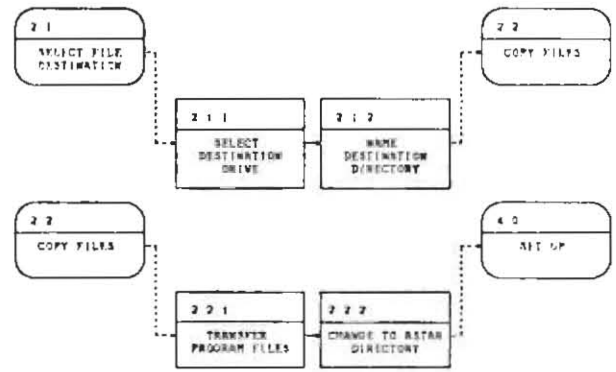
4.2.3 Timing

The ASTAR II requirements for timing are as specified in Section 3.1.2.

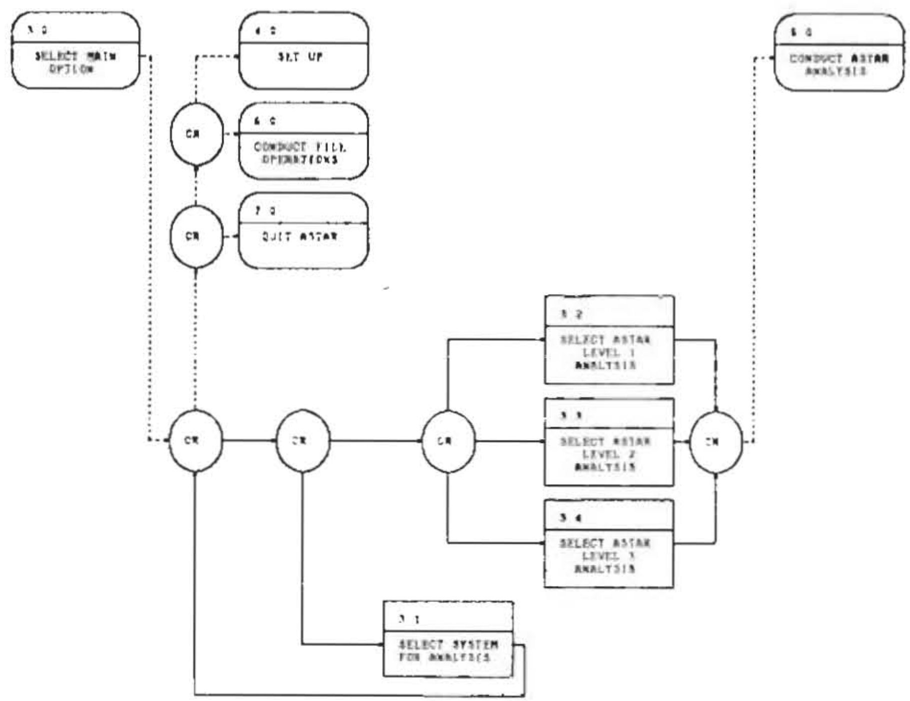
Level 1 ASTAR II
Function 2.0



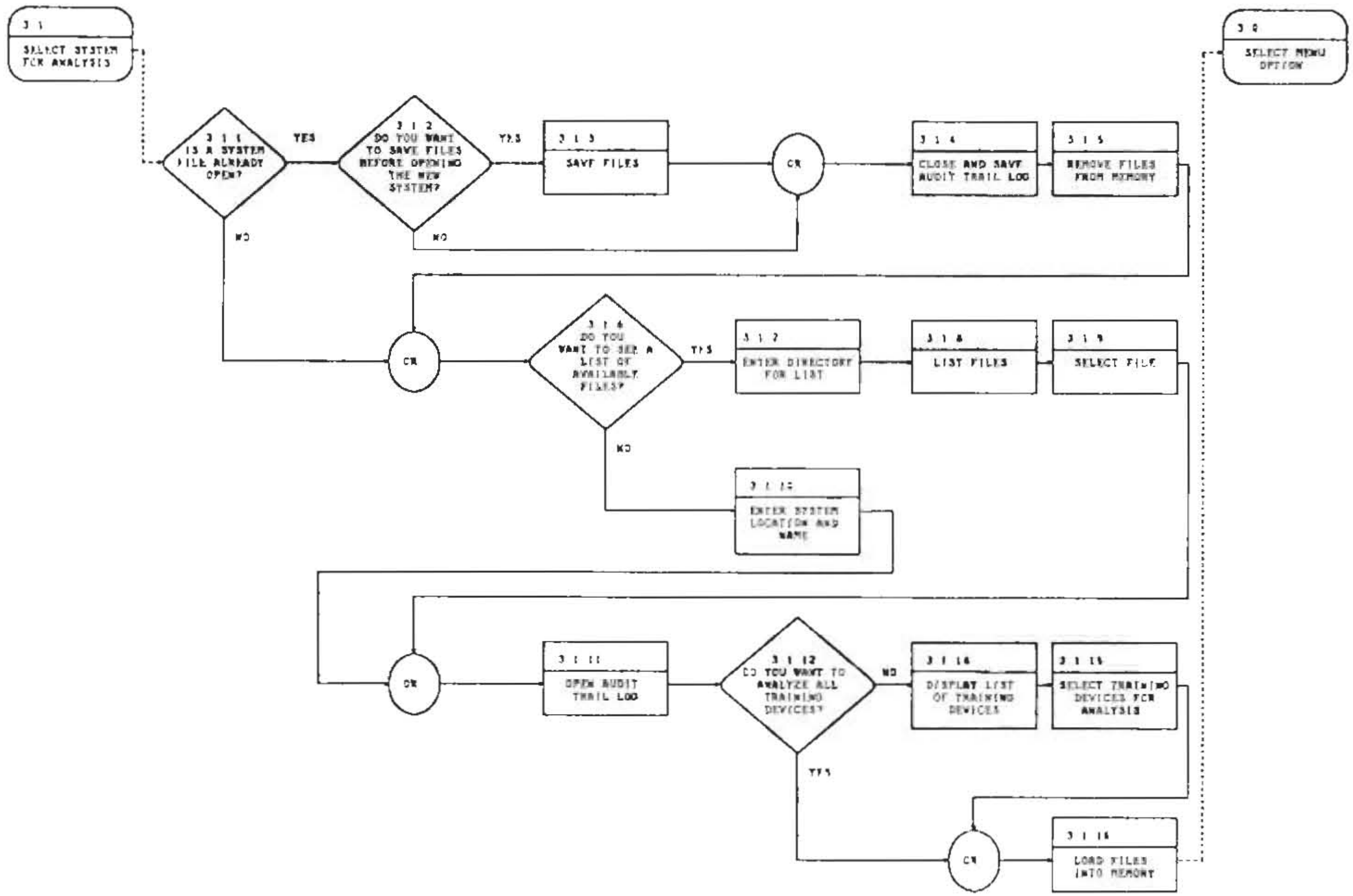
Level 2 ASTAR II
Sub-Functions 2.1 and 2.2



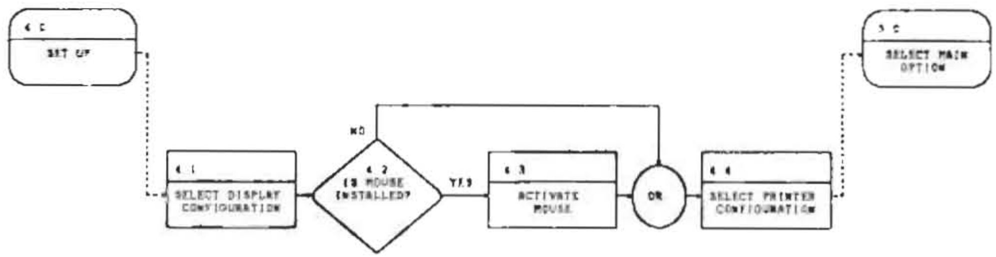
Level 1 ASTAR II
Function 3.0



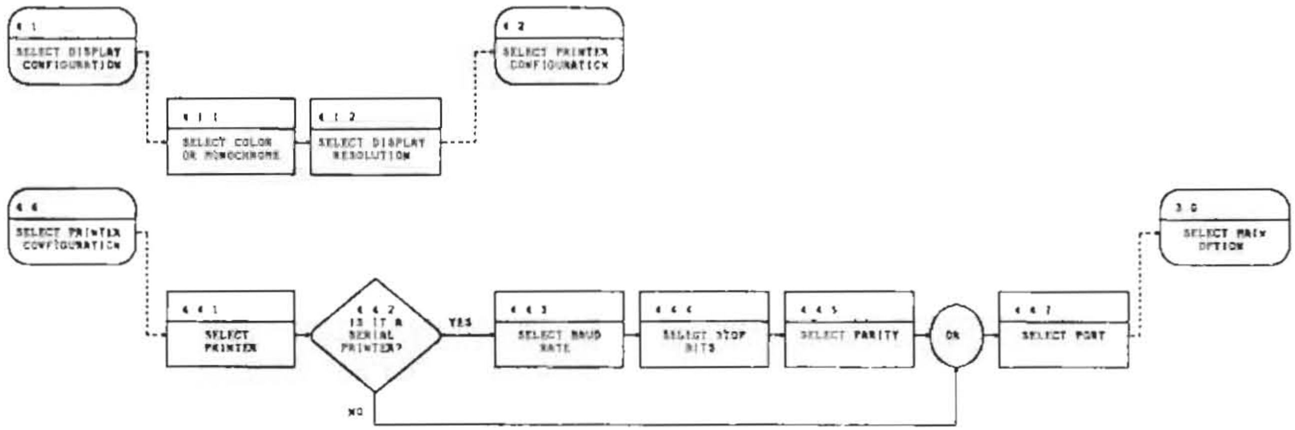
Level 2 ASTAR II
Sub-Function 3.1



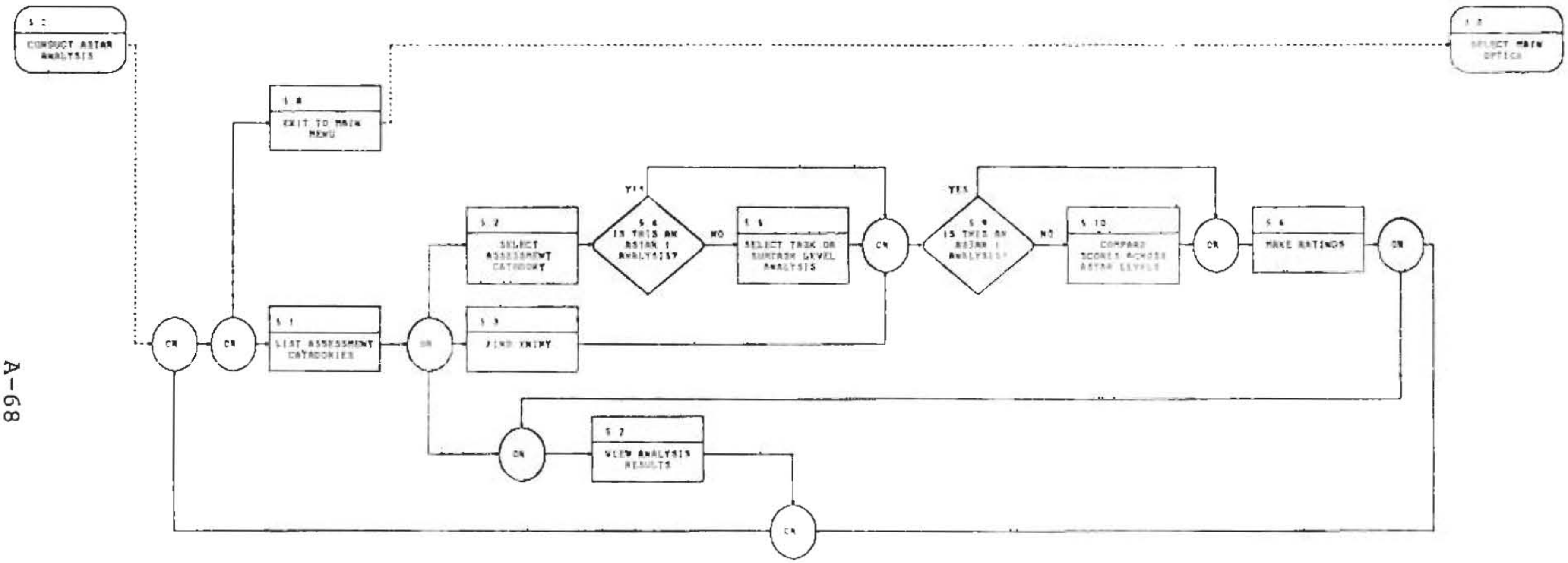
Level 1 ASTAR II
Function 4.0



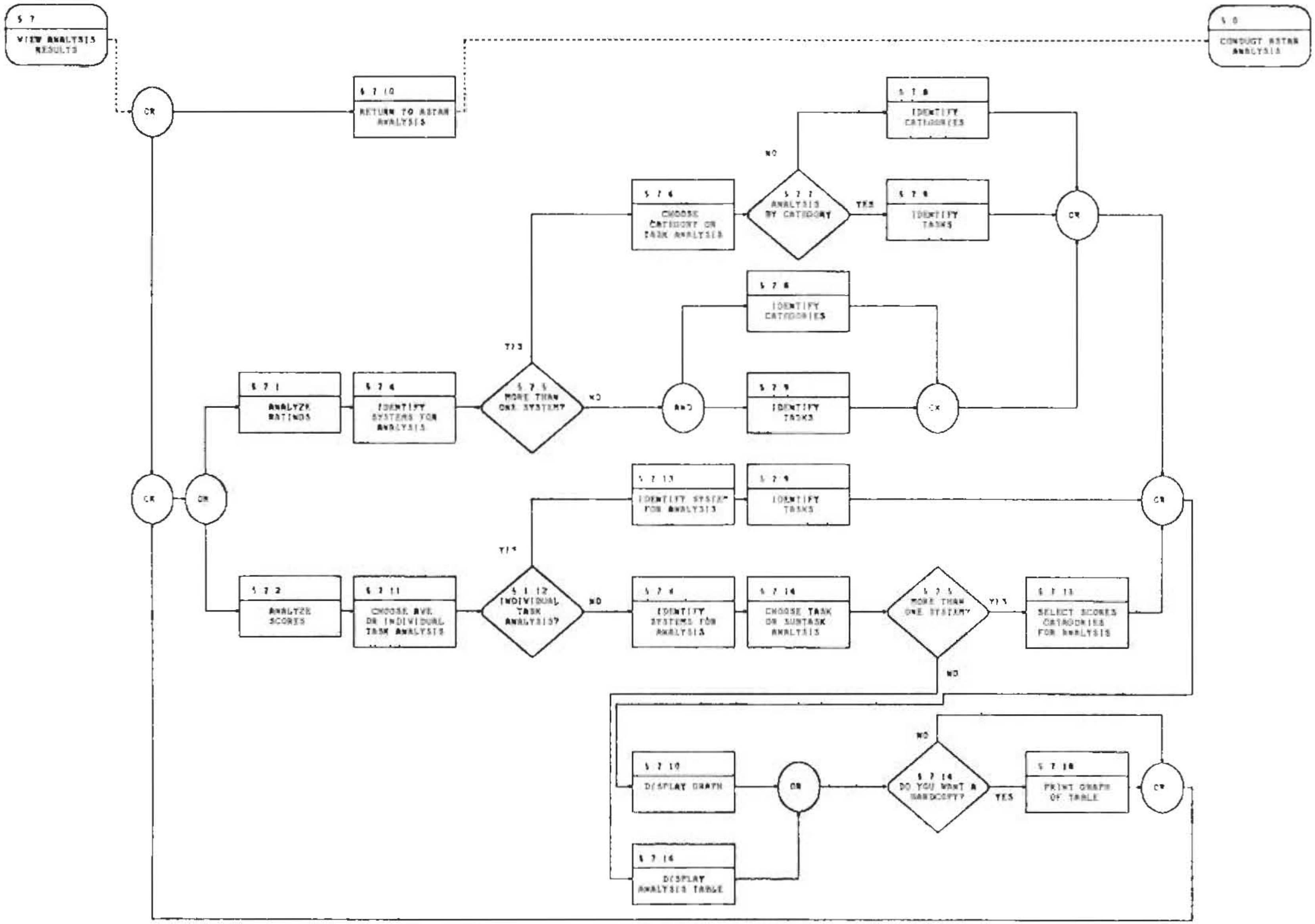
Level 2 ASTAR II
Sub-Functions 4.1 and 4.2



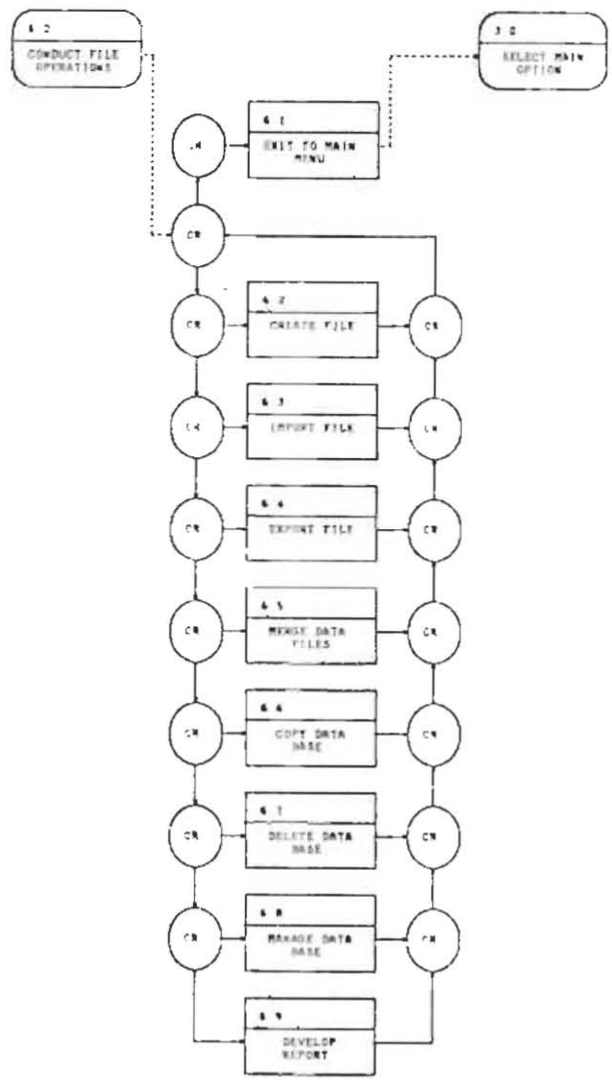
Level 1 ASTAR II
Function 5.0



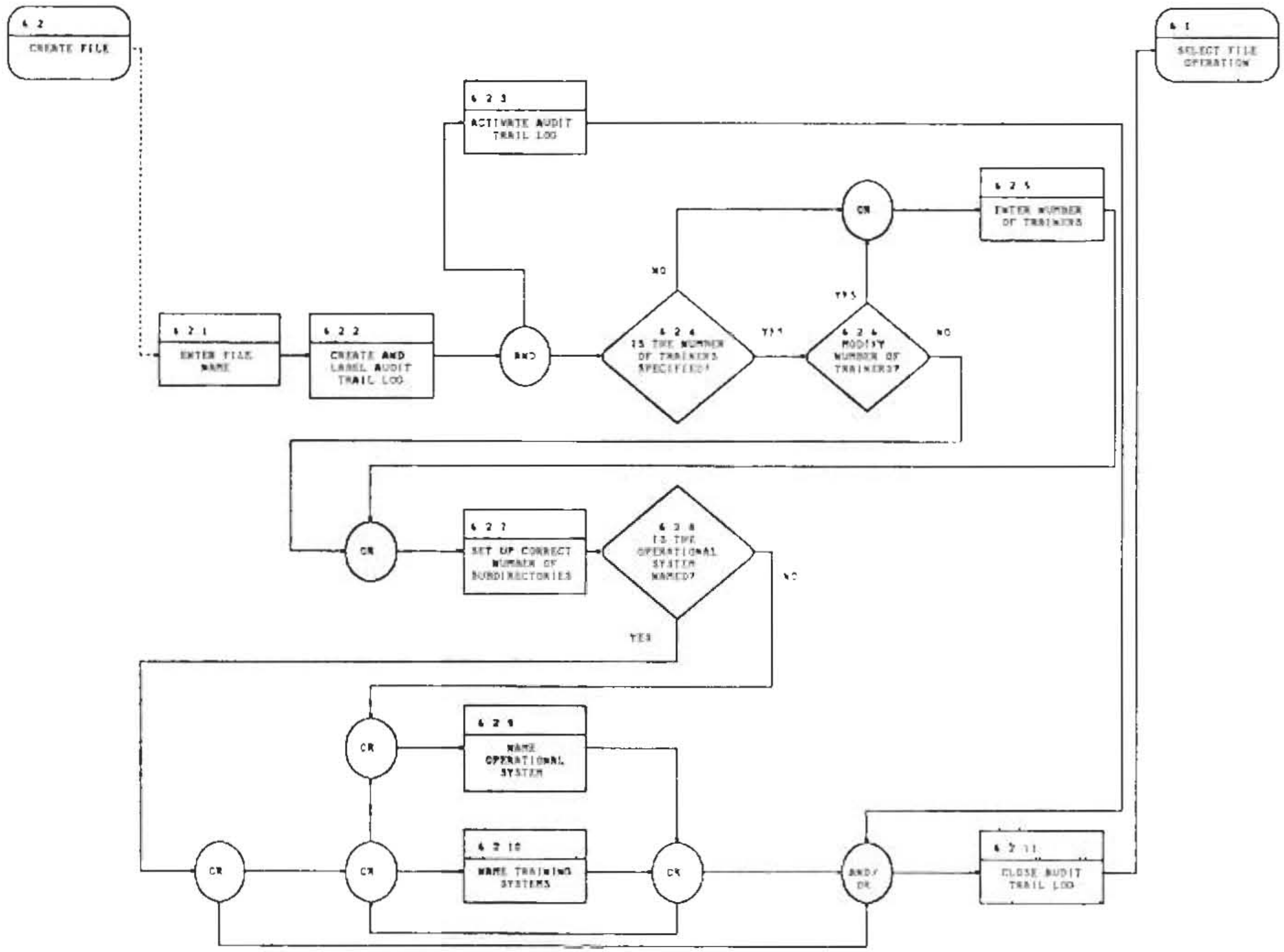
Level 2 ASTAR II
Sub-Function 5.7



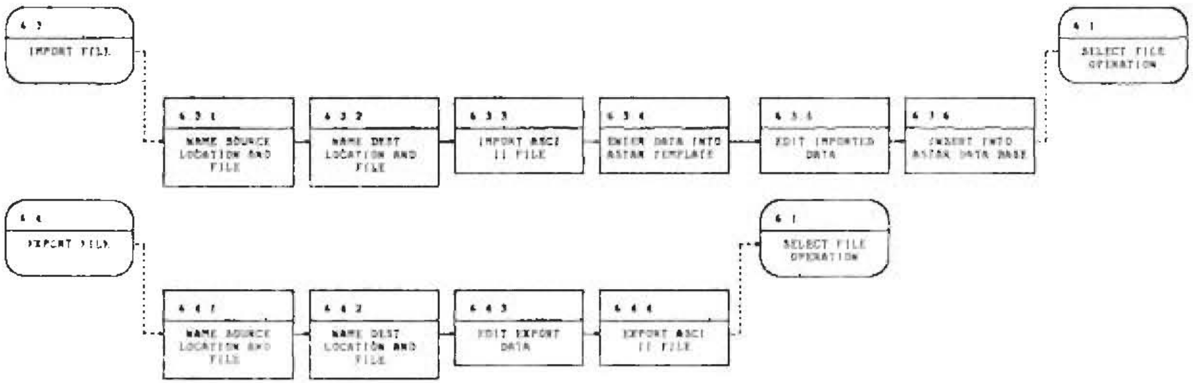
Level 1 ASTAR II
Function 6.0



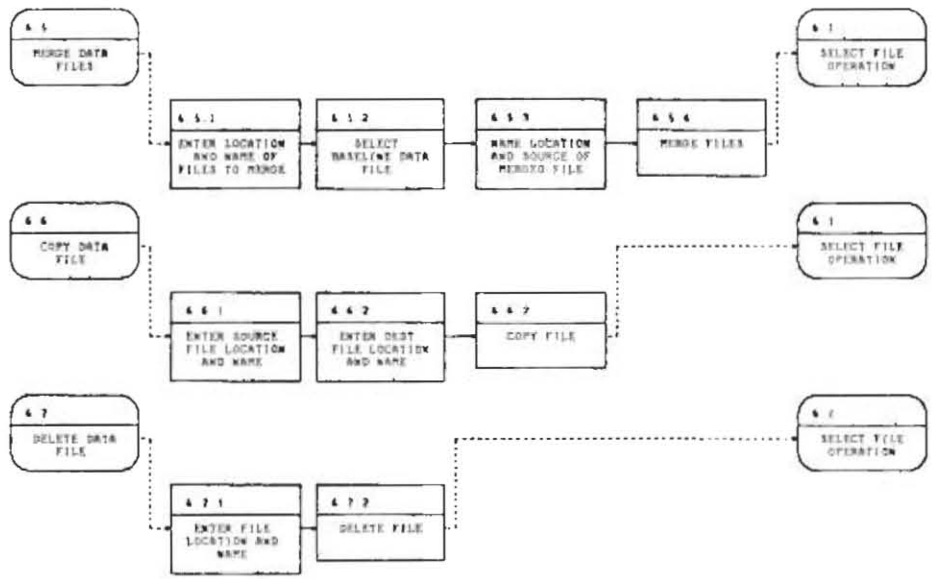
Level 2 ASTAR II
Sub-Function 6.2



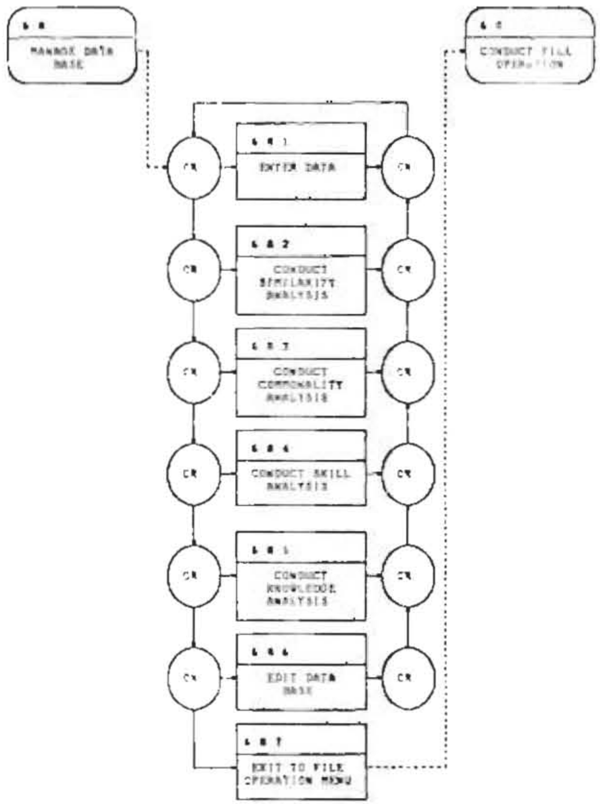
Level 2 ASTAR II
Sub-Functions 6.3 and 6.4



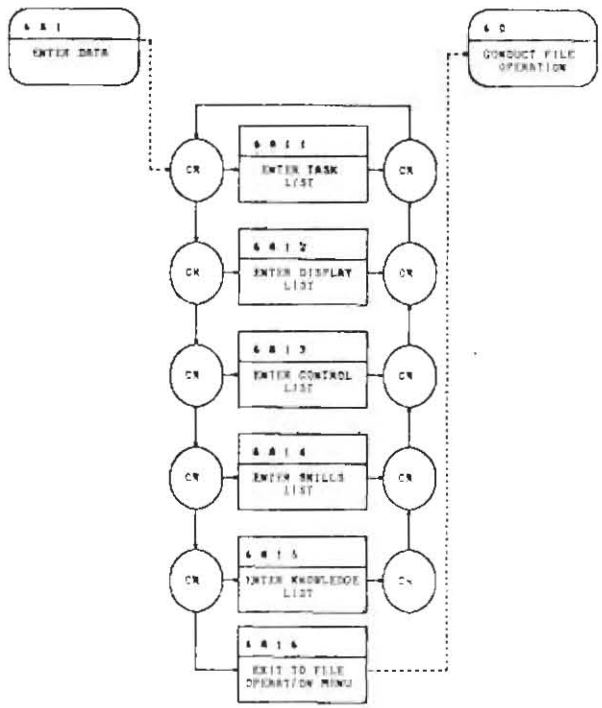
Level 2 ASTAR II
Sub-Functions 6.5, 6.6 and 6.7



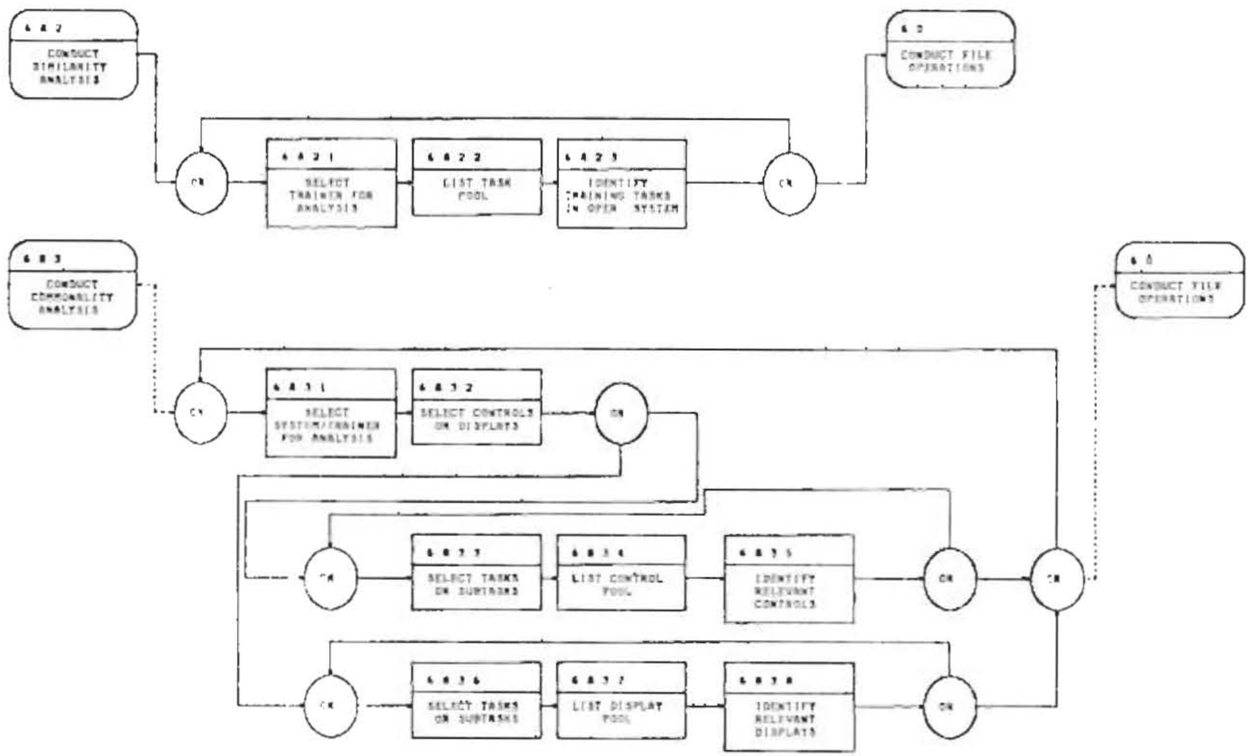
Level 2 ASTAR II
Sub-Function 6.8



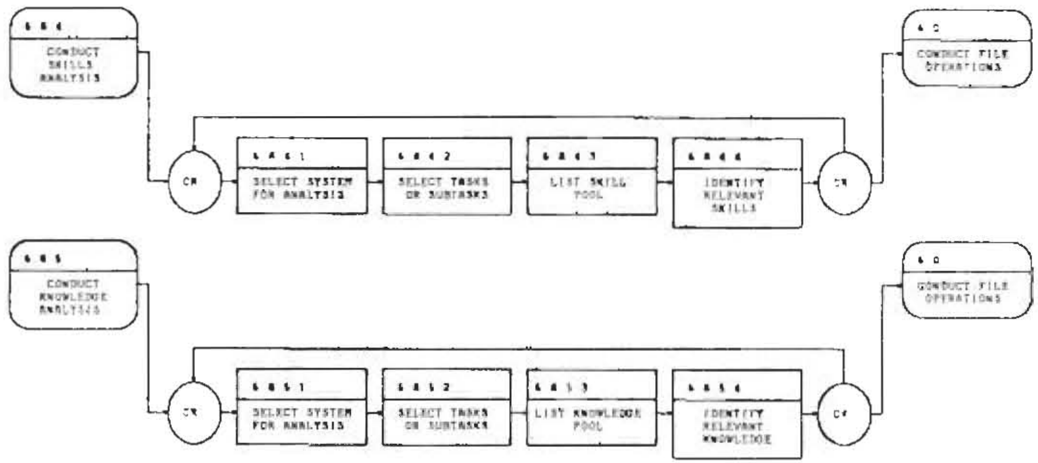
Level 3 ASTAR II
Sub-Function 6.8.1



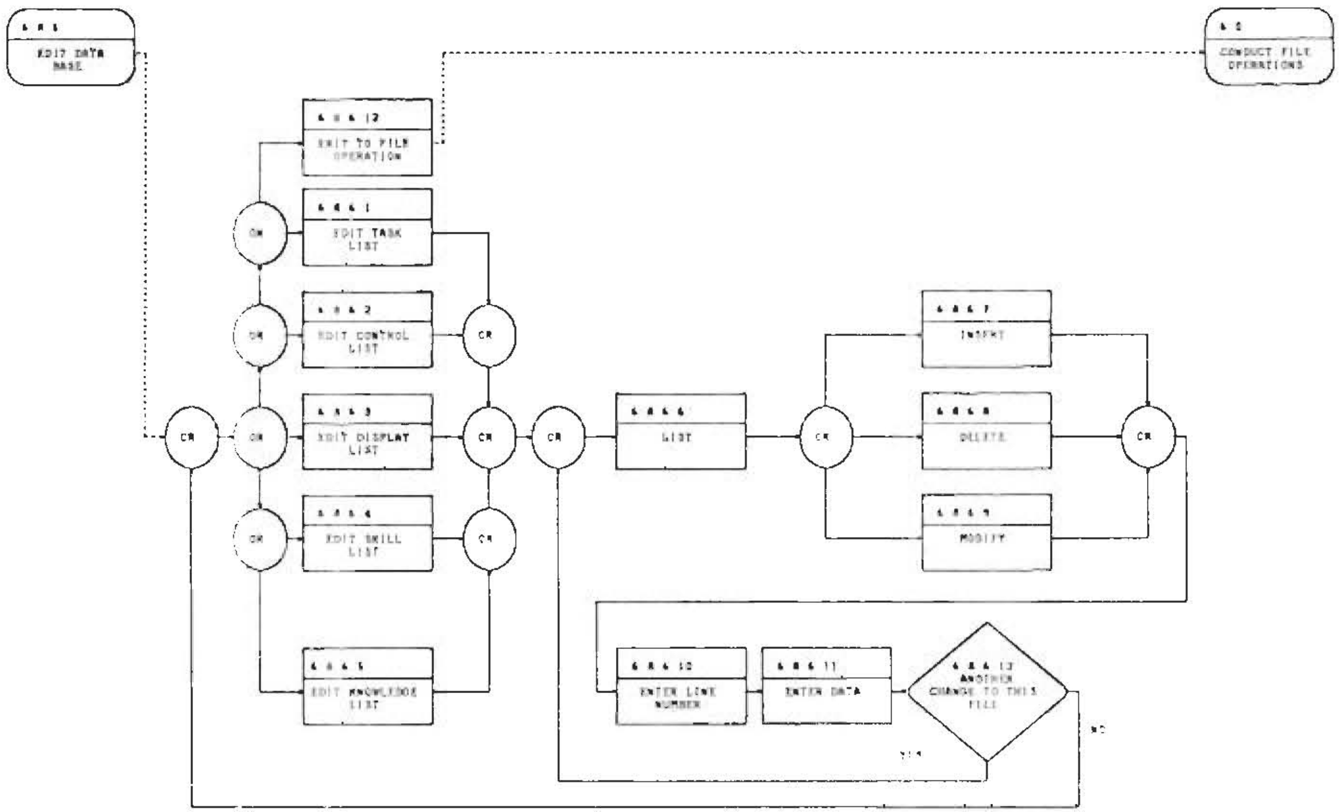
Level 3 ASTAR II
Sub-Functions 6.8.2 and 6.8.3



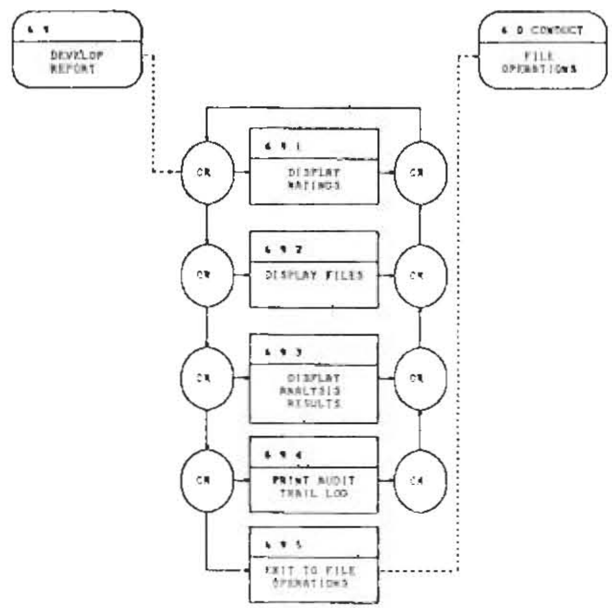
Level 3 Revised ASTAR
Sub-Functions 6.8.4 and 6.8.5



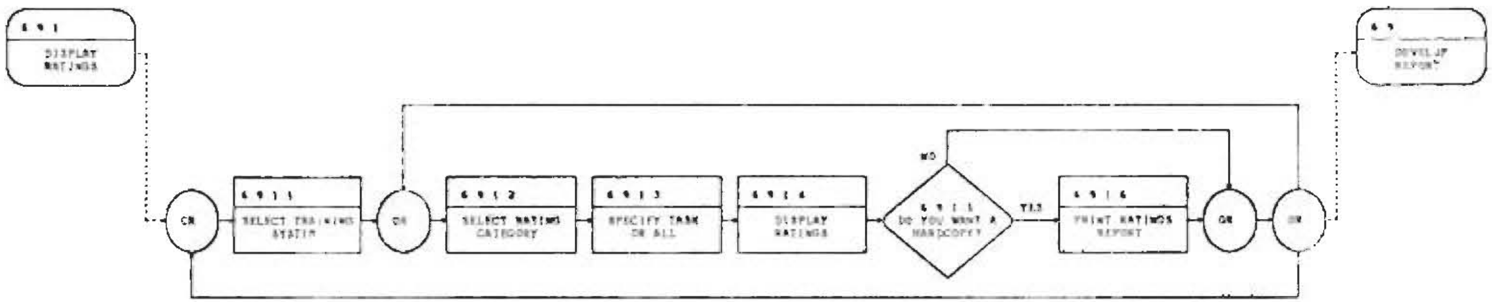
Level 3 ASTAR II
Sub-Function 6.8.6



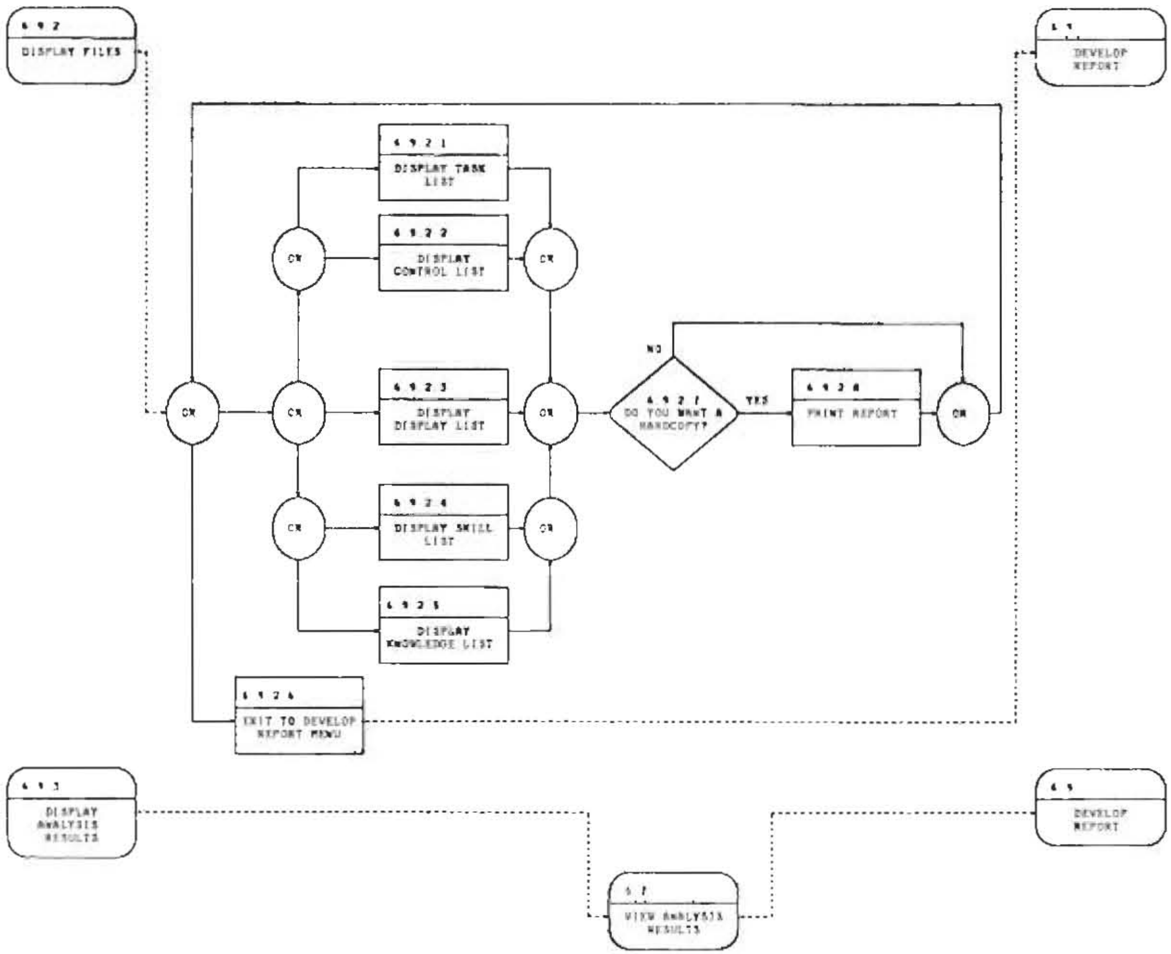
Level 2 ASTAR II
Sub-Function 6.9



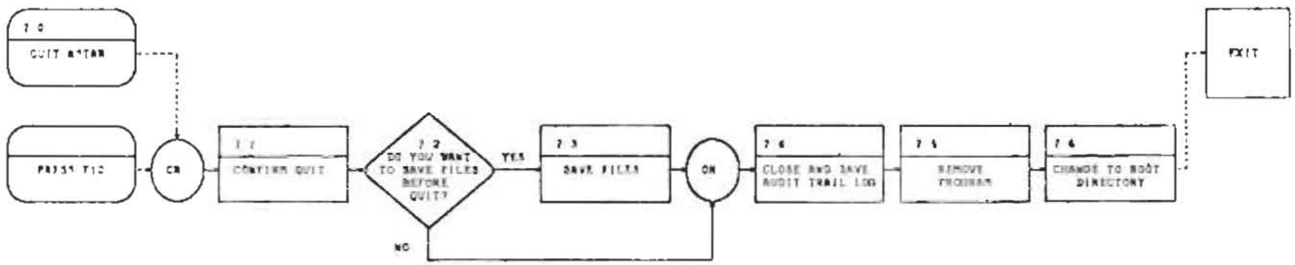
Level 3 ASTAR II
Sub-Function 6.9.1



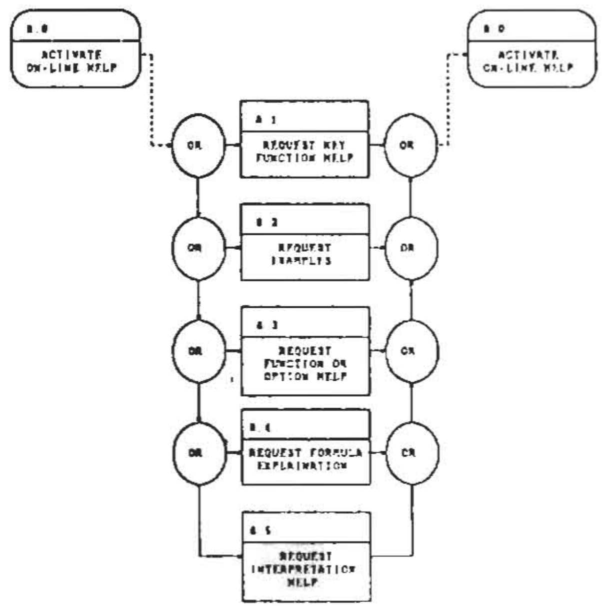
Level 3 ASTAR II
Sub-Functions 6.9.2 and 6.9.3



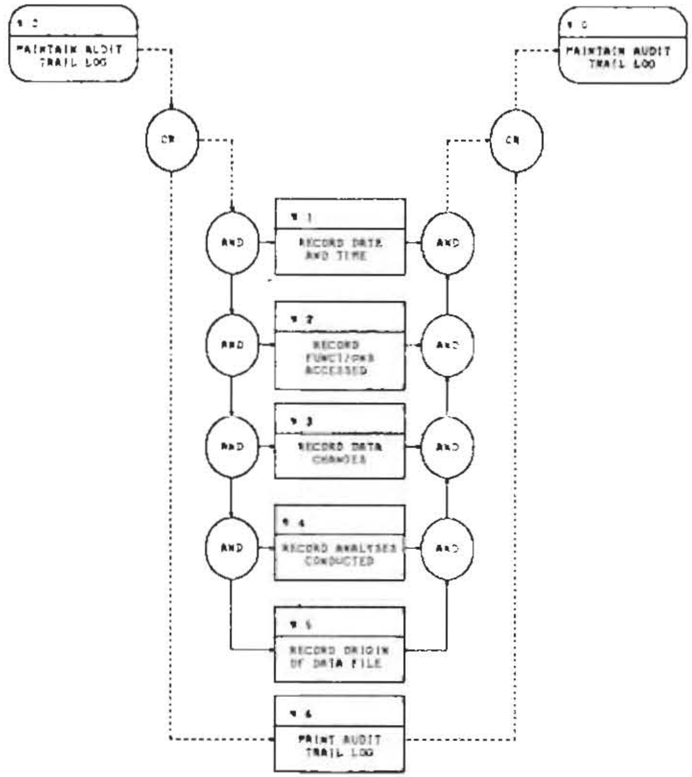
Level 1 ASTAR II
Function 7.0



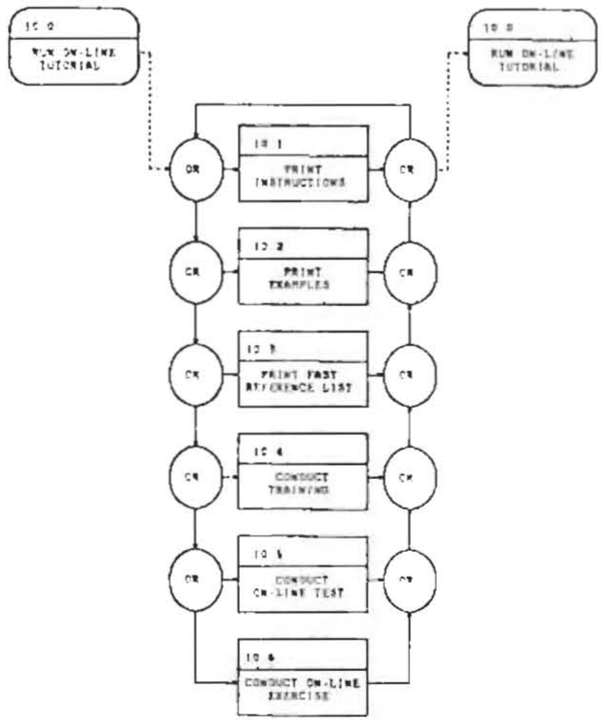
Level 1 ASTAR II
Function 8.0



Level 1 ASTAR II
Function 9.0



Level 1 ASTAR II
Function 10.0



4.3 FLEXIBILITY

Two areas within ASTAR II require flexibility in the program development. The first area is the file of ASTAR II questions. The three levels of ASTAR II questions should remain as independent text files. This permits terminology within questions to be modified for a specific operational environment. These changes should be made by appropriate DoD program personnel to ensure that all users within an operational environment are using an equivalent version of the program. The second area of potential modification is the ASTAR II computational formulas. If new information becomes available which indicates that the formulas could be improved, it should be possible to easily make the necessary changes. This requires the source code for ASTAR II to have adequate internal documentation and be structured so that the equations can be easily updated and verified. Changes to the computational formulas should only be made by personnel within the DoD organization charged with ASTAR II configuration control.

4.4 SYSTEM DATA

4.4.1 Inputs

The system data inputs are the same as described in Sections 3.1.1 and 3.4.

4.4.2 Outputs

The system data outputs are the same as described in Section 3.1.2. Annex 6 provides examples of the different ASTAR II outputs indicating suggested format, headings, etc.

4.4.3 Data Base

The data base structure for ASTAR II shall be hierarchical and be comprised of separate smaller data bases for different data classes. An overall data base structure will be established for each system. Under this top level structure, separate smaller data bases will be established for each training device. This permits flexibility in selecting subsets of devices for analysis and editing. Below is a list of the basic data bases needed for ASTAR II.

1. Title: System Data Base

   Definition: Top level data base that defines the data base structure for a weapons system. It contains information on the number of training devices, the training device names, etc. It will also include the current computed ASTAR scores. The audit trail log may be part of the system data base or a separate data base.

2. Title: Audit Trail Log (may be implemented as part of the system data base)

   Definition: A date and time tagged file of ASTAR II operations on a specific system data base. It contains information on the date of creation, source (new or merged), if merged it identifies the source files, operations conducted on each access of the ASTAR II data base, etc.

3. Title: Training Device Rating Data Base

   Definition: A numeric and text data base which contains the ASTAR II ratings, for all three levels, for a particular device. This data base also contains the commonality and similarity analysis for the data base training device. These analyses are used to determine the active ratings for ASTAR II Level 2 and 3 analyses as appropriate.

4. Title: Task data base

   Definition: A numeric and text file which contains the master list of tasks and subtasks and their associated number. (A master list is the total list of items across all devices prior to editing to create the tailored list applicable to a particular device.)

5. Title: Control data base

   Definition: A numeric and text file which contains the master list of device controls and their associated number.

6. Title: Display data base

   Definition: A numeric and text file which contains the master list of device displays and their associated number.

7. Title: Skill data base

   Definition: A numeric and text file which contains the master list of skill items and their associated number.

8. Title: Knowledge data base

   Definition: A numeric and text file which contains the master list of knowledge items and their associated number.

9. Title: Help

   Definition: One or more text files to support the on-line help facility. These files contain help messages, examples, prompts, etc.

10. Title: Error messages

    Definition: Text file which contains a list of the ASTAR II error messages.

11. Title: ASTAR Level 1 questions

    Definition: Text file which contains the questions for an ASTAR Level 1 analysis. Questions are provided in Annex 3.

12. Title: ASTAR Level 2 questions

    Definition: Text file which contains the questions for an ASTAR Level 2 analysis. Questions are provided in Annex 3.

13. Title: ASTAR Level 3 questions

    Definition: Text file which contains the questions for an ASTAR Level 3 analysis. Questions are provided in Annex 3.

SECTION 5. ENVIRONMENT

5.1 EQUIPMENT ENVIRONMENT

The current implementation of ASTAR is designed to run on an IBM PC, XT or 100% compatible, dual floppy disk drives or one floppy drive and one hard drive, monochrome monitor and 256k memory. This hardware environment is insufficient for useful implementation of ASTAR because it does not support more recent common microprocessors or printer outputs. The hardware environment for ASTAR II is outlined below. The hardware environment is compatible with the joint services ISD/LSAR DSS specification. Requirements are as follows:

a. Hardware - - IBM PC, XT, AT, PS/2 or 100% compatibles. A color monitor is recommended but not required; EGA or VGA preferred. A mouse is also recommended although not included in the ISD/LSAR DSS specification.

b. Main Memory - - Hardware should include 640k bytes of RAM.

c. Printer - - Any IBM character graphics set printer with 80 to 256 columns.

d. Storage Capacity - - Sufficient to support the import of data from other programs. Minimum storage recommended is 20 to 30m bytes. (ISD/LSAR DSS requires 65m bytes for a single weapon system.)

5.2 SUPPORT SOFTWARE ENVIRONMENT

The software support environment for ASTAR II is minimal. It is designed to run as a stand alone program operating in a MS-DOS environment with no external software requirements. It can be used in conjunction with other programs capable of producing ASCII data files, e.g., word processors, which are available in the user's work environment. The organization providing configuration control for ASTAR II should have available the C compiler selected for the program. The compiler would only be necessary for recompilation if changes are made to the program, such as modification of the computational formulas.

5.3 INTERFACES

The ASTAR II system should have the capability to interface with word processors, spreadsheets, data base programs or the data base of ISD/LSAR DSS to access task and control and display data. The data exchange format should be in ASCII format. Interface should be by disk or optionally by modem. Such an interface would save considerable duplication of effort and data entry time. The import routine within ASTAR II should provide a template which permits the imported data to be reformatted to meet ASTAR II data base structure and organization.

5.4 SUMMARY OF IMPACTS

5.4.1 **ADP Organization Impacts**

There are no ADP organizational impacts anticipated.

5.4.2 **ADP Operational Impacts**

There are no ADP operational impacts anticipated.

5.4.3 **ADP Development Impacts**

The personnel and processing commitment necessary to revise and test the ASTAR system will depend on the degree of acceptance of the recommended options and improvements.

5.5 FAILURE CONTINGENCIES

Backup disks of the ASTAR software and data bases should be kept available in the unlikely event of a software failure. A hardware failure can be overcome by using another IBM or IBM compatible PC. If both software and system hardware failures are encountered users would be instructed to return to manual methods.

5.6 SECURITY

ASTAR itself will require no special security provisions. However, in some instances, classified task, control and display information might be entered into the ASTAR data base. In such instances, normal national security regulations regarding "need to know" and levels of user clearance would prevail. The highest, most restrictive level of classification would be applied to the ASTAR disk holding the classified data base.

If data is exported to another program, such as ISD/LSAR DSS, special provisions should be observed. To maintain the integrity of the data base, it is important that importing of data be limited to those users of an appropriate level of responsibility.

5.7 ASSUMPTIONS AND CONSTRAINTS

It is assumed that ASTAR II will be compatible with the range of IBM compatible microcomputers in government and contractor inventory at the time of its development.

SECTION 6. COST FACTORS

This section addresses the cost factors which are associated with the actual development of ASTAR II. Actual cost estimates will be developed as part of the proposal response if the decision is made to develop ASTAR II. The cost factors include:

Technical Management
Subject Matter Expertise
Software Design
Training Materials
Software Development
Documentation
Reports
Test and Evaluation
Travel
Miscellaneous
Implementation

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SECTION 7. SYSTEM DEVELOPMENT PLAN

The system development plan is TBD. It will be developed by the developer and sponsor of the ASTAR II development effort when pursued.

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SECTION 8. ANNEXES

This section provides annexes of supporting data for the ASTAR II development effort. Annex 1 presents a compilation of the comments, ratings and suggestions derived during the operational evaluation which drove the design of ASTAR II. Annex 2 provides the source code for the current implementation of ASTAR. Annex 3 provides a print out of the ASTAR questions. Annex 4 provides detailed flow diagrams and other data for the current implementation of ASTAR. Annexes 2, 3 and 4 are intended to provide background information on the operation of ASTAR. Annex 5 provides hard copy examples of the preliminary screens associated with ASTAR II. Finally, Annex 6 provides samples of ASTAR II output formats.

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ANNEX 1

ASTAR COMMENTS/SUGGESTIONS

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COMPOSITE ASTAR NEGATIVE COMMENTS, BELOW AVERAGE RATINGS AND SUGGESTED CHANGES

1.	Tediousness and length of time associated with the entry of almost identical lists of controls and displays for both the operational system and the trainer in both the workbook and the computer.	M60A1 SEAWOLF
2.	Inflexibility of the model once the data is entered	SEAWOLF
3.	Provide input/output capabilities from data base and spreadsheet programs	DLI SEAWOLF
4.	Allow revision of data base	SEAWOLF DLI
5.	Allow input to be duplicated	SEAWOLF
6.	Upgrade to mouse input	SEAWOLF
7.	Allow side-by-side comparison of two systems rather than the current practice of producing output for one system followed by output for the next	SEAWOLF DLI
8.	Offer graphics capabilities	SEAWOLF
9.	The lack of definition of the data in final summary renders it meaningless.	M60A1
10.	Need documents or screen presentations to tell how to interpret the different scores.	M60A1
11.	Lack of organization of the menus which prohibited a free flow in and out of the process. In other words, there was no capability to escape from the program at any point and then return at a later time to the same point. This could be done, of course, but not quickly and conveniently. Instead, the user was forced to work his way through a time consuming, complex procedure to arrive at his point of interest.	M60A1
12.	ASTAR should be reprogrammed to make it more user friendly and to provide a more meaningful output.	M60A1

13.	Simplified utility menus to allow easy editing, addition, and deletion of controls and displays, and task and subtask data	M60A1	
14.	A way to save data on both hard drive and floppy disks.	M60A1	
15.	Some cost factors be included in ASTAR or costing recommendations made that could be used with the existing ASTAR results	DLI	
16.	Overall utility ASTAR rated 3 on scale of 1 to 3 compared to conventional methods and AIMS. (1=highest, 3=lowest)	ATTITUDE	
17.	Overall ease of use ASTAR rated 2.6 on scale of 1 to 3 compared to conventional methods and AIMS. (1=highest, 3=lowest)	ATTITUDE	
18.	Overall relevance of ASTAR rated 2.6 on scale of 1 to 3 compared to conventional methods and AIMS. (1=highest, 3=lowest)	ATTITUDE	
19.	Overall effectiveness ASTAR rated 2.3 on scale of 1 to 3 compared to conventional methods and AIMS. (1=highest, 3=lowest)	ATTITUDE	

The following ratings were made on a seven point scale. (1 = low, 4 = average, 7 = high)

20.	Not Useful/Useful rating of 2.3	ATTITUDE	
21	Difficult/Easy rating of 2.1	ATTITUDE	
22.	Frustrating/Satisfying rating of 2.1	ATTITUDE	
23.	Rigid/Flexible rating of 2.3	ATTITUDE	
24.	Unproductive/Productive rating of 1.8	ATTITUDE	
25.	Illogical/Logical organization of menus of 3.6 (2 of 3 rated average or above)	ATTITUDE	NICE
26.	Confusing/Very Clear Labels rating of 3.6 (2 of 3 rated above average)	ATTITUDE	NICE
27.	Not Helpful/Helpful prompts rating of 3 (2 OF 3 average)	ATTITUDE	OPTION
28.	Never/Always kept informed rating of 2.6	ATTITUDE	
29.	Difficult/Easy learn to operate rating of 2.1	ATTITUDE	

30.	Difficult/Easy to explore features rating of 2.3	ATTITUDE	
31.	Not Helpful/Helpful instructional materials rating of 2.8	ATITTUDE	
32.	Incomplete/Thorough instructional materials rating of 3.3 (1 slightly below average and 1 above average)	ATTITUDE	OPTION
33.	Never/Always straight forward tasks rating of 3.1	ATTITUDE	
34.	Not Helpful/Helpful feedback rating of 3.0	ATTITUDE	
35.	High/Low memory requirement rating of 2.8	ATTITUDE	
36.	Not Helpful/Helpful error message rating of 1.6	ATTITUDE	
37.	Not Useful/Useful analysis results rating of 2.0	ATTITUDE	
38.	Difficult/Easy to understand results rating of 1.6	ATTITUDE	
39.	Confusing/Clear format of results rating of 2.3	ATTITUDE	
40.	Integrate with the Joint Services ILS/LSAR DSS	COMMENT	

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ANNEX 2

ASTAR SOURCE CODE

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```
 IDENTIFICATION DIVISION.
 PROGRAM-ID.   ASTARX.
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*         the U.S. Government pursuant to the
*         copyright license under DAR clause 7-104.9(a)
*                                        (1979 MAR)
*---------------------------------------------------------------.
*  THIS PROGRAM IS THE ASTAR MENU PROGRAM.
*---------------------------------------------------------------.
 AUTHOR. Timothy OConnor.
 INSTALLATION. American Institutes for Research.
 DATE-WRITTEN.  JULY 1984.
 ENVIRONMENT DIVISION.
 CONFIGURATION SECTION.
 SOURCE-COMPUTER.
 OBJECT-COMPUTER.
 INPUT-OUTPUT SECTION.
 FILE-CONTROL.
 DATA DIVISION.
 WORKING-STORAGE SECTION.
 01   NOTHING PIC X.
 01   CTL-STATUS-WORD    PIC XX.
 01   DEVICE-STATUS-WORD  PIC XX.
 01   TITLE-STATUS-WORD  PIC XX.
 01   NEW-DESC      PIC X(54).
 01   OPTION       PIC X.
 01   LAST-KEY    PIC XX.

 PROCEDURE DIVISION.
 BEGIN.
     DISPLAY (1, 1) ERASE.
     DISPLAY (1, 22)
             "ASTAR MAIN MENU".
     DISPLAY (2, 27)
                  "ver 2.0".
     DISPLAY (5, 23)
              "(1) ASTAR 1".
     DISPLAY (7, 23)
              "(2) ASTAR 2".
     DISPLAY (9, 23)
              "(3) ASTAR 3".
     DISPLAY (11, 23)
              "(4) Display Ratings".
     DISPLAY (13, 23)
              "(5) Database Maintenance".
     DISPLAY (15, 23)
              "(6) EXIT PROGRAM".
     DISPLAY (17, 14)
     "Enter option   ".
     ACCEPT (LIN, COL) OPTION WITH AUTO-SKIP.
     DISPLAY (1, 1) ERASE.
     IF OPTION = "1"  CALL "ASTAR1".
     IF OPTION = "2"  CALL "ASTAR2".
     IF OPTION = "3"  CALL "ASTAR3".
```

```
IF OPTION = "4"  CALL "LIST".
IF OPTION = "5"  CALL "MAINT".
IF OPTION = "6"  STOP RUN.
  GO TO BEGIN.
```

```
 IDENTIFICATION DIVISION.
 PROGRAM-ID.   ASTAR1.
*       c 1984, American Institutes for Research
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*         the U.S. Government pursuant to the
*         copyright license under DAR clause 7-104.9(a)
*                                        (1979 MAR)
* -------------------------------------------------------.
* THIS IS THE ASTAR 1  ANALYSIS PROGRAM.
* ------------------------------------------------------- .
 AUTHOR. Timothy OConnor.
 INSTALLATION. American Institutes for Research.
 ENVIRONMENT DIVISION.
 CONFIGURATION SECTION.
 SOURCE-COMPUTER.
 OBJECT-COMPUTER.
 INPUT-OUTPUT SECTION.
 FILE-CONTROL.

       SELECT DEVICE-FILE ASSIGN TO DISK
            ORGANIZATION IS INDEXED
            ACCESS MODE IS DYNAMIC
            RECORD KEY IS DEVICE-KEY
            FILE STATUS IS DEVICE-STATUS-WORD.


     SELECT TEXT-FILE ASSIGN TO DISK
             ORGANIZATION IS LINE SEQUENTIAL.

 DATA DIVISION.
 FILE SECTION.
 FD  DEVICE-FILE
        LABEL RECORD IS STANDARD;
        VALUE OF FILE-ID IS "B:DEVICE".
 01  DEVICE-RECORD.
     03 DEVICE-KEY      PIC X(10).
     03 DEVICE-ANALYSIS   OCCURS 20 TIMES PIC 999.
     03 DEVICE-TITLE   PIC X(60).

 FD  TEXT-FILE
         LABEL RECORD IS STANDARD;
         VALUE OF FILE-ID IS "ASTAR1.DOC".
 01  TEXT-RECORD.
     05 REC-INDICATOR      PIC XX.
     05 FILLER             PIC X.
     05 ANALYSIS-NUMBER    PIC X.
     05 FILLER           PIC X(75).


 WORKING-STORAGE SECTION.
 01  NOTHING PIC X.
 01  TASK-NO  PIC Z(4).9999 DISPLAY.
 01  RATING PIC 999.
 01  PREVIOUS-RATING PIC ZZ9.
 01  DEVICE-STATUS-WORD  PIC XX.
```

```
01   EOF-DEVICE  PIC 9  VALUE 0.
01   TITLE-STATUS-WORD  PIC XX.
01   REQ-TASK-NO.
     05 REQ-TYPE  PIC 9.
     05 REQ-TASK    PIC Z(4).
     05 FILLER  PIC X.
     05 REQ-SUBTASK    PIC X(4).
01   READ-TASK-NO.
     05 READ-TYPE   PIC 9.
     05 READ-TASK1  PIC Z(4).
     05 FILLER  PIC X.
     05 READ-SUBTASK PIC X(4).
01   LAST-KEY    PIC XX.
01   OPTION    PIC 9.
01   PREV-OPTION   PIC 9.
01   X    PIC 9(4).
01   Z    PIC 9(4).
01   I    PIC 9(4).
01   DISPLAY-NUMBER  PIC  ZZ,ZZZ.99.
01   TRAINING-PROBLEM    PIC 9(5)V99.
01   ACQUISITION-EFFICIENCY   PIC 9(5)V99.
01   TRAINING-ACQUISITION  PIC 9(5)V99.
01   TRANSFER-PROBLEM   PIC 9(5)V99.
01   TRANSFER-EFFICIENCY  PIC 9(5)V99.
01   ADDITIONAL-DEFICIT  PIC S9999.
01   TRAINING-TRANSFER   PIC 9(5)V99.
01   ASTAR               PIC 9(5)V99.
01   SQR1               PIC S9(9) COMP.
01   SQR-ROOT            PIC 9(5)V99  COMP.
01   J                  PIC 9(9) COMP.


PROCEDURE DIVISION.
BEGIN.
     OPEN I-O DEVICE-FILE.
     OPEN INPUT TEXT-FILE.
     DISPLAY (1, 1) ERASE.
     MOVE "0   0.0000" TO DEVICE-KEY.
     MOVE TASK-NO TO REQ-TASK-NO.
     READ DEVICE-FILE RECORD INVALID KEY GO TO BAD-KEY.
     MOVE 0 TO OPTION.
MENU.
     MOVE OPTION TO PREV-OPTION.
     MOVE 0 TO OPTION.
     MOVE 0 TO EOF-DEVICE
     MOVE "00" TO LAST-KEY
     DISPLAY (1, 1)ERASE.
     DISPLAY (1, 25)
                "        ASTAR 1                          ".
     DISPLAY (4, 25)
                "(1)  Performance Deficit                  ".
     DISPLAY (5, 25)
                "(2)  Learning Difficulty                  ".
     DISPLAY (6, 25)
                "(3)  Quality of Training-Acquisition      ".
```

```
    DISPLAY (7, 25)
               "(4)  Residual Deficit                          ".
    DISPLAY (8, 25)
               "(5)  Residual Learning Difficulty              ".
    DISPLAY (9, 25)
               "(6)  Physical Similarity                       ".
    DISPLAY (10, 25)
               "(7)  Functional Similarity                     ".
    DISPLAY (11, 25)
               "(8)  Quality of Training-Transfer              ".
    DISPLAY (12, 25)
               "(9)  Evaluation Summary                        ".
    DISPLAY (15, 12)"Enter Option Number ".
    ACCEPT (LIN, COL) OPTION WITH AUTO-SKIP.
    ACCEPT LAST-KEY FROM ESCAPE KEY.
    IF LAST-KEY = "01" GO TO STOP-RUN.
    DISPLAY (1, 1)ERASE.
    IF OPTION = 01 GO TO PERFORMANCE-DEFICIT-ANALYSIS.
    IF OPTION = 02 GO TO LEARNING-DIFFICULTY-ANALYSIS.
    IF OPTION = 03 GO TO TRAINING-ACQUISITION-ANALYSIS.
    IF OPTION = 04 GO TO RESIDUAL-DEFICIT-ANALYSIS.
    IF OPTION = 05 GO TO RESIDUAL-DIFFICULTY-ANALYSIS.
    IF OPTION = 06 GO TO PHYSICAL-SIMILARITY-ANALYSIS.
    IF OPTION = 07 GO TO FUNCTIONAL-SIMILARITY-ANALYSIS.
    IF OPTION = 08 GO TO TRAINING-TRANSFER-ANALYSIS.
    IF OPTION = 09 GO TO EVALUATION-SUMMARY.
    IF OPTION = 10 GO TO STOP-RUN.
    GO TO MENU.
PERFORMANCE-DEFICIT-ANALYSIS.
    MOVE 1 TO X.
    MOVE 1 TO Z.
    PERFORM FIND-SCREEN THRU DISPLAY-SCREEN-EXIT.
    IF LAST-KEY = "01" GO TO MENU.
    PERFORM RATE-TASKS THRU RATE-TASKS-EXIT.
    GO TO MENU.
LEARNING-DIFFICULTY-ANALYSIS.
    MOVE 2 TO X.
    MOVE 2 TO Z.
    PERFORM FIND-SCREEN THRU DISPLAY-SCREEN-EXIT.
    IF LAST-KEY = "01" GO TO MENU.
    PERFORM RATE-TASKS THRU RATE-TASKS-EXIT.
    GO TO MENU.
TRAINING-ACQUISITION-ANALYSIS.
    MOVE 3 TO X.
    MOVE 3 TO Z.
    PERFORM FIND-SCREEN THRU DISPLAY-SCREEN-EXIT.
    IF LAST-KEY = "01" GO TO MENU.
    PERFORM RATE-TASKS THRU RATE-TASKS-EXIT.
    GO TO MENU.
RESIDUAL-DEFICIT-ANALYSIS.
    MOVE 4 TO X.
    MOVE 4 TO Z.
    PERFORM FIND-SCREEN THRU DISPLAY-SCREEN-EXIT.
    IF LAST-KEY = "01" GO TO MENU.
    PERFORM RATE-TASKS THRU RATE-TASKS-EXIT.
```

```
    GO TO MENU.
RESIDUAL-DIFFICULTY-ANALYSIS.
    MOVE 5 TO X.
    MOVE 5 TO Z.
    PERFORM FIND-SCREEN THRU DISPLAY-SCREEN-EXIT.
    IF LAST-KEY = "01" GO TO MENU.
    PERFORM RATE-TASKS THRU RATE-TASKS-EXIT.
    GO TO MENU.
PHYSICAL-SIMILARITY-ANALYSIS.
    MOVE 6 TO X.
    MOVE 6 TO Z.
    PERFORM FIND-SCREEN THRU DISPLAY-SCREEN-EXIT.
    IF LAST-KEY = "01" GO TO MENU.
    PERFORM RATE-TASKS THRU RATE-TASKS-EXIT.
    GO TO MENU.
FUNCTIONAL-SIMILARITY-ANALYSIS.
    MOVE 7 TO X.
    MOVE 7 TO Z.
    PERFORM FIND-SCREEN THRU DISPLAY-SCREEN-EXIT.
    IF LAST-KEY = "01" GO TO MENU.
    PERFORM RATE-TASKS THRU RATE-TASKS-EXIT.
    GO TO MENU.
TRAINING-TRANSFER-ANALYSIS.
    MOVE 8 TO X.
    MOVE 8 TO Z.
    PERFORM FIND-SCREEN THRU DISPLAY-SCREEN-EXIT.
    IF LAST-KEY = "01" GO TO MENU.
    PERFORM RATE-TASKS THRU RATE-TASKS-EXIT.
    GO TO MENU.
FIND-SCREEN.
    IF ANALYSIS-NUMBER > OPTION OR OPTION = PREV-OPTION
       CLOSE TEXT-FILE
       OPEN INPUT TEXT-FILE
       READ TEXT-FILE RECORD AT END GO TO EOF-TEXT.
    DISPLAY (1, 1) ERASE.
READ-TEXT.
    IF REC-INDICATOR = "ZZ" AND
      ANALYSIS-NUMBER = OPTION GO TO DISPLAY-SCREEN.
    IF REC-INDICATOR = "ZQ" AND ANALYSIS-NUMBER = OPTION
        PERFORM DISPLAY-INTRO-SCREEN THRU
                DISPLAY-INTRO-SCREEN-EXIT
        PERFORM HIT-ANY-KEY
        GO TO READ-TEXT.
    READ TEXT-FILE RECORD AT END GO TO EOF-TEXT.
    GO TO READ-TEXT.
DISPLAY-SCREEN.
    IF LAST-KEY = "01" GO TO DISPLAY-SCREEN-EXIT.
    READ TEXT-FILE RECORD AT END GO TO EOF-TEXT.
    IF REC-INDICATOR = "ZZ" OR REC-INDICATOR = "ZQ"
      GO TO DISPLAY-SCREEN-EXIT.
    DISPLAY TEXT-RECORD.
    GO TO DISPLAY-SCREEN.
DISPLAY-SCREEN-EXIT.
    EXIT.
HIT-ANY-KEY.
```

```
    DISPLAY (LIN, COL) "Hit any key to continue ".
    ACCEPT (LIN, COL) NOTHING WITH AUTO-SKIP.
    ACCEPT LAST-KEY FROM ESCAPE KEY.
    DISPLAY(1, 1)ERASE.
RATE-TASKS.
    DISPLAY (23 , 1)ERASE.
    DISPLAY (LIN, 1) DEVICE-TITLE.
    DISPLAY " ".
    MOVE DEVICE-ANALYSIS(X) TO RATING.
    IF RATING NOT = 999
      MOVE RATING TO PREVIOUS-RATING
      DISPLAY (LIN, 1) "Previous Rating = ", PREVIOUS-RATING.
    DISPLAY (LIN, COL) "    Enter Rating = "
    ACCEPT (LIN, COL) RATING WITH AUTO-SKIP UPDATE.
    ACCEPT LAST-KEY FROM ESCAPE KEY.
    IF LAST-KEY = "01" GO TO RATE-TASKS-EXIT.
    IF RATING = PREVIOUS-RATING GO TO RATE-TASKS-EXIT.
    MOVE RATING TO DEVICE-ANALYSIS(X).
    REWRITE DEVICE-RECORD INVALID KEY GO TO BAD-KEY.
RATE-TASKS-EXIT.
    EXIT.
EVALUATION-SUMMARY.
    DISPLAY (1, 1)ERASE.
    DISPLAY (1, 31) "Evaluation Summary".
    DISPLAY (3, 1)
            "     Performance Deficit                  ".
    MOVE DEVICE-ANALYSIS(1) TO PREVIOUS-RATING.
    IF PREVIOUS-RATING NOT = 999
     DISPLAY (LIN, COL) PREVIOUS-RATING.
    DISPLAY (4, 1)
            "     Learning Difficulty                  ".
    MOVE DEVICE-ANALYSIS(2) TO PREVIOUS-RATING.
    IF PREVIOUS-RATING NOT = 999
     DISPLAY (LIN, COL) PREVIOUS-RATING.
    DISPLAY (5, 1)
            "          Training Problem                ".
    MOVE 999 TO TRAINING-PROBLEM.
    IF DEVICE-ANALYSIS(1) NOT = 999 AND
       DEVICE-ANALYSIS(2) NOT = 999
       COMPUTE TRAINING-PROBLEM ROUNDED =
        (DEVICE-ANALYSIS(1) * DEVICE-ANALYSIS(2)) / 100
       MOVE TRAINING-PROBLEM TO DISPLAY-NUMBER
       DISPLAY (LIN, COL) DISPLAY-NUMBER.
    DISPLAY (6, 1)
            "     Quality of Training-Acquisition   ".
    MOVE DEVICE-ANALYSIS(3) TO PREVIOUS-RATING.
    IF PREVIOUS-RATING NOT = 999
     DISPLAY (LIN, COL) PREVIOUS-RATING.
    DISPLAY (7, 1)
            "          Acquisition-Efficiency       ".
    MOVE 999 TO ACQUISITION-EFFICIENCY.
    IF DEVICE-ANALYSIS(3) NOT = 999
      COMPUTE ACQUISITION-EFFICIENCY ROUNDED =
       (DEVICE-ANALYSIS(3) / 100)
      MOVE ACQUISITION-EFFICIENCY TO SQR-ROOT
```

```
  PERFORM SQUARE-ROOT
  MOVE SQR-ROOT TO ACQUISITION-EFFICIENCY
  MOVE ACQUISITION-EFFICIENCY TO DISPLAY-NUMBER
  DISPLAY(LIN, COL) DISPLAY-NUMBER.
DISPLAY (8, 10)
           "           Acquisition                   ".
IF ACQUISITION-EFFICIENCY = 0
  MOVE .01 TO ACQUISITION-EFFICIENCY.
MOVE 999 TO TRAINING-ACQUISITION.
IF TRAINING-PROBLEM NOT = 999 AND
   ACQUISITION-EFFICIENCY NOT = 999
   COMPUTE TRAINING-ACQUISITION ROUNDED =
   TRAINING-PROBLEM / ACQUISITION-EFFICIENCY
   MOVE TRAINING-ACQUISITION TO DISPLAY-NUMBER
   DISPLAY(LIN, COL) DISPLAY-NUMBER.
DISPLAY (9, 1)
          "      Residual Deficit                  ".
MOVE DEVICE-ANALYSIS(4) TO PREVIOUS-RATING.
IF PREVIOUS-RATING NOT = 999
 DISPLAY (LIN, COL) PREVIOUS-RATING.
DISPLAY (10, 1)
          "      Residual Learning Difficulty      ".
MOVE DEVICE-ANALYSIS(5) TO PREVIOUS-RATING.
IF PREVIOUS-RATING NOT = 999
 DISPLAY (LIN, COL) PREVIOUS-RATING.
DISPLAY (11, 1)
          "      Physical Similarity               ".
MOVE DEVICE-ANALYSIS(6) TO PREVIOUS-RATING.
IF PREVIOUS-RATING NOT = 999
 DISPLAY (LIN, COL) PREVIOUS-RATING.
DISPLAY (12, 1)
          "      Functional Similarity             ".
MOVE DEVICE-ANALYSIS(7) TO PREVIOUS-RATING.
IF PREVIOUS-RATING NOT = 999
 DISPLAY (LIN, COL) PREVIOUS-RATING.
DISPLAY (13, 1)
          "           Transfer Problem              ".
MOVE 999 TO TRANSFER-PROBLEM.
MOVE 0 TO ADDITIONAL-DEFICIT.
IF DEVICE-ANALYSIS(6) NOT = 999 AND
  DEVICE-ANALYSIS(7) NOT = 999
   COMPUTE ADDITIONAL-DEFICIT =
    DEVICE-ANALYSIS(6) - DEVICE-ANALYSIS(7).
IF DEVICE-ANALYSIS(7) > DEVICE-ANALYSIS(6)
     MOVE 0 TO ADDITIONAL-DEFICIT.
IF DEVICE-ANALYSIS(4) NOT = 999 AND
   DEVICE-ANALYSIS(5) NOT = 999
   COMPUTE TRANSFER-PROBLEM ROUNDED =
    ((DEVICE-ANALYSIS(4) * DEVICE-ANALYSIS(5)) / 100) +
       ADDITIONAL-DEFICIT
   MOVE TRANSFER-PROBLEM TO DISPLAY-NUMBER
   DISPLAY (LIN, COL) DISPLAY-NUMBER.
DISPLAY (14, 1)
          "      Quality of Training-Transfer      ".
MOVE DEVICE-ANALYSIS(8) TO PREVIOUS-RATING.
```

```
    IF PREVIOUS-RATING NOT = 999
     DISPLAY (LIN, COL) PREVIOUS-RATING.
    DISPLAY (15, 1)
             "           Transfer Efficiency                 ".
    MOVE 999 TO TRANSFER-EFFICIENCY.
    IF DEVICE-ANALYSIS(8) NOT = 999
      COMPUTE TRANSFER-EFFICIENCY ROUNDED =
       (DEVICE-ANALYSIS(8) / 100)
      MOVE TRANSFER-EFFICIENCY TO SQR-ROOT
      PERFORM SQUARE-ROOT
      MOVE SQR-ROOT TO TRANSFER-EFFICIENCY
      MOVE TRANSFER-EFFICIENCY TO DISPLAY-NUMBER
      DISPLAY(LIN, COL) DISPLAY-NUMBER.
    DISPLAY (16, 10)
             "           Transfer                            ".
    IF TRANSFER-EFFICIENCY = 0
      MOVE .01 TO TRANSFER-EFFICIENCY.
    MOVE 999 TO TRAINING-TRANSFER.
    IF TRANSFER-PROBLEM NOT = 999 AND
       TRANSFER-EFFICIENCY NOT = 999
       COMPUTE TRAINING-TRANSFER ROUNDED =
       TRANSFER-PROBLEM / TRANSFER-EFFICIENCY
       MOVE TRAINING-TRANSFER TO DISPLAY-NUMBER
       DISPLAY(LIN, COL) DISPLAY-NUMBER.
    DISPLAY (18, 10)
             "               d                               ".
    IF TRAINING-ACQUISITION NOT = 999 AND
       TRAINING-TRANSFER NOT = 999
       COMPUTE ASTAR = TRAINING-ACQUISITION +
                       TRAINING-TRANSFER
       MOVE ASTAR TO DISPLAY-NUMBER
       DISPLAY (LIN, COL) DISPLAY-NUMBER.
    DISPLAY (20, 5)ERASE.
    PERFORM HIT-ANY-KEY.
    GO TO MENU.
STOP-RUN.
    DISPLAY(1, 1)ERASE.
    CLOSE DEVICE-FILE.
    CLOSE TEXT-FILE.
    EXIT PROGRAM.
STOPPER.
    STOP RUN.
EOF-TEXT.
    DISPLAY "EOF ON TEXT FILE".
    STOP RUN.
BAD-KEY.
    DISPLAY "INVALID KEY ", DEVICE-KEY.
    STOP RUN.
TIMER.
    PERFORM NO-OP 2000 TIMES.
NO-OP.
    EXIT.
DISPLAY-INTRO-SCREEN.
    READ TEXT-FILE RECORD AT END GO TO EOF-TEXT.
    IF REC-INDICATOR = "ZZ" OR REC-INDICATOR = "ZQ"
```

```
      GO TO DISPLAY-INTRO-SCREEN-EXIT.
    DISPLAY TEXT-RECORD.
    GO TO DISPLAY-INTRO-SCREEN.
DISPLAY-INTRO-SCREEN-EXIT.
    EXIT.
SQUARE-ROOT.
    COMPUTE SQR1 = SQR-ROOT * 10000.
    PERFORM SQR-PROC VARYING J FROM 1 BY 2 UNTIL SQR1 < 0.
    COMPUTE SQR-ROOT ROUNDED = (J - 3) / 200.
SQR-PROC.
    SUBTRACT J FROM SQR1.
```

```
 IDENTIFICATION DIVISION.
 PROGRAM-ID.    ASTAR2.
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*------------------------------------------------------.
* THIS IS THE ASTAR II  ANALYSIS PROGRAM
*------------------------------------------------------.
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 INSTALLATION. American Institutes for Research.
 DATE-WRITTEN.  AUG 1984.
 ENVIRONMENT DIVISION.
 CONFIGURATION SECTION.
 SOURCE-COMPUTER.
 OBJECT-COMPUTER.
 INPUT-OUTPUT SECTION.
 FILE-CONTROL.

       SELECT DEVICE-FILE ASSIGN TO DISK
            ORGANIZATION IS INDEXED
            ACCESS MODE IS DYNAMIC
            RECORD KEY IS DEVICE-KEY
            FILE STATUS IS DEVICE-STATUS-WORD.

      SELECT TITLE-FILE ASSIGN TO DISK
            ORGANIZATION IS INDEXED
            ACCESS MODE IS DYNAMIC
            RECORD KEY IS TITLE-KEY
            FILE STATUS IS TITLE-STATUS-WORD.

     SELECT TEXT-FILE ASSIGN TO DISK
             ORGANIZATION IS LINE SEQUENTIAL.

 DATA DIVISION.
 FILE SECTION.
 FD  DEVICE-FILE
        LABEL RECORD IS STANDARD;
        VALUE OF FILE-ID IS "B:DEVICE".
 01  DEVICE-RECORD.
     05 DEVICE-KEY   PIC X(10).
     05 DEVICE-ANALYSIS OCCURS 20 TIMES PIC 999.
     05 DEVICE-TITLE   PIC X(60).

 FD  TEXT-FILE
         LABEL RECORD IS STANDARD;
         VALUE OF FILE-ID IS "ASTAR2.DOC".
 01  TEXT-RECORD.
     05 REC-INDICATOR      PIC XX.
     05 FILLER             PIC X.
     05 ANALYSIS-NUMBER    PIC X.
     05 FILLER           PIC X(75).

 FD  TITLE-FILE
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        LABEL RECORD IS STANDARD;
        VALUE OF FILE-ID IS "B:TITLE".
01  TITLE-RECORD.
    05 TITLE-KEY.
      07 TITLE-TYPE     PIC 9.
      07 TITLE-TASK     PIC X(9).
      07 TITLE-PERIOD   PIC X.
      07 TITLE-CONTROL  PIC X(9).
    05 TITLE-DESC       PIC X(60).

WORKING-STORAGE SECTION.
01  ANSWER PIC X.
01  NOTHING PIC X.
01  TITLE-FLAG  PIC S9(4) COMP VALUE 0.
01  TASK-NO  PIC Z(3)9.9999 DISPLAY.
01  RATING PIC 999.
01  PREVIOUS-RATING PIC ZZ9.
01  TITLE-STATUS-WORD  PIC XX.
01  DEVICE-STATUS-WORD  PIC XX.
01  EOF-DEVICE  PIC 9  VALUE 0.
01  REQ-TASK-NO.
    05 REQ-TYPE  PIC 9.
    05 REQ-TASK    PIC Z(4).
    05 FILLER  PIC X.
    05 REQ-SUBTASK    PIC X(4).
01  READ-TASK-NO.
    05 READ-TYPE  PIC 9.
    05 READ-TASK1  PIC Z(4).
    05 FILLER  PIC X.
    05 READ-SUBTASK PIC X(4).
01  TASK-KEY.
    05 TYPE-PART  PIC X.
    05 TASK-PART  PIC X(9).
    05 PERIOD-PART PIC X VALUE ".".
    05 CONTROL-PART PIC X(9).
01  OPTION      PIC 9.
01  PREV-OPTION      PIC 9.
01  LAST-KEY    PIC XX.
01  X    PIC 9(4).
01  Q    PIC 9(4).
01  Z    PIC 9(4).
01  K    PIC 9(4).
01  I    PIC 9(4).
01  DISPLAY-NUMBER  PIC  ZZ,ZZZ.99.
01  TRAINING-PROBLEM   PIC 9(5)V99.
01  ACQUISITION-EFFICIENCY   PIC 9(5)V99.
01  TRAINING-ACQUISITION  PIC 9(5)V99.
01  TRANSFER-PROBLEM   PIC 9(5)V99.
01  TRANSFER-EFFICIENCY  PIC 9(5)V99.
01  ADDITIONAL-DEFICIT  PIC S9999.
01  TRAINING-TRANSFER   PIC 9(5)V99.
01  ASTAR PIC 9(5)V99.
01  N1 PIC 9(4).
01  N2 PIC 9(4).
01  N3 PIC 9(4).
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01  TP-PRODUCT PIC 9(8).
01  RD-PRODUCT PIC 9(8).
01  PS-FS PIC 9(8).
01  SQR1                   PIC S9(9) COMP.
01  SQR-ROOT                PIC 9(5)V99  COMP.
01  J                      PIC 9(9) COMP.

PROCEDURE DIVISION.
BEGIN.
    OPEN I-O DEVICE-FILE.
    OPEN INPUT TEXT-FILE.
    OPEN INPUT TITLE-FILE.
    DISPLAY (1, 1) ERASE.
    MOVE ZEROS TO TASK-NO.
    MOVE TASK-NO TO REQ-TASK-NO.
    MOVE 0 TO OPTION.
MENU.
    MOVE OPTION TO PREV-OPTION.
    MOVE 0 TO OPTION.
    MOVE 0 TO EOF-DEVICE.
    MOVE "00" TO LAST-KEY
    DISPLAY (1, 1)ERASE.
    DISPLAY (1, 25)
              "        ASTAR 2                          ".
    DISPLAY (4, 25)
              "(1)  Performance Deficit                 ".
    DISPLAY (5, 25)
              "(2)  Learning Difficulty                 ".
    DISPLAY (6, 25)
              "(3)  Quality of Training-Acquisition     ".
    DISPLAY (7, 25)
              "(4)  Residual Deficit                    ".
    DISPLAY (8, 25)
              "(5)  Residual Learning Difficulty        ".
    DISPLAY (9, 25)
              "(6)  Physical Similarity                 ".
    DISPLAY (10, 25)
              "(7)  Functional Similarity               ".
    DISPLAY (11, 25)
              "(8)  Quality of Training-Transfer        ".
    DISPLAY (12, 25)
              "(9)  Evaluation Summary                  ".
    DISPLAY (15, 12)"Enter Option Number ".
    ACCEPT (LIN, COL) OPTION WITH AUTO-SKIP.
    ACCEPT LAST-KEY FROM ESCAPE KEY.
    IF LAST-KEY = "01" GO TO STOP-RUN.
    DISPLAY (1, 1)ERASE.
    IF OPTION = 1 GO TO PERFORMANCE-DEFICIT-ANALYSIS.
    IF OPTION = 2 GO TO LEARNING-DIFFICULTY-ANALYSIS.
    IF OPTION = 3 GO TO TRAINING-ACQUISITION-ANALYSIS.
    IF OPTION = 4 GO TO RESIDUAL-DEFICIT-ANALYSIS.
    IF OPTION = 5 GO TO RESIDUAL-DIFFICULTY-ANALYSIS.
    IF OPTION = 6 GO TO PHYSICAL-SIMILARITY-ANALYSIS.
    IF OPTION = 7 GO TO FUNCTIONAL-SIMILARITY-ANALYSIS.
    IF OPTION = 8 GO TO TRAINING-TRANSFER-ANALYSIS.
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    IF OPTION = 9 GO TO EVALUATION-SUMMARY.
    GO TO MENU.
PERFORMANCE-DEFICIT-ANALYSIS.
    MOVE 0 TO TYPE-PART.
    MOVE 1 TO X.
    MOVE 1 TO Z.
    PERFORM FIND-STARTING-TASK.
    IF LAST-KEY = "01" GO TO MENU.
    PERFORM FIND-SCREEN THRU DISPLAY-SCREEN-EXIT.
    IF LAST-KEY = "01" GO TO MENU.
    PERFORM RATE-TASKS THRU RATE-TASKS-EXIT  VARYING I
      FROM 1 BY 1 UNTIL EOF-DEVICE = 1 OR LAST-KEY = "01".
    GO TO MENU.
LEARNING-DIFFICULTY-ANALYSIS.
    MOVE 0 TO TYPE-PART.
    MOVE 2 TO X.
    MOVE 2 TO Z
    PERFORM FIND-STARTING-TASK.
    IF LAST-KEY = "01" GO TO MENU.
    PERFORM FIND-SCREEN THRU DISPLAY-SCREEN-EXIT.
    IF LAST-KEY = "01" GO TO MENU.
    PERFORM RATE-TASKS THRU RATE-TASKS-EXIT VARYING I
      FROM 1 BY 1 UNTIL EOF-DEVICE = 1 OR LAST-KEY = "01".
    GO TO MENU.
TRAINING-ACQUISITION-ANALYSIS.
    MOVE 0 TO TYPE-PART.
    MOVE 9 TO X.
    MOVE 12 TO Z
    MOVE "0   0.0000" TO DEVICE-KEY.
    MOVE DEVICE-KEY TO REQ-TASK-NO.
    MOVE DEVICE-KEY TO TASK-KEY.
    START DEVICE-FILE KEY IS EQUAL TO DEVICE-KEY
          INVALID KEY GO TO BAD-KEY.
    PERFORM RATE-TASKS THRU RATE-TASKS-EXIT.
    GO TO MENU.
RESIDUAL-DEFICIT-ANALYSIS.
    MOVE 1 TO TYPE-PART.
    MOVE 1 TO X.
    MOVE 1 TO Z
    PERFORM FIND-STARTING-TASK.
    IF LAST-KEY = "01" GO TO MENU.
    PERFORM FIND-SCREEN THRU DISPLAY-SCREEN-EXIT.
    IF LAST-KEY = "01" GO TO MENU.
    PERFORM RATE-TASKS THRU RATE-TASKS-EXIT VARYING I
      FROM 1 BY 1 UNTIL EOF-DEVICE = 1 OR LAST-KEY = "01".
    GO TO MENU.
RESIDUAL-DIFFICULTY-ANALYSIS.
    MOVE 1 TO TYPE-PART.
    MOVE 2 TO X.
    MOVE 2 TO Z
    PERFORM FIND-STARTING-TASK.
    IF LAST-KEY = "01" GO TO MENU.
    PERFORM FIND-SCREEN THRU DISPLAY-SCREEN-EXIT.
    IF LAST-KEY = "01" GO TO MENU.
    PERFORM RATE-TASKS THRU RATE-TASKS-EXIT VARYING I
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          FROM 1 BY 1 UNTIL EOF-DEVICE = 1 OR LAST-KEY = "01".
        GO TO MENU.
    PHYSICAL-SIMILARITY-ANALYSIS.
        MOVE 1 TO TYPE-PART.
        MOVE 3 TO X.
        MOVE 3 TO Z
        PERFORM FIND-STARTING-TASK.
        IF LAST-KEY = "01" GO TO MENU.
        PERFORM FIND-SCREEN THRU DISPLAY-SCREEN-EXIT.
        IF LAST-KEY = "01" GO TO MENU.
        PERFORM RATE-TASKS THRU RATE-TASKS-EXIT VARYING I
          FROM 1 BY 1 UNTIL EOF-DEVICE = 1 OR LAST-KEY = "01".
        GO TO MENU.
    FUNCTIONAL-SIMILARITY-ANALYSIS.
        MOVE 1 TO TYPE-PART.
        MOVE 4 TO X.
        MOVE 4 TO Z
        PERFORM FIND-STARTING-TASK.
        IF LAST-KEY = "01" GO TO MENU.
        PERFORM FIND-SCREEN THRU DISPLAY-SCREEN-EXIT.
        IF LAST-KEY = "01" GO TO MENU.
        PERFORM RATE-TASKS THRU RATE-TASKS-EXIT VARYING I
          FROM 1 BY 1 UNTIL EOF-DEVICE = 1 OR LAST-KEY = "01".
        GO TO MENU.
    TRAINING-TRANSFER-ANALYSIS.
        MOVE 0 TO TYPE-PART.
        MOVE 13 TO X.
        MOVE 15 TO Z
        MOVE "0   0.0000" TO DEVICE-KEY.
        MOVE DEVICE-KEY TO REQ-TASK-NO.
        MOVE DEVICE-KEY TO TASK-KEY.
        START DEVICE-FILE KEY IS EQUAL TO DEVICE-KEY
              INVALID KEY GO TO BAD-KEY.
        PERFORM RATE-TASKS THRU RATE-TASKS-EXIT.
        GO TO MENU.
    EVALUATION-SUMMARY.
        DISPLAY (1, 1)ERASE.
        DISPLAY (2, 5) "Evaluate by (T)ask or (S)ubtask ? ".
        MOVE SPACES TO ANSWER.
        MOVE "0000" TO REQ-SUBTASK.
        ACCEPT (LIN, COL) ANSWER WITH AUTO-SKIP.
        IF ANSWER = "S" OR ANSWER = "s" MOVE "9999" TO REQ-SUBTASK.
        MOVE 0 TO TRAINING-PROBLEM.
        MOVE 0 TO TRAINING-ACQUISITION.
        MOVE 0 TO TRANSFER-PROBLEM.
        MOVE 0 TO ADDITIONAL-DEFICIT.
        MOVE 0 TO TRAINING-TRANSFER.
        MOVE 0 TO ASTAR.
        MOVE 0 TO N1.
        MOVE 0 TO N2.
        MOVE 0 TO N3.
        MOVE 0 TO TP-PRODUCT.
        MOVE 0 TO RD-PRODUCT.
        MOVE 0 TO PS-FS.
        MOVE "0   0.0000" TO DEVICE-KEY.
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READ DEVICE-FILE RECORD INVALID KEY GO TO BAD-KEY.
MOVE 999 TO ACQUISITION-EFFICIENCY.
IF DEVICE-ANALYSIS(9) NOT = 999 AND
   DEVICE-ANALYSIS(10) NOT = 999 AND
   DEVICE-ANALYSIS(11) NOT = 999 AND
   DEVICE-ANALYSIS(12) NOT = 999
   COMPUTE ACQUISITION-EFFICIENCY ROUNDED =
    ((DEVICE-ANALYSIS(9) + DEVICE-ANALYSIS(10) +
   DEVICE-ANALYSIS(11) + DEVICE-ANALYSIS(12)) / 400)   .
MOVE 999 TO TRANSFER-EFFICIENCY.
IF DEVICE-ANALYSIS(13) NOT = 999 AND
   DEVICE-ANALYSIS(14) NOT = 999 AND
   DEVICE-ANALYSIS(15) NOT = 999
   COMPUTE TRANSFER-EFFICIENCY ROUNDED =
    ((DEVICE-ANALYSIS(13) + DEVICE-ANALYSIS(14) +
    DEVICE-ANALYSIS(15)) / 300)   .
PERFORM SUM-TASK THRU SUM-TASK-EXIT VARYING I FROM 1 BY 1
  UNTIL EOF-DEVICE = 1.
DISPLAY (1, 1)ERASE.
DISPLAY (1, 31) "Evaluation Summary".
DISPLAY (3, 1)
           "          Training Problem              ".
IF N1 NOT = 0
 COMPUTE TRAINING-PROBLEM ROUNDED = TP-PRODUCT / (N1 * 100)
 MOVE TRAINING-PROBLEM TO DISPLAY-NUMBER
 DISPLAY (LIN, COL) DISPLAY-NUMBER.
DISPLAY (5, 1)
           "          Acquisition-Efficiency        ".
IF ACQUISITION-EFFICIENCY NOT = 999
  MOVE ACQUISITION-EFFICIENCY TO SQR-ROOT
  PERFORM SQUARE-ROOT
  MOVE SQR-ROOT TO ACQUISITION-EFFICIENCY
  MOVE ACQUISITION-EFFICIENCY TO DISPLAY-NUMBER
  DISPLAY(LIN, COL) DISPLAY-NUMBER.
DISPLAY (7, 10)
           "          Acquisition                   ".
IF ACQUISITION-EFFICIENCY = 0
     MOVE .01 TO ACQUISITION-EFFICIENCY.
IF ACQUISITION-EFFICIENCY NOT = 999
  COMPUTE TRAINING-ACQUISITION ROUNDED =
   TRAINING-PROBLEM / ACQUISITION-EFFICIENCY
  MOVE TRAINING-ACQUISITION TO DISPLAY-NUMBER
  DISPLAY(LIN, COL) DISPLAY-NUMBER.
DISPLAY (9, 1)
           "          Transfer Problem              ".
IF N3 NOT = 0
  COMPUTE ADDITIONAL-DEFICIT ROUNDED =
    PS-FS / N3.
IF N2 NOT = 0
  COMPUTE TRANSFER-PROBLEM ROUNDED =
    (RD-PRODUCT / (N2 * 100)) +  ADDITIONAL-DEFICIT
  MOVE TRANSFER-PROBLEM TO DISPLAY-NUMBER
  DISPLAY (LIN, COL) DISPLAY-NUMBER.
DISPLAY (11, 1)
           "          Transfer Efficiency           ".
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    IF TRANSFER-EFFICIENCY NOT = 999
      MOVE TRANSFER-EFFICIENCY TO SQR-ROOT
      PERFORM SQUARE-ROOT
      MOVE SQR-ROOT TO TRANSFER-EFFICIENCY
      MOVE TRANSFER-EFFICIENCY TO DISPLAY-NUMBER
      DISPLAY(LIN, COL) DISPLAY-NUMBER.
    DISPLAY (13, 10)
               "          Transfer                      ".
    IF TRANSFER-EFFICIENCY = 0
         MOVE .01 TO TRANSFER-EFFICIENCY.
    IF TRANSFER-EFFICIENCY NOT = 999
      COMPUTE TRAINING-TRANSFER ROUNDED =
         TRANSFER-PROBLEM / TRANSFER-EFFICIENCY
      MOVE TRAINING-TRANSFER TO DISPLAY-NUMBER
      DISPLAY(LIN, COL) DISPLAY-NUMBER.
    DISPLAY (16, 10)
               "              d                         ".
    COMPUTE ASTAR = TRAINING-ACQUISITION +
                        TRAINING-TRANSFER.
    MOVE ASTAR TO DISPLAY-NUMBER.
    DISPLAY (LIN, COL) DISPLAY-NUMBER.
    DISPLAY (20, 5)ERASE.
    PERFORM HIT-ANY-KEY.
    GO TO MENU.
EVALUATION-SUMMARY-EXIT.
    EXIT.
FIND-SCREEN.
    IF ANALYSIS-NUMBER > OPTION OR OPTION = PREV-OPTION
       CLOSE TEXT-FILE
       OPEN INPUT TEXT-FILE
       MOVE 0 TO PREV-OPTION
       READ TEXT-FILE RECORD AT END GO TO EOF-TEXT.
    DISPLAY (1, 1) ERASE.
READ-TEXT.
    IF REC-INDICATOR = "ZZ" AND
      ANALYSIS-NUMBER = OPTION GO TO DISPLAY-SCREEN.
    IF REC-INDICATOR = "ZQ" AND ANALYSIS-NUMBER = OPTION
        PERFORM DISPLAY-INTRO-SCREEN THRU
                DISPLAY-INTRO-SCREEN-EXIT
        PERFORM HIT-ANY-KEY
        GO TO DISPLAY-SCREEN.
    READ TEXT-FILE RECORD AT END GO TO EOF-TEXT.
    GO TO READ-TEXT.
DISPLAY-SCREEN.
    IF LAST-KEY = "01" GO TO DISPLAY-SCREEN-EXIT.
    READ TEXT-FILE RECORD AT END GO TO EOF-TEXT.
    IF REC-INDICATOR = "ZZ" OR REC-INDICATOR = "ZQ"
      GO TO DISPLAY-SCREEN-EXIT.
    DISPLAY TEXT-RECORD.
    GO TO DISPLAY-SCREEN.
DISPLAY-SCREEN-EXIT.
    EXIT.
HIT-ANY-KEY.
    DISPLAY (LIN, COL) "Hit any key to continue ".
    ACCEPT (LIN, COL) NOTHING WITH AUTO-SKIP.
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    ACCEPT LAST-KEY FROM ESCAPE KEY.
    DISPLAY(1, 1)ERASE.
FIND-STARTING-TASK.
    DISPLAY (5, 1)ERASE.
    MOVE ZEROS TO TASK-NO.
    DISPLAY (22, 5)
     "Hit 'F1' to List Training Device Tasks & Subtasks".
    DISPLAY (23, 5)
     "Hit 'F2' to List Operational Equipment Tasks & Subtasks".
    DISPLAY (24, 5)
     "Hit 'F3' to List Training Device Controls & Displays".
    DISPLAY (25, 5)
     "Hit 'F4' to List Operational Equipment ",
            "Controls & Displays".
    IF OPTION < 4
     MOVE 0 TO TYPE-PART
     DISPLAY (5, 1)
     "Enter Starting Training Device Task.Subtask number  "
    ELSE IF OPTION < 9
         MOVE 1 TO TYPE-PART
         DISPLAY (5, 1)
         "Enter Starting Operational Equipment Task.Subtask ",
         "number  ".
    ACCEPT (LIN, COL) TASK-NO WITH AUTO-SKIP PROMPT.
    ACCEPT LAST-KEY FROM ESCAPE KEY.
    MOVE TASK-NO TO TASK-PART.
    IF LAST-KEY = "02" OR LAST-KEY = "03" OR
       LAST-KEY = "04" OR LAST-KEY = "05"
      PERFORM DISPLAY-TASKS THRU DISPLAY-TASKS-END
      GO TO FIND-STARTING-TASK.
    IF LAST-KEY NOT = "01"
     MOVE TASK-NO TO TASK-PART
     MOVE TASK-KEY TO REQ-TASK-NO
     MOVE TASK-KEY TO DEVICE-KEY
     START DEVICE-FILE KEY IS EQUAL TO DEVICE-KEY
               INVALID KEY
                   DISPLAY (LIN, 1) ERASE
                   DISPLAY (LIN, 1)
                   "TASK.SUBTASK NOT FOUND IN DATA BASE "
                   PERFORM TIMER
                   GO TO FIND-STARTING-TASK.
    DISPLAY (1, 1)ERASE.
READ-TASK.
    MOVE 0 TO EOF-DEVICE.
    READ DEVICE-FILE NEXT RECORD AT END MOVE 1 TO EOF-DEVICE
          GO TO READ-TASK-EXIT.
    MOVE DEVICE-KEY TO READ-TASK-NO.
    MOVE DEVICE-KEY TO TASK-KEY.
    IF TASK-PART = "    0.0000" AND OPTION NOT = 3 AND
      OPTION NOT = 8 GO TO READ-TASK.
    IF REQ-SUBTASK = "0000" AND READ-SUBTASK NOT = "0000"
      GO TO READ-TASK.
    IF REQ-SUBTASK NOT = "0000" AND READ-SUBTASK = "0000"
      GO TO READ-TASK.
    IF REQ-TYPE NOT = READ-TYPE GO TO READ-TASK.
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    IF OPTION = 2  AND
        DEVICE-ANALYSIS(1) = 0  GO TO READ-TASK.
    IF (OPTION = 5 OR OPTION = 6 OR OPTION = 7) AND
       DEVICE-ANALYSIS(1) = 0 GO TO READ-TASK.
READ-TASK-EXIT.
    EXIT.
RATE-TASKS.
    PERFORM READ-TASK THRU READ-TASK-EXIT.
    IF EOF-DEVICE = 1 GO TO RATE-TASKS-EXIT.
    PERFORM RATE-EACH-TASK THRU RATE-EACH-TASK-EXIT
      VARYING K FROM X BY 1 UNTIL K > Z  OR  LAST-KEY = "01".
    IF LAST-KEY = "01" GO TO RATE-TASKS-EXIT.
RATE-TASKS-EXIT.
    EXIT.
RATE-EACH-TASK.
    IF X NOT = Z
      DISPLAY (1, 1) ERASE
      PERFORM FIND-SCREEN THRU DISPLAY-SCREEN-EXIT.
    IF LAST-KEY = "01" GO TO RATE-EACH-TASK-EXIT.
    DISPLAY (23 , 1)ERASE.
    DISPLAY (LIN, 1) "Task.Subtask = ", TASK-PART, " ",
               DEVICE-TITLE
    MOVE DEVICE-ANALYSIS(K) TO RATING.
    IF RATING NOT = 999
      MOVE RATING TO PREVIOUS-RATING
      DISPLAY (LIN, 1) "Previous Rating = ", PREVIOUS-RATING.
    DISPLAY (LIN, COL) "    Enter Rating = "
    ACCEPT (LIN, COL) RATING WITH AUTO-SKIP UPDATE.
    ACCEPT LAST-KEY FROM ESCAPE KEY.
    IF LAST-KEY = "01" GO TO RATE-EACH-TASK-EXIT.
    IF RATING = PREVIOUS-RATING GO TO RATE-EACH-TASK-EXIT.
    MOVE RATING TO DEVICE-ANALYSIS(K).
    REWRITE DEVICE-RECORD INVALID KEY GO TO BAD-KEY.
RATE-EACH-TASK-EXIT.
    EXIT.
SUM-TASK.
    MOVE 0 TO EOF-DEVICE.
    READ DEVICE-FILE NEXT RECORD AT END MOVE 1 TO EOF-DEVICE
          GO TO SUM-TASK-EXIT.
    MOVE DEVICE-KEY TO READ-TASK-NO.
    MOVE DEVICE-KEY TO TASK-KEY.
    IF REQ-SUBTASK = "0000" AND READ-SUBTASK NOT = "0000"
      GO TO SUM-TASK.
    IF REQ-SUBTASK NOT = "0000" AND READ-SUBTASK = "0000"
      GO TO SUM-TASK.
    IF TYPE-PART = 1 GO TO SUM-ACTUAL.
SUM-TRAINING-DEVICE.
    IF DEVICE-ANALYSIS(1) = 0 ADD 1 TO N1
         GO TO SUM-ACTUAL.
    IF DEVICE-ANALYSIS(2) NOT = 999
       ADD 1 TO N1
       COMPUTE TP-PRODUCT ROUNDED = TP-PRODUCT +
        (DEVICE-ANALYSIS(1) * DEVICE-ANALYSIS(2)).
    GO TO SUM-TASK-EXIT.
SUM-ACTUAL.
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    IF DEVICE-ANALYSIS(1) = 0  ADD 1 TO N2
          GO TO SUM-TASK-EXIT.
    IF DEVICE-ANALYSIS(2) NOT = 999
      ADD 1 TO N2
       COMPUTE RD-PRODUCT ROUNDED = RD-PRODUCT +
        (DEVICE-ANALYSIS(1) * DEVICE-ANALYSIS(2))
      IF DEVICE-ANALYSIS(3) NOT = 999 AND
       DEVICE-ANALYSIS(4) NOT = 999
       ADD 1 TO N3
       IF DEVICE-ANALYSIS(3) > DEVICE-ANALYSIS(4)
        COMPUTE PS-FS = PS-FS +
        (DEVICE-ANALYSIS(3) - DEVICE-ANALYSIS(4)).
SUM-TASK-EXIT.
    EXIT.
STOP-RUN.
    DISPLAY(1, 1)ERASE.
    CLOSE DEVICE-FILE.
    CLOSE TITLE-FILE.
    CLOSE TEXT-FILE.
    EXIT PROGRAM.
STOPPER.
    STOP RUN.
EOF-TEXT.
    DISPLAY "EOF ON TEXT FILE".
    STOP RUN.
BAD-KEY.
    DISPLAY "INVALID KEY ", DEVICE-KEY.
    STOP RUN.
TIMER.
    PERFORM NO-OP 2000 TIMES.
NO-OP.
    EXIT.
DISPLAY-INTRO-SCREEN.
    READ TEXT-FILE RECORD AT END GO TO EOF-TEXT.
    IF REC-INDICATOR = "ZZ" OR REC-INDICATOR = "ZQ"
      GO TO DISPLAY-INTRO-SCREEN-EXIT.
    DISPLAY TEXT-RECORD.
    GO TO DISPLAY-INTRO-SCREEN.
DISPLAY-INTRO-SCREEN-EXIT.
    EXIT.
DISPLAY-TASKS.
    MOVE 0 TO TYPE-PART.
    IF LAST-KEY = "03" OR LAST-KEY = "05"
      MOVE 1 TO TYPE-PART.
    IF LAST-KEY = "04" OR LAST-KEY = "05"
      MOVE 1 TO TITLE-FLAG.
    MOVE 0 TO Q.
    MOVE TASK-KEY TO DEVICE-KEY.
    MOVE DEVICE-KEY TO REQ-TASK-NO.
    READ DEVICE-FILE RECORD INVALID KEY
      GO TO DISPLAY-TASKS-END.
    IF LAST-KEY = "01" GO TO DISPLAY-TASKS-END.
DISPLAY-TASKS-LOOP.
    MOVE 0 TO I.
    DISPLAY (5, 1)ERASE.
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        DISPLAY (LIN, COL)"          ".
        GO TO DISPLAY-20-DEVICES.
    DISPLAY-20-DEVICES.
        MOVE DEVICE-KEY TO READ-TASK-NO.
        MOVE DEVICE-KEY TO TASK-KEY.
        IF READ-TYPE NOT = REQ-TYPE MOVE 1 TO Q.
        ADD 1 TO I.
        IF I > 16 OR Q = 1
          DISPLAY(25, 7)"Hit any key to continue"
          ACCEPT(LIN, COL)NOTHING WITH AUTO-SKIP
          ACCEPT LAST-KEY FROM ESCAPE KEY
          DISPLAY(6, 1)ERASE
          MOVE 1 TO I
          IF Q = 1 GO TO DISPLAY-TASKS-END.
        IF LAST-KEY = "01" GO TO DISPLAY-TASKS-END.
        IF  READ-SUBTASK NOT = "0000"
         DISPLAY (LIN, COL) "  ".
        DISPLAY TASK-PART, "  ", DEVICE-TITLE.
        IF TITLE-FLAG = 1
          PERFORM DISPLAY-CONTROLS THRU DISPLAY-CONTROLS-END.
        READ DEVICE-FILE NEXT RECORD AT END MOVE 1 TO Q.
        GO TO DISPLAY-20-DEVICES.
    DISPLAY-TASKS-END.
        MOVE 0 TO TITLE-FLAG.
        DISPLAY(6, 1)ERASE.
    DISPLAY-CONTROLS.
        MOVE DEVICE-KEY TO TASK-KEY.
        MOVE SPACES TO CONTROL-PART.
        MOVE TASK-KEY TO TITLE-KEY.
        START TITLE-FILE KEY IS NOT LESS THAN TITLE-KEY
          INVALID KEY GO TO DISPLAY-CONTROLS-END.
        READ TITLE-FILE NEXT RECORD AT END
             GO TO DISPLAY-CONTROLS-END.
    DISPLAY-20-CONTROLS.
        IF TITLE-TASK NOT = TASK-PART OR TITLE-TYPE NOT = TYPE-PART
            GO TO DISPLAY-CONTROLS-END.
        ADD 1 TO I.
        IF I > 16
          DISPLAY(25, 7)"Hit any key to continue"
          ACCEPT(LIN, COL)NOTHING WITH AUTO-SKIP
          ACCEPT LAST-KEY FROM ESCAPE KEY
          DISPLAY(6, 1)ERASE
          DISPLAY TASK-PART, "  ", DEVICE-TITLE
          MOVE 1 TO I.
        IF LAST-KEY = "01" GO TO DISPLAY-CONTROLS-END.
        DISPLAY "       ",  TITLE-CONTROL,
          " ", TITLE-DESC.
        READ TITLE-FILE NEXT RECORD AT END
             GO TO DISPLAY-CONTROLS-END.
        GO TO DISPLAY-20-CONTROLS.
    DISPLAY-CONTROLS-END.
        EXIT.
    SQUARE-ROOT.
        COMPUTE SQR1 = SQR-ROOT * 10000.
        PERFORM SQR-PROC VARYING J FROM 1 BY 2 UNTIL SQR1 < 0.
```

```
    COMPUTE SQR-ROOT ROUNDED = (J - 3) / 200.
SQR-PROC.
    SUBTRACT J FROM SQR1.
```

```
 IDENTIFICATION DIVISION.
 PROGRAM-ID.    ASTAR3.
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*-----------------------------------------------------
* THIS IS THE ASTAR III  ANALYSIS PROGRAM.
*-----------------------------------------------------
 AUTHOR. Timothy OConnor.
 INSTALLATION. American Institutes for Research.
 DATE-WRITTEN.  AUG 1984.
 ENVIRONMENT DIVISION.
 CONFIGURATION SECTION.
 SOURCE-COMPUTER.
 OBJECT-COMPUTER.
 INPUT-OUTPUT SECTION.
 FILE-CONTROL.

       SELECT DEVICE-FILE ASSIGN TO DISK
            ORGANIZATION IS INDEXED
            ACCESS MODE IS DYNAMIC
            RECORD KEY IS DEVICE-KEY
            FILE STATUS IS DEVICE-STATUS-WORD.

      SELECT TITLE-FILE ASSIGN TO DISK
            ORGANIZATION IS INDEXED
            ACCESS MODE IS DYNAMIC
            RECORD KEY IS TITLE-KEY
            FILE STATUS IS TITLE-STATUS-WORD.

      SELECT CONTROL-FILE ASSIGN TO DISK
            ORGANIZATION IS INDEXED
            ACCESS MODE IS DYNAMIC
            RECORD KEY IS CONTROL-KEY
            FILE STATUS IS CTL-STATUS-WORD.

     SELECT TEXT-FILE ASSIGN TO DISK
             ORGANIZATION IS LINE SEQUENTIAL.

 DATA DIVISION.
 FILE SECTION.
 FD  DEVICE-FILE
        LABEL RECORD IS STANDARD;
        VALUE OF FILE-ID IS "B:DEVICE".
 01  DEVICE-RECORD.
     05 DEVICE-KEY    PIC X(10).
     05 DEVICE-ANALYSIS OCCURS 20 TIMES PIC 999.
     05 DEVICE-TITLE    PIC X(60).


 FD  TITLE-FILE
         LABEL RECORD IS STANDARD;
         VALUE OF FILE-ID IS "B:TITLE".
```

```
01  TITLE-RECORD.
    05 TITLE-KEY.
      07 TITLE-TYPE      PIC 9.
      07 TITLE-TASK      PIC X(9).
      07 TITLE-PERIOD    PIC X.
      07 TITLE-CONTROL   PIC X(9).
    05 TITLE-DESC        PIC X(60).

FD  CONTROL-FILE
        LABEL RECORD IS STANDARD;
       VALUE OF FILE-ID IS "B:CONTROL".
01  CONTROL-RECORD.
    05 CONTROL-KEY.
       07 CTL-TYPE      PIC 9.
       07 CTL-TASK      PIC X(4).
       07 FILLER        PIC X.
       07 CTL-SUBTASK   PIC X(4).
       07 FILLER        PIC X.
       07 CTL-NO        PIC X(9).
    05 CONTROL-ANALYSIS OCCURS 2 TIMES  PIC 999.
    05 CORR-CTL-KEY   PIC X(20).

FD  TEXT-FILE
        LABEL RECORD IS STANDARD;
        VALUE OF FILE-ID IS "ASTAR3.DOC".
01  TEXT-RECORD.
    05 REC-INDICATOR      PIC XX.
    05 FILLER             PIC X.
    05 ANALYSIS-NUMBER    PIC X.
    05 FILLER           PIC X(75).


WORKING-STORAGE SECTION.
77  NOTHING PIC X.
77  TASK-NO  PIC Z(3)9.9999 DISPLAY.
77  RATING PIC 999.
77  PREVIOUS-RATING PIC ZZ9.
77  CTL-STATUS-WORD    PIC XX.
77  DEVICE-STATUS-WORD  PIC XX.
77  TITLE-STATUS-WORD  PIC XX.
77  EOF-CONTROL   PIC 9  VALUE 0.
77  EOF-DEVICE  PIC 9  VALUE 0.
77  PREV-OPTION      PIC 9 COMP.
77  OPTION       PIC 9 COMP.
77  LAST-KEY     PIC XX.
77  X     PIC 9(4) COMP.
77  Q     PIC 9(4) COMP.
77  Z     PIC 9(4) COMP.
77  K     PIC 9(4) COMP.
77  I     PIC 9(4) COMP.
77  DISPLAY-NUMBER  PIC  ZZ,ZZZ.99.
77  TRAINING-PROBLEM   PIC 9(5)V99 COMP.
77  ACQUISITION-EFFICIENCY   PIC 9(5)V99 COMP.
77  TRAINING-ACQUISITION  PIC 9(5)V99 COMP.
77  TRANSFER-PROBLEM   PIC 9(5)V99 COMP.
```

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77  TRANSFER-EFFICIENCY  PIC 9(5)V99 COMP.
77  ADDITIONAL-DEFICIT  PIC S9999 COMP.
77  TRAINING-TRANSFER   PIC 9(5)V99 COMP.
77  ASTAR PIC 9(5)V99.
77  N1 PIC 9(4) COMP.
77  N2 PIC 9(4) COMP.
77  N3 PIC 9(4) COMP.
77  N4 PIC 9(4) COMP.
77  N5 PIC 9(4) COMP.
77  TP-PRODUCT PIC 9(8) COMP.
77  AE-PRODUCT PIC 9(8)V99 COMP.
77  RD-PRODUCT PIC 9(8) COMP.
77  TE-PRODUCT PIC 9(8)V99 COMP.
77  PS-FS PIC 9(8) COMP.
77  DIFFICULTY PIC 9(4) COMP.
77  ANSWER PIC X.
01  TITLE-FLAG  PIC S9(4) COMP VALUE 0.
01  REQ-TASK-NO.
    05 REQ-TYPE  PIC 9.
    05 REQ-TASK    PIC Z(4).
    05 FILLER  PIC X.
    05 REQ-SUBTASK    PIC X(4).
01  READ-TASK-NO.
    05 READ-TYPE  PIC 9.
    05 READ-TASK1  PIC Z(4).
    05 FILLER  PIC X.
    05 READ-SUBTASK PIC X(4).
01  TASK-KEY.
    05 TYPE-PART  PIC X.
    05 TASK-PART  PIC X(9).
    05 PERIOD-PART PIC X VALUE ".".
    05 CONTROL-PART PIC X(9).
01  REQ-CTL-KEY.
    05 REQ-CTL-TYPE     PIC 9.
    05 REQ-CTL-TASK     PIC X(4).
    05 FILLER        PIC X.
    05 REQ-CTL-SUBTASK  PIC X(4).
    05 FILLER        PIC X.
    05 REQ-CTL-NO       PIC X(9).
01  SQR1               PIC S9(9) COMP.
01  SQR-ROOT            PIC 9(5)V99  COMP.
01  J                  PIC 9(9) COMP.

PROCEDURE DIVISION.
BEGIN.
    OPEN I-O DEVICE-FILE.
    OPEN I-O TITLE-FILE.
    OPEN I-O CONTROL-FILE.
    OPEN INPUT TEXT-FILE.
    DISPLAY (1, 1) ERASE.
    MOVE ZEROS TO TASK-NO.
    MOVE TASK-NO TO REQ-TASK-NO.
    MOVE 0 TO OPTION.
MENU.
    MOVE OPTION TO PREV-OPTION.
```

```
    MOVE 0 TO OPTION.
    MOVE 0 TO EOF-DEVICE
    MOVE "00" TO LAST-KEY
    DISPLAY (1, 1)ERASE.
    DISPLAY (1, 25)
               "        ASTAR 3                          ".
    DISPLAY (4, 25)
               "(1)  Performance Deficit                 ".
    DISPLAY (5, 25)
               "(2)  Learning Difficulty                 ".
    DISPLAY (6, 25)
               "(3)  Quality of Training-Acquisition     ".
    DISPLAY (7, 25)
               "(4)  Residual Deficit                    ".
    DISPLAY (8, 25)
               "(5)  Residual Learning Difficulty        ".
    DISPLAY (9, 25)
               "(6)  Physical Similarity                 ".
    DISPLAY (10, 25)
               "(7)  Functional Similarity               ".
    DISPLAY (11, 25)
               "(8)  Quality of Training-Transfer        ".
    DISPLAY (12, 25)
              "(9)  Evaluation Summary                  ".
    DISPLAY (16, 12)"Enter Option Number ".
    ACCEPT (LIN, COL) OPTION WITH AUTO-SKIP.
    ACCEPT LAST-KEY FROM ESCAPE KEY.
    IF LAST-KEY = "01" GO TO STOP-RUN.
    DISPLAY (1, 1)ERASE.
    IF OPTION = 1 GO TO PERFORMANCE-DEFICIT-ANALYSIS.
    IF OPTION = 2 GO TO LEARNING-DIFFICULTY-ANALYSIS.
    IF OPTION = 3 GO TO TRAINING-ACQUISITION-ANALYSIS.
    IF OPTION = 4 GO TO RESIDUAL-DEFICIT-ANALYSIS.
    IF OPTION = 5 GO TO RESIDUAL-DIFFICULTY-ANALYSIS.
    IF OPTION = 6 GO TO PHYSICAL-SIMILARITY-ANALYSIS.
    IF OPTION = 7 GO TO FUNCTIONAL-SIMILARITY-ANALYSIS.
    IF OPTION = 8 GO TO TRAINING-TRANSFER-ANALYSIS.
    IF OPTION = 9 GO TO EVALUATION-SUMMARY.
    GO TO MENU.
PERFORMANCE-DEFICIT-ANALYSIS.
    MOVE 0 TO TYPE-PART.
    MOVE 3 TO X.
    MOVE 3 TO Z.
    PERFORM FIND-STARTING-TASK.
    IF LAST-KEY = "01" GO TO MENU.
    PERFORM FIND-SCREEN THRU DISPLAY-SCREEN-EXIT.
    IF LAST-KEY = "01" GO TO MENU.
    PERFORM RATE-TASKS THRU RATE-TASKS-EXIT  VARYING I
      FROM 1 BY 1 UNTIL EOF-DEVICE = 1 OR LAST-KEY = "01".
    GO TO MENU.
LEARNING-DIFFICULTY-ANALYSIS.
    MOVE 0 TO TYPE-PART.
    MOVE 4 TO X.
    MOVE 9 TO Z
    PERFORM FIND-STARTING-TASK.
```

```
        IF LAST-KEY = "01" GO TO MENU.
        PERFORM RATE-TASKS THRU RATE-TASKS-EXIT VARYING I
          FROM 1 BY 1 UNTIL EOF-DEVICE = 1 OR LAST-KEY = "01".
        GO TO MENU.
    TRAINING-ACQUISITION-ANALYSIS.
        MOVE 0 TO TYPE-PART.
        MOVE 10 TO X.
        MOVE 20 TO Z
        PERFORM FIND-STARTING-TASK.
        IF LAST-KEY = "01" GO TO MENU.
        PERFORM RATE-TASKS THRU RATE-TASKS-EXIT VARYING I
          FROM 1 BY 1 UNTIL EOF-DEVICE = 1 OR LAST-KEY = "01".
        GO TO MENU.
    RESIDUAL-DEFICIT-ANALYSIS.
        MOVE 1 TO TYPE-PART.
        MOVE 6 TO X.
        MOVE 6 TO Z
        PERFORM FIND-STARTING-TASK.
        IF LAST-KEY = "01" GO TO MENU.
        PERFORM FIND-SCREEN THRU DISPLAY-SCREEN-EXIT.
        IF LAST-KEY = "01" GO TO MENU.
        PERFORM RATE-TASKS THRU RATE-TASKS-EXIT VARYING I
          FROM 1 BY 1 UNTIL EOF-DEVICE = 1 OR LAST-KEY = "01".
        GO TO MENU.
    RESIDUAL-DIFFICULTY-ANALYSIS.
        MOVE 1 TO TYPE-PART.
        MOVE 7 TO X.
        MOVE 12 TO Z
        PERFORM FIND-STARTING-TASK.
        IF LAST-KEY = "01" GO TO MENU.
        PERFORM RATE-TASKS THRU RATE-TASKS-EXIT VARYING I
          FROM 1 BY 1 UNTIL EOF-DEVICE = 1 OR LAST-KEY = "01".
        GO TO MENU.
    PHYSICAL-SIMILARITY-ANALYSIS.
        MOVE 1 TO TYPE-PART.
        MOVE 1 TO X.
        MOVE 1 TO Z
        PERFORM FIND-STARTING-TASK.
        IF LAST-KEY = "01" GO TO MENU.
        PERFORM FIND-SCREEN THRU DISPLAY-SCREEN-EXIT.
        IF LAST-KEY = "01" GO TO MENU.
        PERFORM RATE-CONTROLS THRU RATE-CONTROLS-EXIT VARYING I
          FROM 1 BY 1 UNTIL EOF-DEVICE = 1 OR LAST-KEY = "01".
        GO TO MENU.
    FUNCTIONAL-SIMILARITY-ANALYSIS.
        MOVE 1 TO TYPE-PART.
        MOVE 2 TO X.
        MOVE 2 TO Z
        PERFORM FIND-STARTING-TASK.
        IF LAST-KEY = "01" GO TO MENU.
        PERFORM FIND-SCREEN THRU DISPLAY-SCREEN-EXIT.
        IF LAST-KEY = "01" GO TO MENU.
        PERFORM RATE-CONTROLS THRU RATE-CONTROLS-EXIT VARYING I
          FROM 1 BY 1 UNTIL EOF-DEVICE = 1 OR LAST-KEY = "01".
        GO TO MENU.
```

```
TRAINING-TRANSFER-ANALYSIS.
    MOVE 1 TO TYPE-PART.
    MOVE 13 TO X.
    MOVE 20 TO Z
    PERFORM FIND-STARTING-TASK.
    IF LAST-KEY = "01" GO TO MENU.
    PERFORM RATE-TASKS THRU RATE-TASKS-EXIT VARYING I
      FROM 1 BY 1 UNTIL EOF-DEVICE = 1 OR LAST-KEY = "01".
    GO TO MENU.
EVALUATION-SUMMARY.
    DISPLAY (1, 1)ERASE.
    DISPLAY (2, 5) "Evaluate by (T)ask or (S)ubtask ? ".
    MOVE SPACES TO ANSWER.
    MOVE "0000" TO REQ-SUBTASK.
    ACCEPT (LIN, COL) ANSWER WITH AUTO-SKIP.
    IF ANSWER = "S" OR ANSWER = "s" MOVE "9999" TO REQ-SUBTASK.
    MOVE 0 TO TRAINING-PROBLEM.
    MOVE 0 TO TRAINING-ACQUISITION.
    MOVE 0 TO TRANSFER-PROBLEM.
    MOVE 0 TO ADDITIONAL-DEFICIT.
    MOVE 0 TO TRAINING-TRANSFER.
    MOVE 0 TO ASTAR.
    MOVE 0 TO N1.
    MOVE 0 TO N2.
    MOVE 0 TO N3.
    MOVE 0 TO N4.
    MOVE 0 TO N5.
    MOVE 0 TO TP-PRODUCT.
    MOVE 0 TO AE-PRODUCT.
    MOVE 0 TO RD-PRODUCT.
    MOVE 0 TO TE-PRODUCT.
    MOVE 0 TO PS-FS.
    MOVE "0   0.0000" TO DEVICE-KEY.
    READ DEVICE-FILE RECORD INVALID KEY GO TO BAD-KEY.
    PERFORM SUM-TASK THRU SUM-TASK-EXIT VARYING I FROM 1 BY 1
      UNTIL EOF-DEVICE = 1.
    DISPLAY (1, 1)ERASE.
    DISPLAY (1, 31) "Evaluation Summary".
    DISPLAY (3, 1)
            "          Training Problem                 ".
    IF N1 NOT = 0
     COMPUTE TRAINING-PROBLEM ROUNDED = TP-PRODUCT / N1
     MOVE TRAINING-PROBLEM TO DISPLAY-NUMBER
     DISPLAY (LIN, COL) DISPLAY-NUMBER.
    DISPLAY (5, 1)
            "          Acquisition-Efficiency           ".
    MOVE 999 TO ACQUISITION-EFFICIENCY.
    IF N2 NOT = 0
     COMPUTE ACQUISITION-EFFICIENCY ROUNDED =
         AE-PRODUCT / (N2 * 100)
      MOVE ACQUISITION-EFFICIENCY TO SQR-ROOT
      PERFORM SQUARE-ROOT
      MOVE SQR-ROOT TO ACQUISITION-EFFICIENCY
     MOVE ACQUISITION-EFFICIENCY TO DISPLAY-NUMBER
     DISPLAY (LIN, COL) DISPLAY-NUMBER.
```

```
    DISPLAY (7, 10)
               "              Acquisition                     ".
     IF ACQUISITION-EFFICIENCY = 0
       MOVE .01 TO ACQUISITION-EFFICIENCY.
    IF ACQUISITION-EFFICIENCY NOT = 999
      COMPUTE TRAINING-ACQUISITION ROUNDED =
       TRAINING-PROBLEM / ACQUISITION-EFFICIENCY
      MOVE TRAINING-ACQUISITION TO DISPLAY-NUMBER
      DISPLAY(LIN, COL) DISPLAY-NUMBER.
    DISPLAY (9, 1)
               "              Transfer Problem                ".
    IF N5 NOT = 0 AND PS-FS NOT = 0
      COMPUTE ADDITIONAL-DEFICIT ROUNDED = PS-FS / N5.
    IF N3 NOT = 0
      COMPUTE TRANSFER-PROBLEM ROUNDED =
        (RD-PRODUCT / N3) +  ADDITIONAL-DEFICIT
      MOVE TRANSFER-PROBLEM TO DISPLAY-NUMBER
      DISPLAY (LIN, COL) DISPLAY-NUMBER.
    DISPLAY (11, 1)
               "              Transfer Efficiency             ".
    MOVE 999 TO TRANSFER-EFFICIENCY.
    IF N4 NOT = 0
       COMPUTE TRANSFER-EFFICIENCY ROUNDED =
        TE-PRODUCT / (N4 * 100)
      MOVE TRANSFER-EFFICIENCY TO SQR-ROOT
      PERFORM SQUARE-ROOT
      MOVE SQR-ROOT TO TRANSFER-EFFICIENCY
       MOVE TRANSFER-EFFICIENCY TO DISPLAY-NUMBER
       DISPLAY(LIN, COL) DISPLAY-NUMBER.
    DISPLAY (13, 10)
               "              Transfer                        ".
     IF TRANSFER-EFFICIENCY = 0
       MOVE .01 TO TRANSFER-EFFICIENCY.
    IF TRANSFER-EFFICIENCY NOT = 999
      COMPUTE TRAINING-TRANSFER ROUNDED =
         TRANSFER-PROBLEM / TRANSFER-EFFICIENCY
      MOVE TRAINING-TRANSFER TO DISPLAY-NUMBER
      DISPLAY(LIN, COL) DISPLAY-NUMBER.
    DISPLAY (16, 10)
               "                  d                           ".
    COMPUTE ASTAR = TRAINING-ACQUISITION +
                    TRAINING-TRANSFER.
    MOVE ASTAR TO DISPLAY-NUMBER.
    DISPLAY (LIN, COL) DISPLAY-NUMBER.
    DISPLAY (20, 5)ERASE.
    PERFORM HIT-ANY-KEY.
    GO TO MENU.
EVALUATION-SUMMARY-EXIT.
    EXIT.
FIND-SCREEN.
    IF ANALYSIS-NUMBER > OPTION OR OPTION = PREV-OPTION
       CLOSE TEXT-FILE
       OPEN INPUT TEXT-FILE
       MOVE 0 TO PREV-OPTION
       READ TEXT-FILE RECORD AT END GO TO EOF-TEXT.
```

```
    DISPLAY (1, 1) ERASE.
READ-TEXT.
    IF REC-INDICATOR = "ZZ" AND
      ANALYSIS-NUMBER = OPTION GO TO DISPLAY-SCREEN.
    IF REC-INDICATOR = "ZQ" AND ANALYSIS-NUMBER = OPTION
        PERFORM DISPLAY-INTRO-SCREEN THRU
                DISPLAY-INTRO-SCREEN-EXIT
        PERFORM HIT-ANY-KEY
        GO TO DISPLAY-SCREEN.
    READ TEXT-FILE RECORD AT END GO TO EOF-TEXT.
    GO TO READ-TEXT.
DISPLAY-SCREEN.
    IF LAST-KEY = "01" GO TO DISPLAY-SCREEN-EXIT.
    READ TEXT-FILE RECORD AT END GO TO EOF-TEXT.
    IF REC-INDICATOR = "ZZ" OR REC-INDICATOR = "ZQ"
      GO TO DISPLAY-SCREEN-EXIT.
    DISPLAY TEXT-RECORD.
    GO TO DISPLAY-SCREEN.
DISPLAY-SCREEN-EXIT.
    EXIT.
HIT-ANY-KEY.
    DISPLAY (LIN, COL) "Hit any key to continue ".
    ACCEPT (LIN, COL) NOTHING WITH AUTO-SKIP.
    ACCEPT LAST-KEY FROM ESCAPE KEY.
    DISPLAY(1, 1)ERASE.
FIND-STARTING-TASK.
    DISPLAY (5, 1)ERASE.
    MOVE ZEROS TO TASK-NO.
    DISPLAY (22, 5)
     "Hit 'F1' to List Training Device Tasks & Subtasks".
    DISPLAY (23, 5)
     "Hit 'F2' to List Operational Equipment Tasks & Subtasks".
    DISPLAY (24, 5)
     "Hit 'F3' to List Training Device Controls & Displays".
    DISPLAY (25, 5)
     "Hit 'F4' to List Operational Equipment ",
            "Controls & Displays".
    IF OPTION < 4
     MOVE 0 TO TYPE-PART
     DISPLAY (5, 1)
     "Enter Starting Training Device Task.Subtask number  "
    ELSE IF OPTION < 9
         MOVE 1 TO TYPE-PART
         DISPLAY (5, 1)
         "Enter Starting Operational Equipment Task.Subtask ",
         "number  ".
    ACCEPT (LIN, COL) TASK-NO WITH AUTO-SKIP PROMPT.
    ACCEPT LAST-KEY FROM ESCAPE KEY.
    MOVE TASK-NO TO TASK-PART.
    MOVE TASK-KEY TO REQ-TASK-NO.
    IF LAST-KEY = "02" OR LAST-KEY = "03" OR
      LAST-KEY = "04" OR LAST-KEY = "05"
      PERFORM DISPLAY-TASKS THRU DISPLAY-TASKS-END
      GO TO FIND-STARTING-TASK.
    IF LAST-KEY  = "00"
```

```
       MOVE TASK-KEY TO REQ-TASK-NO
       MOVE REQ-TASK-NO TO DEVICE-KEY
       START DEVICE-FILE KEY IS EQUAL TO DEVICE-KEY
                INVALID KEY
                    DISPLAY (LIN, 1) ERASE
                    DISPLAY (LIN, 1)
                    "TASK.SUBTASK NOT FOUND IN DATA BASE "
                    PERFORM TIMER
                    GO TO FIND-STARTING-TASK.
 READ-TASK.
     MOVE 0 TO EOF-DEVICE.
     READ DEVICE-FILE NEXT RECORD AT END MOVE 1 TO EOF-DEVICE
           GO TO READ-TASK-EXIT.
     MOVE DEVICE-KEY TO READ-TASK-NO.
     MOVE DEVICE-KEY TO TASK-KEY.
     IF TASK-PART = "   0.0000" GO TO READ-TASK.
     IF REQ-TYPE NOT = READ-TYPE GO TO READ-TASK.
     IF REQ-SUBTASK = "0000" AND READ-SUBTASK NOT = "0000"
       GO TO READ-TASK.
     IF REQ-SUBTASK NOT = "0000" AND READ-SUBTASK = "0000"
       GO TO READ-TASK.
     IF (OPTION = 2  OR OPTION = 3) AND
         DEVICE-ANALYSIS(3) > 3
       GO TO READ-TASK.
     IF OPTION > 4 AND DEVICE-ANALYSIS(6) > 3
       GO TO READ-TASK.
     IF (OPTION = 6 OR OPTION = 7) AND
         DEVICE-ANALYSIS(5) NOT = 1
       GO TO READ-TASK.
 READ-TASK-EXIT.
     EXIT.
 RATE-TASKS.
     PERFORM READ-TASK THRU READ-TASK-EXIT.
     IF EOF-DEVICE = 1 GO TO RATE-TASKS-EXIT.
     PERFORM RATE-EACH-TASK THRU RATE-EACH-TASK-EXIT
       VARYING K FROM X BY 1 UNTIL K > Z  OR  LAST-KEY = "01".
     IF LAST-KEY = "01" GO TO RATE-TASKS-EXIT.
 RATE-TASKS-EXIT.
     EXIT.
 RATE-EACH-TASK.
     IF X NOT = Z
       DISPLAY (1, 1) ERASE
       PERFORM FIND-SCREEN THRU DISPLAY-SCREEN-EXIT.
     IF LAST-KEY = "01" GO TO RATE-EACH-TASK-EXIT.
     DISPLAY (23 , 1)ERASE.
     DISPLAY (LIN, 1) "Task.Subtask = ", TASK-PART, " ",
                DEVICE-TITLE
     MOVE DEVICE-ANALYSIS(K) TO RATING.
     IF RATING NOT = 999
       MOVE RATING TO PREVIOUS-RATING
       DISPLAY (LIN, 1) "Previous Rating = ", PREVIOUS-RATING.
     DISPLAY (LIN, COL) "    Enter Rating = "
     ACCEPT (LIN, COL) RATING WITH AUTO-SKIP UPDATE.
     ACCEPT LAST-KEY FROM ESCAPE KEY.
     IF LAST-KEY = "01" GO TO RATE-EACH-TASK-EXIT.
```

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    IF RATING = PREVIOUS-RATING GO TO RATE-EACH-TASK-EXIT.
    MOVE RATING TO DEVICE-ANALYSIS(K)
    REWRITE DEVICE-RECORD INVALID KEY GO TO BAD-KEY.
RATE-EACH-TASK-EXIT.
    EXIT.
RATE-CONTROLS.
    PERFORM READ-TASK THRU READ-TASK-EXIT.
    IF EOF-DEVICE = 1 GO TO RATE-CONTROLS-EXIT.
    MOVE DEVICE-KEY TO REQ-CTL-KEY.
    MOVE DEVICE-KEY TO TASK-KEY.
    MOVE REQ-CTL-TYPE TO CONTROL-KEY.
    MOVE REQ-CTL-TASK TO CTL-TASK.
    MOVE 0 TO EOF-CONTROL.
    MOVE 0 TO EOF-DEVICE.
    START CONTROL-FILE KEY IS NOT LESS THAN CONTROL-KEY
          INVALID KEY
            GO TO RATE-CONTROLS-EXIT.
    DISPLAY (21 , 1)ERASE.
    DISPLAY "Task = ", TASK-PART, " ", DEVICE-TITLE.
    PERFORM RATE-EACH-CONTROL THRU RATE-EACH-CONTROL-EXIT
     VARYING K FROM 1 BY 1 UNTIL EOF-CONTROL = 1 OR
      EOF-DEVICE = 1 OR LAST-KEY = "01".
    IF LAST-KEY = "01" GO TO RATE-CONTROLS-EXIT.
RATE-CONTROLS-EXIT.
    EXIT.
RATE-EACH-CONTROL.
    MOVE 0 TO EOF-CONTROL.
    READ CONTROL-FILE NEXT RECORD AT END
      MOVE 1 TO EOF-CONTROL
      GO TO RATE-EACH-CONTROL-EXIT.
    IF REQ-CTL-TYPE NOT = CTL-TYPE OR
      REQ-CTL-TASK NOT = CTL-TASK
      GO TO RATE-EACH-CONTROL-EXIT.
    IF REQ-CTL-SUBTASK NOT = "0000" AND
      REQ-CTL-SUBTASK NOT = CTL-SUBTASK
      GO TO RATE-EACH-CONTROL-EXIT.
    MOVE CONTROL-KEY TO TITLE-KEY.
    READ TITLE-FILE RECORD INVALID KEY PERFORM BAD-KEY.
    DISPLAY (22, 1)ERASE.
    DISPLAY (22, 1)" ", TITLE-CONTROL, " ", TITLE-DESC.
    MOVE CORR-CTL-KEY TO DEVICE-KEY.
    READ DEVICE-FILE RECORD INVALID KEY PERFORM BAD-KEY.
    MOVE DEVICE-KEY TO TASK-KEY.
    DISPLAY (23, 1)"Task = ", TASK-PART, " ", DEVICE-TITLE.
    MOVE CORR-CTL-KEY TO TITLE-KEY.
    READ TITLE-FILE RECORD INVALID KEY PERFORM BAD-KEY.
    DISPLAY(24, 1) " ", TITLE-CONTROL, " ", TITLE-DESC.
    MOVE CONTROL-ANALYSIS(X) TO RATING.
    DISPLAY (25, 5)ERASE.
    IF RATING NOT = 999
      MOVE RATING TO PREVIOUS-RATING
      DISPLAY (25, 5)"Previous Rating = ", PREVIOUS-RATING.
    DISPLAY (LIN, COL) "    Enter Rating = "
    ACCEPT (LIN, COL) RATING WITH AUTO-SKIP UPDATE.
    ACCEPT LAST-KEY FROM ESCAPE KEY.
```

```
    IF LAST-KEY = "01" GO TO RATE-EACH-CONTROL-EXIT.
    IF RATING = PREVIOUS-RATING GO TO RATE-EACH-CONTROL-EXIT.
    MOVE RATING TO CONTROL-ANALYSIS(X)
    REWRITE CONTROL-RECORD INVALID KEY GO TO BAD-KEY.
RATE-EACH-CONTROL-EXIT.
    MOVE READ-TASK-NO TO DEVICE-KEY.
    READ DEVICE-FILE RECORD
          INVALID KEY MOVE 1 TO EOF-DEVICE.
STOP-RUN.
    DISPLAY(1, 1)ERASE.
    CLOSE DEVICE-FILE.
    CLOSE TITLE-FILE.
    CLOSE CONTROL-FILE.
    CLOSE TEXT-FILE.
    EXIT PROGRAM.
STOPPED.
    STOP RUN.
EOF-TEXT.
    DISPLAY "EOF ON TEXT FILE".
    STOP RUN.
BAD-KEY.
    DISPLAY "INVALID KEY ", DEVICE-KEY, TITLE-KEY.
    STOP RUN.
TIMER.
    PERFORM NO-OP 2000 TIMES.
NO-OP.
    EXIT.
DISPLAY-INTRO-SCREEN.
    READ TEXT-FILE RECORD AT END GO TO EOF-TEXT.
    IF REC-INDICATOR = "ZZ" OR REC-INDICATOR = "ZQ"
      GO TO DISPLAY-INTRO-SCREEN-EXIT.
    DISPLAY TEXT-RECORD.
    GO TO DISPLAY-INTRO-SCREEN.
DISPLAY-INTRO-SCREEN-EXIT.
    EXIT.
SUM-TASK.
    MOVE 0 TO EOF-DEVICE.
    READ DEVICE-FILE NEXT RECORD AT END MOVE 1 TO EOF-DEVICE
          GO TO SUM-TASK-EXIT.
    MOVE DEVICE-KEY TO READ-TASK-NO.
    IF REQ-SUBTASK = "0000" AND READ-SUBTASK NOT = "0000"
      GO TO SUM-TASK.
    IF REQ-SUBTASK NOT = "0000" AND READ-SUBTASK = "0000"
      GO TO SUM-TASK.
    IF READ-TYPE = 1 GO TO SUM-ACTUALS.
    IF DEVICE-ANALYSIS(3) > 3 ADD 1 TO N1
                GO TO SUM-TASK-EXIT.
    IF DEVICE-ANALYSIS(3) NOT = 999
      MOVE 999 TO DIFFICULTY
      IF DEVICE-ANALYSIS(3) < 4  AND
        DEVICE-ANALYSIS(4) NOT = 999 AND
        DEVICE-ANALYSIS(5) NOT = 999 AND
        DEVICE-ANALYSIS(6) NOT = 999 AND
        DEVICE-ANALYSIS(7) NOT = 999 AND
        DEVICE-ANALYSIS(8) NOT = 999 AND
```

```
        DEVICE-ANALYSIS(9) NOT = 999
         ADD 1 TO N1
         COMPUTE DIFFICULTY ROUNDED =
          DEVICE-ANALYSIS (4) +
          DEVICE-ANALYSIS (5) +
          DEVICE-ANALYSIS (6) +
          DEVICE-ANALYSIS (7) +
          DEVICE-ANALYSIS (8) +
          DEVICE-ANALYSIS (9).
    IF DEVICE-ANALYSIS(3) = 0 AND DIFFICULTY NOT = 999
       COMPUTE TP-PRODUCT ROUNDED = TP-PRODUCT +
        (10 * DIFFICULTY).
    IF DEVICE-ANALYSIS(3) = 1 AND DIFFICULTY NOT = 999
       COMPUTE TP-PRODUCT ROUNDED = TP-PRODUCT +
        (9 * DIFFICULTY).
    IF DEVICE-ANALYSIS(3) = 2 AND DIFFICULTY NOT = 999
       COMPUTE TP-PRODUCT ROUNDED = TP-PRODUCT +
        (7 * DIFFICULTY).
    IF DEVICE-ANALYSIS(3) = 3 AND DIFFICULTY NOT = 999
       COMPUTE TP-PRODUCT ROUNDED = TP-PRODUCT +
        (4 * DIFFICULTY).

    IF DEVICE-ANALYSIS(3) < 4 AND
      DEVICE-ANALYSIS(10) NOT = 999 AND
      DEVICE-ANALYSIS(11) NOT = 999 AND
      DEVICE-ANALYSIS(12) NOT = 999 AND
      DEVICE-ANALYSIS(13) NOT = 999 AND
      DEVICE-ANALYSIS(14) NOT = 999 AND
      DEVICE-ANALYSIS(15) NOT = 999 AND
      DEVICE-ANALYSIS(16) NOT = 999 AND
      DEVICE-ANALYSIS(17) NOT = 999 AND
      DEVICE-ANALYSIS(18) NOT = 999 AND
      DEVICE-ANALYSIS(19) NOT = 999 AND
      DEVICE-ANALYSIS(20) NOT = 999
      ADD 1 TO N2
      COMPUTE AE-PRODUCT ROUNDED =
        AE-PRODUCT +
        ((DEVICE-ANALYSIS(10) +
        DEVICE-ANALYSIS(11) +
        DEVICE-ANALYSIS(12) +
        DEVICE-ANALYSIS(13) +
        DEVICE-ANALYSIS(14) +
        DEVICE-ANALYSIS(15) +
        DEVICE-ANALYSIS(16) +
        DEVICE-ANALYSIS(17) +
        DEVICE-ANALYSIS(18) +
        DEVICE-ANALYSIS(19) +
        DEVICE-ANALYSIS(20)) / 11 ).
    GO TO SUM-TASK-EXIT.
SUM-ACTUALS.
    IF READ-TYPE = 0 GO TO SUM-TASK-EXIT.
    IF DEVICE-ANALYSIS(6) > 3  ADD 1 TO N3
        GO TO SUM-TASK-EXIT.

    IF DEVICE-ANALYSIS(6) NOT = 999
```

```
        MOVE 999 TO DIFFICULTY
        IF DEVICE-ANALYSIS(6) < 4  AND
          DEVICE-ANALYSIS(7) NOT = 999 AND
          DEVICE-ANALYSIS(8) NOT = 999 AND
          DEVICE-ANALYSIS(9) NOT = 999 AND
          DEVICE-ANALYSIS(10) NOT = 999 AND
          DEVICE-ANALYSIS(11) NOT = 999 AND
          DEVICE-ANALYSIS(12) NOT = 999
           ADD 1 TO N3
           COMPUTE DIFFICULTY ROUNDED =
            DEVICE-ANALYSIS (7) +
            DEVICE-ANALYSIS (8) +
            DEVICE-ANALYSIS (9) +
            DEVICE-ANALYSIS (10) +
            DEVICE-ANALYSIS (11) +
            DEVICE-ANALYSIS (12).
      IF DEVICE-ANALYSIS(6) = 0 AND DIFFICULTY NOT = 999
         COMPUTE RD-PRODUCT ROUNDED = RD-PRODUCT +
          (10 * DIFFICULTY).
      IF DEVICE-ANALYSIS(6) = 1 AND DIFFICULTY NOT = 999
         COMPUTE RD-PRODUCT ROUNDED = RD-PRODUCT +
          (9 * DIFFICULTY).
      IF DEVICE-ANALYSIS(6) = 2 AND DIFFICULTY NOT = 999
         COMPUTE RD-PRODUCT ROUNDED = RD-PRODUCT +
          (7 * DIFFICULTY).
      IF DEVICE-ANALYSIS(6) = 3 AND DIFFICULTY NOT = 999
         COMPUTE RD-PRODUCT ROUNDED = RD-PRODUCT +
          (4 * DIFFICULTY).
      IF DEVICE-ANALYSIS(5) = 1
        PERFORM SUM-CONTROLS THRU SUM-CONTROLS-EXIT.
      IF DEVICE-ANALYSIS(6) < 4 AND
        DEVICE-ANALYSIS(13) NOT = 999 AND
        DEVICE-ANALYSIS(14) NOT = 999 AND
        DEVICE-ANALYSIS(15) NOT = 999 AND
        DEVICE-ANALYSIS(16) NOT = 999 AND
        DEVICE-ANALYSIS(17) NOT = 999 AND
        DEVICE-ANALYSIS(18) NOT = 999 AND
        DEVICE-ANALYSIS(19) NOT = 999 AND
        DEVICE-ANALYSIS(20) NOT = 999
        ADD 1 TO N4
        COMPUTE TE-PRODUCT ROUNDED =
          TE-PRODUCT +
          ((DEVICE-ANALYSIS(13) +
          DEVICE-ANALYSIS(14) +
          DEVICE-ANALYSIS(15) +
          DEVICE-ANALYSIS(16) +
          DEVICE-ANALYSIS(17) +
          DEVICE-ANALYSIS(18) +
          DEVICE-ANALYSIS(19) +
          DEVICE-ANALYSIS(20)) / 8).
  SUM-TASK-EXIT.
      EXIT.
  SUM-CONTROLS.
      MOVE READ-TASK-NO TO REQ-CTL-KEY.
      MOVE REQ-CTL-KEY TO CONTROL-KEY.
```

```
    START CONTROL-FILE KEY IS NOT LESS THAN CONTROL-KEY
      INVALID KEY GO TO SUM-CONTROLS-EXIT.
SUM-EACH-CONTROL.
    READ CONTROL-FILE NEXT RECORD AT END
      GO TO SUM-CONTROLS-EXIT.
    IF REQ-CTL-TASK NOT = CTL-TASK GO TO SUM-CONTROLS-EXIT.
    IF REQ-CTL-SUBTASK NOT = "0000" AND
      REQ-CTL-SUBTASK NOT = CTL-SUBTASK
      GO TO SUM-CONTROLS-EXIT.
    IF CONTROL-ANALYSIS(1) = 999 OR CONTROL-ANALYSIS(2) = 999
      GO TO SUM-CONTROLS-EXIT.
    ADD 1 TO N5.
    IF CONTROL-ANALYSIS(1) > CONTROL-ANALYSIS(2)
      COMPUTE PS-FS = PS-FS +
        (CONTROL-ANALYSIS(1) - CONTROL-ANALYSIS(2)).
    GO TO SUM-EACH-CONTROL.
SUM-CONTROLS-EXIT.
    EXIT.
DISPLAY-TASKS.
    IF LAST-KEY = "04" OR LAST-KEY = "05"
      MOVE 1 TO TITLE-FLAG.
    IF LAST-KEY = "03" OR LAST-KEY = "05"
      MOVE 1 TO TYPE-PART.
    MOVE 0 TO Q.
    MOVE TASK-KEY TO DEVICE-KEY.
    MOVE DEVICE-KEY TO REQ-TASK-NO.
    READ DEVICE-FILE RECORD INVALID KEY
      GO TO DISPLAY-TASKS-END.
    IF LAST-KEY = "01" GO TO DISPLAY-TASKS-END.
DISPLAY-TASKS-LOOP.
    MOVE 0 TO I.
    DISPLAY (5, 1)ERASE.
    DISPLAY (LIN, COL)"          ".
    GO TO DISPLAY-20-DEVICES.
DISPLAY-20-DEVICES.
    MOVE DEVICE-KEY TO READ-TASK-NO.
    MOVE DEVICE-KEY TO TASK-KEY.
    IF READ-TYPE NOT = REQ-TYPE MOVE 1 TO Q.
    ADD 1 TO I.
    IF I > 16 OR Q = 1
      DISPLAY(25, 7)"Hit any key to continue"
      ACCEPT(LIN, COL)NOTHING WITH AUTO-SKIP
      ACCEPT LAST-KEY FROM ESCAPE KEY
      DISPLAY(6, 1)ERASE
      MOVE 1 TO I
      IF Q = 1 GO TO DISPLAY-TASKS-END.
    IF LAST-KEY = "01" GO TO DISPLAY-TASKS-END.
    IF  READ-SUBTASK NOT = "0000"
     DISPLAY (LIN, COL) "  ".
    DISPLAY TASK-PART, "  ", DEVICE-TITLE.
    IF TITLE-FLAG = 1
      PERFORM DISPLAY-CONTROLS THRU DISPLAY-CONTROLS-END.
    READ DEVICE-FILE NEXT RECORD AT END MOVE 1 TO Q.
    GO TO DISPLAY-20-DEVICES.
DISPLAY-TASKS-END.
```

```
    MOVE 0 TO TITLE-FLAG.
    DISPLAY(6, 1)ERASE.
DISPLAY-CONTROLS.
    MOVE DEVICE-KEY TO TASK-KEY.
    MOVE SPACES TO CONTROL-PART.
    MOVE TASK-KEY TO TITLE-KEY.
    START TITLE-FILE KEY IS NOT LESS THAN TITLE-KEY
      INVALID KEY GO TO DISPLAY-CONTROLS-END.
    READ TITLE-FILE NEXT RECORD AT END
         GO TO DISPLAY-CONTROLS-END.
DISPLAY-20-CONTROLS.
    IF TITLE-TASK NOT = TASK-PART OR TITLE-TYPE NOT = TYPE-PART
        GO TO DISPLAY-CONTROLS-END.
    ADD 1 TO I.
    IF I > 16
      DISPLAY(25, 7)"Hit any key to continue"
      ACCEPT(LIN, COL)NOTHING WITH AUTO-SKIP
      ACCEPT LAST-KEY FROM ESCAPE KEY
      DISPLAY(6, 1)ERASE
      DISPLAY TASK-PART, "  ", DEVICE-TITLE
      MOVE 1 TO I.
    IF LAST-KEY = "01" GO TO DISPLAY-CONTROLS-END.
    DISPLAY "       ",  TITLE-CONTROL,
      " ", TITLE-DESC.
    READ TITLE-FILE NEXT RECORD AT END
         GO TO DISPLAY-CONTROLS-END.
    GO TO DISPLAY-20-CONTROLS.
DISPLAY-CONTROLS-END.
    EXIT.
SQUARE-ROOT.
    COMPUTE SQR1 = SQR-ROOT * 10000.
    PERFORM SQR-PROC VARYING J FROM 1 BY 2 UNTIL SQR1 < 0.
    COMPUTE SQR-ROOT ROUNDED = (J - 3) / 200.
SQR-PROC.
    SUBTRACT J FROM SQR1.
```

```
 IDENTIFICATION DIVISION.
 PROGRAM-ID.   LIST.
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*----------------------------------------------------
*THIS IS THE ASTAR DATA FILE LISTING PROGRAM
*----------------------------------------------------
 AUTHOR. Timothy OConnor.
 INSTALLATION. American Institutes for Research.
 DATE-WRITTEN.  OCT 1984.
 ENVIRONMENT DIVISION.
 CONFIGURATION SECTION.
 SOURCE-COMPUTER.
 OBJECT-COMPUTER.
 INPUT-OUTPUT SECTION.
 FILE-CONTROL.

       SELECT DEVICE-FILE ASSIGN TO DISK
            ORGANIZATION IS INDEXED
            ACCESS MODE IS DYNAMIC
            RECORD KEY IS DEVICE-KEY
            FILE STATUS IS DEVICE-STATUS-WORD.

      SELECT TITLE-FILE ASSIGN TO DISK
            ORGANIZATION IS INDEXED
            ACCESS MODE IS DYNAMIC
            RECORD KEY IS TITLE-KEY
            FILE STATUS IS TITLE-STATUS-WORD.


      SELECT CONTROL-FILE ASSIGN TO DISK
            ORGANIZATION IS INDEXED
            ACCESS MODE IS DYNAMIC
            RECORD KEY IS CONTROL-KEY
            FILE STATUS IS CTL-STATUS-WORD.

 DATA DIVISION.
 FILE SECTION.
 FD  DEVICE-FILE
        LABEL RECORD IS STANDARD;
        VALUE OF FILE-ID IS "B:DEVICE".
 01  DEVICE-RECORD.
     05 DEVICE-KEY   PIC X(10).
     05 DEVICE-ANALYSIS OCCURS 20 TIMES PIC 999.
     05 DEVICE-TITLE   PIC X(60).

 FD  TITLE-FILE
         LABEL RECORD IS STANDARD;
         VALUE OF FILE-ID IS "B:TITLE".
 01  TITLE-RECORD.
     05 TITLE-KEY.
       07 TITLE-TYPE     PIC 9.
```

```
          07 TITLE-TASK      PIC X(9).
          07 TITLE-PERIOD    PIC X.
          07 TITLE-CONTROL   PIC X(9).
        05 TITLE-DESC        PIC X(60).

FD  CONTROL-FILE
        LABEL RECORD IS STANDARD;
       VALUE OF FILE-ID IS "B:CONTROL".
01  CONTROL-RECORD.
    05 CONTROL-KEY     PIC X(20).
    05 CONTROL-ANALYSIS OCCURS 2 TIMES PIC 999.
    05 CORR-CTL-KEY    PIC X(20).
WORKING-STORAGE SECTION.
01  ANSWER PIC X.
01  NOTHING PIC X.
01  TITLE-FLAG  PIC S9(4) COMP VALUE 0.
01  TASK-NO  PIC Z(3)9.9999 DISPLAY.
01  CTL-STATUS-WORD     PIC XX.
01  RATING PIC 999.
01  PREVIOUS-RATING PIC ZZ9.
01  TITLE-STATUS-WORD  PIC XX.
01  DEVICE-STATUS-WORD  PIC XX.
01  EOF-DEVICE  PIC 9  VALUE 0.
01  REQ-TASK-NO.
    05 REQ-TYPE  PIC 9.
    05 REQ-TASK    PIC Z(4).
    05 FILLER  PIC X.
    05 REQ-SUBTASK    PIC X(4).
01  READ-TASK-NO.
    05 READ-TYPE  PIC 9.
    05 READ-TASK1  PIC Z(4).
    05 FILLER  PIC X.
    05 READ-SUBTASK PIC X(4).
01  TASK-KEY.
    05 TYPE-PART  PIC X.
    05 TASK-PART  PIC X(9).
    05 PERIOD-PART PIC X VALUE ".".
    05 CONTROL-PART PIC X(9).
01  OPTION       PIC 9.
01  PREV-OPTION       PIC 9.
01  LAST-KEY     PIC XX.
01  X     PIC 9(4).
01  Q     PIC 9(4).
01  Z     PIC 9(4).
01  K     PIC 9(4).
01  I     PIC 9(4).

PROCEDURE DIVISION.
BEGIN.
    OPEN I-O DEVICE-FILE.
    OPEN INPUT CONTROL-FILE.
    OPEN INPUT TITLE-FILE.
    DISPLAY (1, 1) ERASE.
    MOVE ZEROS TO TASK-NO.
    MOVE TASK-NO TO REQ-TASK-NO.
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```
    MOVE 0 TO OPTION.
MENU.
    MOVE OPTION TO PREV-OPTION.
    MOVE 0 TO OPTION.
    MOVE 0 TO EOF-DEVICE.
    MOVE "00" TO LAST-KEY
    DISPLAY (1, 1)ERASE.
    DISPLAY (1, 25)
               "            LIST RATINGS          ".
    DISPLAY (4, 25)
               "(1)  List Training Device Ratings      ".
    DISPLAY (6, 25)
               "(2)  List Operational Equipment Ratings".
    DISPLAY (8, 25)
               "(3)  List Common Controls & Displays".
    DISPLAY (10, 25)
               "(4)  EXIT PROGRAM".
    DISPLAY (13, 12)"Enter Option Number ".
    ACCEPT (LIN, COL) OPTION WITH AUTO-SKIP.
    ACCEPT LAST-KEY FROM ESCAPE KEY.
    DISPLAY (1, 1)ERASE.
    IF OPTION = 1 GO TO TASK-LIST-LOOP.
    IF OPTION = 2 GO TO TASK-LIST-LOOP.
    IF OPTION = 3 GO TO CONTROL-LIST-LOOP.
    IF OPTION = 4 GO TO STOP-RUN.
    GO TO MENU.
TASK-LIST-LOOP.
    PERFORM FIND-STARTING-TASK.
    IF LAST-KEY = "01" GO TO MENU.
    PERFORM READ-TASK THRU READ-TASK-EXIT.
    GO TO MENU.
CONTROL-LIST-LOOP.
    PERFORM FIND-STARTING-TASK.
    IF LAST-KEY = "01" GO TO MENU.
    MOVE TASK-KEY TO CONTROL-KEY.
    START CONTROL-FILE KEY IS NOT LESS THAN CONTROL-KEY
               INVALID KEY
                   DISPLAY (LIN, 1) ERASE
                   DISPLAY (LIN, 1)
                   "TASK.SUBTASK NOT FOUND IN DATA BASE "
                   PERFORM TIMER
                   GO TO CONTROL-LIST-LOOP.
    DISPLAY (1, 1)ERASE.
    PERFORM READ-CONTROL THRU READ-CONTROL-EXIT.
    GO TO MENU.
HIT-ANY-KEY.
    DISPLAY (25, 50) "Hit any key to continue ".
    ACCEPT (LIN, COL) NOTHING WITH AUTO-SKIP.
    ACCEPT LAST-KEY FROM ESCAPE KEY.
    DISPLAY(1, 1)ERASE.
FIND-STARTING-TASK.
    DISPLAY (5, 1)ERASE.
    MOVE ZEROS TO TASK-NO.
    DISPLAY (22, 5)
     "Hit 'F1' to List Training Device Tasks & Subtasks".
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```
    DISPLAY (23, 5)
     "Hit 'F2' to List Operational Equipment Tasks & Subtasks".
    DISPLAY (24, 5)
     "Hit 'F3' to List Training Device Controls & Displays".
    DISPLAY (25, 5)
     "Hit 'F4' to List Operational Equipment ",
            "Controls & Displays".
    IF OPTION = 1
     MOVE 0 TO TYPE-PART
     DISPLAY (5, 1)
     "Enter Starting Training Device Task.Subtask number  "
    ELSE
         MOVE 1 TO TYPE-PART
         DISPLAY (5, 1)
         "Enter Starting Operational Equipment Task.Subtask ",
         "number  ".
    ACCEPT (LIN, COL) TASK-NO WITH AUTO-SKIP PROMPT.
    ACCEPT LAST-KEY FROM ESCAPE KEY.
    MOVE TASK-NO TO TASK-PART.
    IF LAST-KEY = "02" OR LAST-KEY = "03" OR
       LAST-KEY = "04" OR LAST-KEY = "05"
      PERFORM DISPLAY-TASKS THRU DISPLAY-TASKS-END
      GO TO FIND-STARTING-TASK.
    IF LAST-KEY NOT = "01"
     MOVE TASK-NO TO TASK-PART
     MOVE TASK-KEY TO REQ-TASK-NO
     MOVE TASK-KEY TO DEVICE-KEY
     START DEVICE-FILE KEY IS EQUAL TO DEVICE-KEY
               INVALID KEY
                   DISPLAY (LIN, 1) ERASE
                   DISPLAY (LIN, 1)
                   "TASK.SUBTASK NOT FOUND IN DATA BASE "
                   PERFORM TIMER
                   GO TO FIND-STARTING-TASK.
    DISPLAY (1, 1)ERASE.
READ-TASK.
    MOVE 0 TO EOF-DEVICE.
    READ DEVICE-FILE NEXT RECORD AT END MOVE 1 TO EOF-DEVICE
          GO TO READ-TASK-EXIT.
    MOVE DEVICE-KEY TO READ-TASK-NO.
    MOVE DEVICE-KEY TO TASK-KEY.
    IF DEVICE-KEY = "1   0.0000" GO TO READ-TASK.
    DISPLAY (1, 1)ERASE.
    IF TYPE-PART = "0" DISPLAY (1, 32)
       "Training Device ".
    IF TYPE-PART = "1" DISPLAY (1, 32)
       "Operational Equipment".
    DISPLAY (3, 1)ERASE.
    DISPLAY "    ", TASK-PART, "    ", DEVICE-TITLE.
    DISPLAY " ".
DISPLAY-ASTAR1.
    IF DEVICE-KEY NOT = "0   0.0000" GO TO DISPLAY-ASTAR-TD.
    DISPLAY " ".
    DISPLAY " ".
    DISPLAY "                          ",
```

```
           "ASTAR 1 - Device Level Ratings".
     DISPLAY " ".
     DISPLAY " PERFORM   LEARNING  TRAINING  RESIDUAL ",
           " RESIDUAL  PHYSICAL  FUNCTION  TRAINING".
     DISPLAY " DEFICIT     DIFF      ACQ     DEFICIT  ",
           "LEARN DIFF SIMILAR   SIMILAR   TRANSFER".
     DISPLAY "    ", DEVICE-ANALYSIS(1), "     ",
           "    ", DEVICE-ANALYSIS(2), "     ",
           "    ", DEVICE-ANALYSIS(3), "     ",
           "    ", DEVICE-ANALYSIS(4), "     ",
           "    ", DEVICE-ANALYSIS(5), "     ",
           "    ", DEVICE-ANALYSIS(6), "     ",
           "    ", DEVICE-ANALYSIS(7), "     ",
           "    ", DEVICE-ANALYSIS(8).
     DISPLAY " ".
     DISPLAY " ".
     DISPLAY "    -------------------------------------",
           "-----------------------------------".
     DISPLAY " ".
     DISPLAY "                            ",
           "ASTAR 2 - Device Level Ratings".
     DISPLAY " ".
     DISPLAY "        TRAINING ACQUISITION            ",
           "          TRAINING TRANSFER               ".
     DISPLAY "      (1)       (2)       (3)       (4)        ",
           "         (1)       (2)        (3)        ".
     DISPLAY "      ", DEVICE-ANALYSIS(9),
           "      ", DEVICE-ANALYSIS(10),
           "      ", DEVICE-ANALYSIS(11),
           "      ", DEVICE-ANALYSIS(12), "        ",
           "         ", DEVICE-ANALYSIS(13),
           "        ", DEVICE-ANALYSIS(14),
           "        ", DEVICE-ANALYSIS(15).
     PERFORM HIT-ANY-KEY.
     IF LAST-KEY = "01" GO TO READ-TASK-EXIT.
     GO TO READ-TASK.
 DISPLAY-ASTAR-TD.
     IF TYPE-PART = "1" GO TO DISPLAY-ASTAR-OE.
     DISPLAY "                 ",
       "ASTAR 2 - Training Device Task(Subtask) Ratings".
     DISPLAY " ".
     DISPLAY "        PERFORMANCE DEFICIT             ",
           "        LEARNING DIFFICULTY             ".
     DISPLAY "              ", DEVICE-ANALYSIS(1),
           "                     ",
           "              ", DEVICE-ANALYSIS(2),

     DISPLAY " ".
     DISPLAY "    -------------------------------------",
           "-----------------------------------".
     DISPLAY " ".
     DISPLAY "                ",
       "ASTAR 3 - Training Device Task(Subtask) Ratings".
     DISPLAY " ".
     DISPLAY "        PERFORMANCE DEFICIT             ",
```

```
           "          LEARNING DIFFICULTY            ".
    DISPLAY "                                         ",
           "   (1)    (2)    (3)    (4)    (5)    (6)   ".
    DISPLAY "                  ", DEVICE-ANALYSIS(3),
           "                    ",
           "   ", DEVICE-ANALYSIS(4),
           "   ", DEVICE-ANALYSIS(5),
           "   ", DEVICE-ANALYSIS(6),
           "   ", DEVICE-ANALYSIS(7),
           "   ", DEVICE-ANALYSIS(8),
           "   ", DEVICE-ANALYSIS(9).
    DISPLAY " ".
    DISPLAY "                                  TRAINING ",
           "ACQUISITION                              ".
    DISPLAY "    (1)     (2)     (3)     (4)     (5)     (",
           "6)     (7)     (8)     (9)    (10)    (11)  ".
    DISPLAY "    ", DEVICE-ANALYSIS(10),
           "    ", DEVICE-ANALYSIS(11),
           "    ", DEVICE-ANALYSIS(12),
           "    ", DEVICE-ANALYSIS(13),
           "    ", DEVICE-ANALYSIS(14),
           "    ", DEVICE-ANALYSIS(15),
           "    ", DEVICE-ANALYSIS(16),
           "    ", DEVICE-ANALYSIS(17),
           "    ", DEVICE-ANALYSIS(18),
           "    ", DEVICE-ANALYSIS(19),
           "    ", DEVICE-ANALYSIS(20).
    PERFORM HIT-ANY-KEY.
    IF LAST-KEY = "01" GO TO READ-TASK-EXIT.
    GO TO READ-TASK.
DISPLAY-ASTAR-OE.
    DISPLAY "                ",
      "ASTAR 2 - Operational Equipment Task(Subtask) Ratings".
    DISPLAY " ".
    DISPLAY "         RESIDUAL DEFICIT                 ",
           "    RESIDUAL LEARNING DIFFICULTY        ".
    DISPLAY "                 ", DEVICE-ANALYSIS(1),
           "                   ",
           "                    ", DEVICE-ANALYSIS(2).
    DISPLAY " ".
    DISPLAY "        PHYSICAL SIMILARITY              ",
           "       FUNCTIONAL SIMILARITY              ".
    DISPLAY "                 ", DEVICE-ANALYSIS(3),
           "                   ",
           "                 ", DEVICE-ANALYSIS(4).
    DISPLAY " ".
    DISPLAY "   -------------------------------------",
           "-------------------------------------".
    DISPLAY " ".
    DISPLAY "               ",
      "ASTAR 3 - Operational Equipment Task(Subtask) Ratings".
    DISPLAY " ".
    DISPLAY "            COMMONALITY                  ",
           "         RESIDUAL DEFICIT                ".
    DISPLAY "                 ", DEVICE-ANALYSIS(5),
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            "                          ",
            "                          ", DEVICE-ANALYSIS(6).
    DISPLAY " ".
    DISPLAY "     RESIDUAL LEARNING DIFFICULTY       ",
            "          TRAINING TRANSFER              ".
    DISPLAY "  (1)    (2)    (3)    (4)    (5)    (6)      ",
            "(1)   (2)   (3)   (4)   (5)   (6)   (7)   (8) ".
    DISPLAY "  ", DEVICE-ANALYSIS(7),
            "   ", DEVICE-ANALYSIS(8),
            "   ", DEVICE-ANALYSIS(9),
            "   ", DEVICE-ANALYSIS(10),
            "   ", DEVICE-ANALYSIS(11),
            "   ", DEVICE-ANALYSIS(12),
            "     ", DEVICE-ANALYSIS(13),
            "  ", DEVICE-ANALYSIS(14),
            "  ", DEVICE-ANALYSIS(15),
            "  ", DEVICE-ANALYSIS(16),
            "  ", DEVICE-ANALYSIS(17),
            "  ", DEVICE-ANALYSIS(18),
            "  ", DEVICE-ANALYSIS(19),
            "  ", DEVICE-ANALYSIS(20).
    PERFORM HIT-ANY-KEY.
    IF LAST-KEY = "01" GO TO READ-TASK-EXIT.
    GO TO READ-TASK.
READ-TASK-EXIT.
    EXIT.
READ-CONTROL.
    READ CONTROL-FILE NEXT RECORD AT END
        GO TO READ-CONTROL-EXIT.
    MOVE CONTROL-KEY TO TITLE-KEY.
    MOVE CONTROL-KEY TO DEVICE-KEY.
    READ DEVICE-FILE RECORD INVALID KEY GO TO READ-CONTROL.
    READ TITLE-FILE RECORD INVALID KEY GO TO READ-CONTROL.
    MOVE DEVICE-KEY TO TASK-KEY.
    IF DEVICE-ANALYSIS(5) NOT = 1 GO TO READ-CONTROL.
    DISPLAY (1, 1)ERASE.
    IF TYPE-PART = "1" DISPLAY (1, 32)
        "Operational Equipment".
    DISPLAY (3, 1)ERASE.
    DISPLAY "    ", TASK-PART, "    ", DEVICE-TITLE.
    DISPLAY " ".
    DISPLAY "      ", TITLE-CONTROL, "    ", TITLE-DESC.
    MOVE CORR-CTL-KEY TO DEVICE-KEY.
    MOVE CORR-CTL-KEY TO TITLE-KEY.
    READ DEVICE-FILE RECORD INVALID KEY GO TO READ-CONTROL.
    READ TITLE-FILE RECORD INVALID KEY GO TO READ-CONTROL.
    MOVE DEVICE-KEY TO TASK-KEY.
    IF TYPE-PART = "0" DISPLAY (7, 32)
        "Training Device".
    DISPLAY (9, 1)ERASE.
    DISPLAY "    ", TASK-PART, "    ", DEVICE-TITLE.
    DISPLAY " ".
    DISPLAY "      ", TITLE-CONTROL, "    ", TITLE-DESC.
    DISPLAY " ".
    DISPLAY "         ---------------------------------------".
```

```
    DISPLAY " ".
    DISPLAY "         PHYSICAL SIMILARITY           ",
            "        FUNCTIONAL SIMILARITY          ".
    DISPLAY "                 ", CONTROL-ANALYSIS(1),
            "                    ",
            "                 ", CONTROL-ANALYSIS(2).
    DISPLAY " ".
    PERFORM HIT-ANY-KEY.
    IF LAST-KEY = "01" GO TO READ-CONTROL-EXIT.
    GO TO READ-CONTROL.
READ-CONTROL-EXIT.
    EXIT.
STOP-RUN.
    DISPLAY(1, 1)ERASE.
    CLOSE DEVICE-FILE.
    CLOSE CONTROL-FILE.
    CLOSE TITLE-FILE.
    EXIT PROGRAM.
STOPPED.
    STOP RUN.
TIMER.
    PERFORM NO-OP 2000 TIMES.
NO-OP.
    EXIT.
DISPLAY-TASKS.
    MOVE 0 TO TYPE-PART.
    IF LAST-KEY = "03" OR LAST-KEY = "05"
      MOVE 1 TO TYPE-PART.
    IF LAST-KEY = "04" OR LAST-KEY = "05"
      MOVE 1 TO TITLE-FLAG.
    MOVE 0 TO Q.
    MOVE TASK-KEY TO DEVICE-KEY.
    MOVE DEVICE-KEY TO REQ-TASK-NO.
    READ DEVICE-FILE RECORD INVALID KEY
      GO TO DISPLAY-TASKS-END.
    IF LAST-KEY = "01" GO TO DISPLAY-TASKS-END.
DISPLAY-TASKS-LOOP.
    MOVE 0 TO I.
    DISPLAY (5, 1)ERASE.
    DISPLAY (LIN, COL)"          ".
    GO TO DISPLAY-20-DEVICES.
DISPLAY-20-DEVICES.
    MOVE DEVICE-KEY TO READ-TASK-NO.
    MOVE DEVICE-KEY TO TASK-KEY.
    IF READ-TYPE NOT = REQ-TYPE MOVE 1 TO Q.
    ADD 1 TO I.
    IF I > 16 OR Q = 1
      DISPLAY(25, 7)"Hit any key to continue"
      ACCEPT(LIN, COL)NOTHING WITH AUTO-SKIP
      ACCEPT LAST-KEY FROM ESCAPE KEY
      DISPLAY(6, 1)ERASE
      MOVE 1 TO I
      IF Q = 1 GO TO DISPLAY-TASKS-END.
    IF LAST-KEY = "01" GO TO DISPLAY-TASKS-END.
    IF  READ-SUBTASK NOT = "0000"
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     DISPLAY (LIN, COL) "  ".
    DISPLAY TASK-PART, "  ", DEVICE-TITLE.
    IF TITLE-FLAG = 1
      PERFORM DISPLAY-CONTROLS THRU DISPLAY-CONTROLS-END.
    READ DEVICE-FILE NEXT RECORD AT END MOVE 1 TO Q.
    GO TO DISPLAY-20-DEVICES.
DISPLAY-TASKS-END.
    MOVE 0 TO TITLE-FLAG.
    DISPLAY(6, 1)ERASE.
DISPLAY-CONTROLS.
    MOVE DEVICE-KEY TO TASK-KEY.
    MOVE SPACES TO CONTROL-PART.
    MOVE TASK-KEY TO TITLE-KEY.
    START TITLE-FILE KEY IS NOT LESS THAN TITLE-KEY
      INVALID KEY GO TO DISPLAY-CONTROLS-END.
    READ TITLE-FILE NEXT RECORD AT END
         GO TO DISPLAY-CONTROLS-END.
DISPLAY-20-CONTROLS.
    IF TITLE-TASK NOT = TASK-PART OR TITLE-TYPE NOT = TYPE-PART
        GO TO DISPLAY-CONTROLS-END.
    ADD 1 TO I.
    IF I > 16
      DISPLAY(25, 7)"Hit any key to continue"
      ACCEPT(LIN, COL)NOTHING WITH AUTO-SKIP
      ACCEPT LAST-KEY FROM ESCAPE KEY
      DISPLAY(6, 1)ERASE
      DISPLAY TASK-PART, "  ", DEVICE-TITLE
      MOVE 1 TO I.
    IF LAST-KEY = "01" GO TO DISPLAY-CONTROLS-END.
    DISPLAY "        ",  TITLE-CONTROL,
      " ", TITLE-DESC.
    READ TITLE-FILE NEXT RECORD AT END
         GO TO DISPLAY-CONTROLS-END.
    GO TO DISPLAY-20-CONTROLS.
DISPLAY-CONTROLS-END.
    EXIT.
```

```
 IDENTIFICATION DIVISION.
 PROGRAM-ID.   MAINT.
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*---------------------------------------------------
*THIS IS THE ASTAR DATA FILE MAINTENANCE PROGRAM
*---------------------------------------------------
  AUTHOR. Timothy OConnor.
 INSTALLATION. American Institutes for Research.
 DATE-WRITTEN.  AUG 1984.
 ENVIRONMENT DIVISION.
 CONFIGURATION SECTION.
 SOURCE-COMPUTER.
 OBJECT-COMPUTER.
 INPUT-OUTPUT SECTION.
 FILE-CONTROL.

       SELECT DEVICE-FILE ASSIGN TO DISK
            ORGANIZATION IS INDEXED
            ACCESS MODE IS DYNAMIC
            RECORD KEY IS DEVICE-KEY
            FILE STATUS IS DEVICE-STATUS-WORD.

      SELECT CONTROL-FILE ASSIGN TO DISK
            ORGANIZATION IS INDEXED
            ACCESS MODE IS DYNAMIC
            RECORD KEY IS CONTROL-KEY
            FILE STATUS IS CTL-STATUS-WORD.

      SELECT TITLE-FILE ASSIGN TO DISK
            ORGANIZATION IS INDEXED
            ACCESS MODE IS DYNAMIC
            RECORD KEY IS TITLE-KEY
            FILE STATUS IS TITLE-STATUS-WORD.

 DATA DIVISION.
 FILE SECTION.
 FD  DEVICE-FILE
        LABEL RECORD IS STANDARD;
        VALUE OF FILE-ID IS "B:DEVICE".
 01  DEVICE-RECORD.
     05 DEVICE-KEY   PIC X(10).
     05 DEVICE-ANALYSIS OCCURS 20 TIMES PIC 999.
     05 DEVICE-TITLE   PIC X(60).

 FD  TITLE-FILE
         LABEL RECORD IS STANDARD;
         VALUE OF FILE-ID IS "B:TITLE".
 01  TITLE-RECORD.
     05 TITLE-KEY.
       07 TITLE-TYPE     PIC 9.
       07 TITLE-TASK     PIC X(9).
```

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      07 TITLE-PERIOD   PIC X.
      07 TITLE-CONTROL  PIC X(9).
    05 TITLE-DESC       PIC X(60).

FD  CONTROL-FILE
        LABEL RECORD IS STANDARD;
       VALUE OF FILE-ID IS "B:CONTROL".
01  CONTROL-RECORD.
    05 CONTROL-KEY    PIC X(20).
    05 CONTROL-ANALYSIS OCCURS 2 TIMES PIC 999.
    05 CORR-CTL-KEY   PIC X(20).

WORKING-STORAGE SECTION.
77  RATING PIC 999.
77  PREVIOUS-RATING PIC ZZ9.
77  EOF-DEVICE  PIC 9  VALUE 0.
77  TITLE-FLAG  PIC 9(4) COMP VALUE 0.
77  I    PIC 9(4) COMP.
01  REQ-TASK-NO.
    05 REQ-TYPE     PIC 9.
    05 REQ-TASK     PIC Z(4).
    05 FILLER  PIC X.
    05 REQ-SUBTASK    PIC X(4).
01  TASK-KEY.
    05 TYPE-PART  PIC X.
    05 TASK-PART  PIC X(9).
    05 PERIOD-PART PIC X VALUE ".".
    05 CONTROL-PART PIC X(9).
01  C-D-KEY  PIC X(10).
01  TASK-NO  PIC Z(3)9.9999 DISPLAY.
01  NOTHING PIC X.
01  CTL-STATUS-WORD    PIC XX.
01  READ-TASK-NO.
    05 READ-TYPE  PIC 9.
    05 READ-TASK1  PIC Z(4).
    05 FILLER  PIC X.
    05 READ-SUBTASK PIC X(4).
01  DEVICE-STATUS-WORD  PIC XX.
01  TITLE-STATUS-WORD  PIC XX.
01  NEW-DESC     PIC X(54).
01  OPTION      PIC X.
01  LAST-KEY      PIC XX.
01  Z       PIC 99.

PROCEDURE DIVISION.
BEGIN.
    OPEN I-O DEVICE-FILE.
    OPEN I-O CONTROL-FILE.
    OPEN I-O TITLE-FILE.
    DISPLAY (1, 1) ERASE.
    MOVE 0 TO TASK-NO.
    MOVE SPACES TO DEVICE-KEY.
DISPLAY-MENU.
    DISPLAY (1, 1) ERASE.
    DISPLAY (1, 12)
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      "          Data Base Maintenance".
     DISPLAY (3, 12)
      "(1) Training Device - Task and Subtask Maintenance".
     DISPLAY (5, 12)
      "(2) Training Device - Control and Display Maintenance".
     DISPLAY (7, 12)
      "(3) Operational Equipment - Task and Subtask Maintenance".
     DISPLAY (9, 12)
      "(4) Operational Equipment - Control and Display ",
              "Maintenance".
     DISPLAY (11, 12)
      "(5) Commonality Analysis"
     DISPLAY (13, 12)
      "(6) Similarity Matching"
     DISPLAY (15, 12)
      "(7) EXIT PROGRAM"
     DISPLAY (17, 30)
      "Enter Option  ".
     ACCEPT (LIN, COL) OPTION WITH AUTO-SKIP.
     DISPLAY (1, 1) ERASE.
     IF OPTION = "1" PERFORM DISPLAY-FUNCTION-KEYS
                     GO TO DEVICE-TITLES.
     IF OPTION = "2" PERFORM DISPLAY-FUNCTION-KEYS
                     GO TO CONTROL-TITLES.
     IF OPTION = "3" PERFORM DISPLAY-FUNCTION-KEYS
                     GO TO DEVICE-TITLES.
     IF OPTION = "4" PERFORM DISPLAY-FUNCTION-KEYS
                     GO TO CONTROL-TITLES.
     IF OPTION = "5" GO TO COMMONALITY-ANALYSIS.
     IF OPTION = "6" GO TO SIMILARITY-ANALYSIS.
     IF OPTION = "7" GO TO STOP-RUN.
     GO TO DISPLAY-MENU.
 DEVICE-TITLES.
     IF OPTION = 1 MOVE 0 TO TYPE-PART.
     IF OPTION = 3 MOVE 1 TO TYPE-PART.
     MOVE "   0.0000" TO TASK-PART
     IF TYPE-PART = 0
      DISPLAY (3, 15)
      "(1) Training Device - Task and Subtask Definition      ".
     IF TYPE-PART = 1
       DISPLAY (3, 15)
      "(3) Operational Equipment - Task and Subtask Definition".
     MOVE TASK-KEY TO DEVICE-KEY.
     READ DEVICE-FILE RECORD INVALID KEY GO TO ADD-DEVICE.
     IF TYPE-PART = 0
      DISPLAY (6, 5)
               "Enter  Training Device  Task.Subtask number   ".
     IF TYPE-PART = 1
      DISPLAY (6, 5)
        "Enter  Operational Equipment Task.Subtask number   ".
     MOVE ZEROS TO TASK-NO.
     ACCEPT (LIN, COL) TASK-NO WITH AUTO-SKIP PROMPT.
     ACCEPT LAST-KEY FROM ESCAPE KEY.
     IF LAST-KEY = "01" GO TO DISPLAY-MENU.
     IF LAST-KEY = "02" OR LAST-KEY = "03" OR
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           LAST-KEY = "04" OR LAST-KEY = "05"
          PERFORM DISPLAY-TASKS THRU DISPLAY-TASKS-END
          GO TO DEVICE-TITLES.
        MOVE TASK-NO TO TASK-PART.
        MOVE TASK-KEY TO DEVICE-KEY.
        DISPLAY (4, 1) ERASE.
        DISPLAY (6, 5) "Task.Subtask = ", TASK-PART.
        DISPLAY (7, 5) "        Title = ".
        READ DEVICE-FILE RECORD
          INVALID KEY GO TO ADD-DEVICE.
        ACCEPT (LIN, COL) DEVICE-TITLE WITH UPDATE.
        ACCEPT LAST-KEY FROM ESCAPE KEY.
        IF LAST-KEY = "01" GO TO DISPLAY-MENU.
        IF DEVICE-TITLE = "DELETE" OR DEVICE-TITLE = "delete"
          GO TO DELETE-DEVICE.
        REWRITE DEVICE-RECORD INVALID KEY PERFORM BAD-KEY.
        DISPLAY (4, 1)ERASE.
        PERFORM DISPLAY-FUNCTION-KEYS.
        GO TO DEVICE-TITLES.
    ADD-DEVICE.
        MOVE SPACES TO DEVICE-TITLE.
        IF DEVICE-KEY = "0   0.0000"
          DISPLAY (6, 5) "Enter Title of Training Device"
        ELSE
         IF DEVICE-KEY = "1   0.0000"
          DISPLAY (6, 5) "Enter Title of Operational Equipment ".
        DISPLAY (7, 5) "        Title = ".
        ACCEPT (LIN, COL) DEVICE-TITLE WITH UPDATE.
        ACCEPT LAST-KEY FROM ESCAPE KEY.
        IF LAST-KEY = "01" GO TO DISPLAY-MENU.
        IF DEVICE-TITLE = "DELETE" OR DEVICE-TITLE  = "delete"
          GO TO DISPLAY-MENU.
        PERFORM MOVE-NINES VARYING I FROM 1 BY 1 UNTIL I > 20.
        WRITE DEVICE-RECORD INVALID PERFORM BAD-KEY.
        DISPLAY (4, 1)ERASE.
        PERFORM DISPLAY-FUNCTION-KEYS.
        GO TO DEVICE-TITLES.
    CONTROL-TITLES.
        IF OPTION = 2
          MOVE 0 TO TYPE-PART
          DISPLAY (3, 12)
          "(2) Training Device - Control and Display Mainten",
                "ance      ".
        IF OPTION = 4
          MOVE 1 TO TYPE-PART
          DISPLAY (3, 12)
          "(4) Operational Equipment - Control and Display ",
                "Maintenance".
        IF TYPE-PART = 0
         DISPLAY (6, 5)
           "Enter  Training Device  Task.Subtask number        ".
        IF TYPE-PART = 1
         DISPLAY (6, 5)
           "Enter  Operational Equipment Task.Subtask number   ".
        MOVE 0 TO TASK-NO.
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```
    ACCEPT (LIN, COL) TASK-NO WITH AUTO-SKIP PROMPT.
    ACCEPT LAST-KEY FROM ESCAPE KEY.
    IF LAST-KEY = "01" GO TO DISPLAY-MENU.
    IF LAST-KEY = "02" OR LAST-KEY = "03" OR
      LAST-KEY = "04" OR LAST-KEY = "05"
      PERFORM DISPLAY-TASKS THRU DISPLAY-TASKS-END
      GO TO CONTROL-TITLES.
    MOVE TASK-NO TO TASK-PART.
    MOVE TASK-KEY TO DEVICE-KEY.
    READ DEVICE-FILE RECORD INVALID KEY
        PERFORM BAD-KEY
        GO TO CONTROL-TITLES.
    DISPLAY (4, 1) ERASE.
    DISPLAY (6, 5) "Task.Subtask = ", TASK-PART.
    DISPLAY (7, 5) "        Title = ", DEVICE-TITLE.
GET-CONTROL-TITLE.
    DISPLAY (9, 1)ERASE.
    DISPLAY (9, 10)
               "Enter Control or Display number   ".
    MOVE "." TO PERIOD-PART.
    MOVE "          " TO CONTROL-PART.
    ACCEPT (LIN, COL) CONTROL-PART WITH UPDATE.
    ACCEPT LAST-KEY FROM ESCAPE KEY.
    IF LAST-KEY NOT = "00"
      DISPLAY (4, 1)ERASE
      GO TO CONTROL-TITLES.
    MOVE SPACES TO TITLE-DESC.
    MOVE TASK-KEY TO TITLE-KEY.
    DISPLAY (8, 1)ERASE.
    DISPLAY (9, 5) "Control/Display =", TASK-PART, ".",
        CONTROL-PART.
    DISPLAY (10, 5) "           Title = ".
    READ TITLE-FILE RECORD
      INVALID KEY GO TO ADD-CONTROL.
    ACCEPT (LIN, COL) TITLE-DESC WITH UPDATE.
    ACCEPT LAST-KEY FROM ESCAPE KEY.
    IF LAST-KEY = "01" GO TO DISPLAY-MENU.
    IF LAST-KEY NOT = "00"
      DISPLAY (4, 1)ERASE
      GO TO CONTROL-TITLES.
    IF TITLE-DESC = "DELETE" OR TITLE-DESC = "delete"
      GO TO DELETE-CONTROL.
    REWRITE TITLE-RECORD INVALID KEY PERFORM BAD-KEY.
    DISPLAY (4, 1)ERASE.
    PERFORM DISPLAY-FUNCTION-KEYS.
    GO TO GET-CONTROL-TITLE.
ADD-CONTROL.
    MOVE SPACES TO TITLE-DESC.
    ACCEPT (LIN, COL) TITLE-DESC WITH UPDATE.
    ACCEPT LAST-KEY FROM ESCAPE KEY.
    IF LAST-KEY NOT = "00" GO TO DISPLAY-MENU.
    IF TITLE-DESC = "DELETE" OR TITLE-KEY = "delete"
      GO TO DISPLAY-MENU.
    WRITE TITLE-RECORD INVALID KEY PERFORM BAD-KEY.
    GO TO GET-CONTROL-TITLE.
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```
DELETE-DEVICE.
    DELETE DEVICE-FILE RECORD INVALID KEY PERFORM BAD-KEY.
    DISPLAY (4, 1)ERASE.
    PERFORM DISPLAY-FUNCTION-KEYS.
    GO TO DEVICE-TITLES.
DELETE-CONTROL.
    MOVE TITLE-KEY TO CONTROL-KEY.
    DELETE TITLE-FILE RECORD INVALID KEY PERFORM BAD-KEY.
    DELETE CONTROL-FILE RECORD INVALID KEY GO TO CONTROL-TITLES.
    DISPLAY (4, 1)ERASE.
    PERFORM DISPLAY-FUNCTION-KEYS.
    GO TO CONTROL-TITLES.
BAD-KEY.
    DISPLAY (4, 1)ERASE.
    DISPLAY (9, 8)"Task.Subtask = ", TASK-PART, " ",
      "NOT FOUND IN DATABASE".
    PERFORM TIMER.
    DISPLAY (4, 1) ERASE.
    PERFORM DISPLAY-FUNCTION-KEYS.
STOP-RUN.
    DISPLAY (1, 1)ERASE.
    CLOSE  CONTROL-FILE, DEVICE-FILE, TITLE-FILE.
    EXIT PROGRAM.
STOPPED.
    STOP RUN.
DISPLAY-TASKS.
    MOVE 0 TO TYPE-PART.
    IF LAST-KEY = "03" OR LAST-KEY = "05"
      MOVE 1 TO TYPE-PART.
    IF LAST-KEY = "04" OR LAST-KEY = "05"
      MOVE 1 TO TITLE-FLAG.
    MOVE TASK-NO TO TASK-PART.
    MOVE 0 TO Z.
    MOVE TASK-KEY TO DEVICE-KEY.
    MOVE DEVICE-KEY TO REQ-TASK-NO.
    READ DEVICE-FILE RECORD INVALID KEY
      GO TO DISPLAY-TASKS-END.
    IF LAST-KEY = "01" GO TO DISPLAY-TASKS-END.
 DISPLAY-TASKS-LOOP.
    MOVE 0 TO I.
    DISPLAY (8, 1)ERASE.
    DISPLAY (LIN, COL)"      ".
    GO TO DISPLAY-20-DEVICES.
DISPLAY-20-DEVICES.
    MOVE DEVICE-KEY TO READ-TASK-NO.
    MOVE DEVICE-KEY TO TASK-KEY.
    IF READ-TYPE NOT = REQ-TYPE GO TO DISPLAY-TASKS-END.
    ADD 1 TO I.
    IF I > 16
      DISPLAY(25, 50)"Hit any key to continue"
      ACCEPT(LIN, COL)NOTHING WITH AUTO-SKIP
      ACCEPT LAST-KEY FROM ESCAPE KEY
      MOVE 1 TO I
      IF LAST-KEY NOT = "01" DISPLAY(8, 1)ERASE.
    IF LAST-KEY = "01" GO TO DISPLAY-TASKS-END.
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    IF  READ-SUBTASK NOT = "0000"
     DISPLAY (LIN, COL) "  ".
    DISPLAY TASK-PART, "  ", DEVICE-TITLE.
    IF TITLE-FLAG = 1
      PERFORM DISPLAY-CONTROLS THRU DISPLAY-CONTROLS-END.
    READ DEVICE-FILE NEXT RECORD
       AT END GO TO DISPLAY-TASKS-END.
    GO TO DISPLAY-20-DEVICES.
DISPLAY-TASKS-END.
    MOVE 0 TO TITLE-FLAG.
DISPLAY-CONTROLS.
    MOVE DEVICE-KEY TO TASK-KEY.
    MOVE SPACES TO CONTROL-PART.
    MOVE TASK-KEY TO TITLE-KEY.
    START TITLE-FILE KEY IS NOT LESS THAN TITLE-KEY
      INVALID KEY GO TO DISPLAY-CONTROLS-END.
    READ TITLE-FILE NEXT RECORD AT END
         GO TO DISPLAY-CONTROLS-END.
DISPLAY-20-CONTROLS.
    IF TITLE-TASK NOT = TASK-PART OR TITLE-TYPE NOT = TYPE-PART
        GO TO DISPLAY-CONTROLS-END.
    ADD 1 TO I.
    IF I > 16
      DISPLAY(25, 50)"Hit any key to continue"
      ACCEPT(LIN, COL)NOTHING WITH AUTO-SKIP
      ACCEPT LAST-KEY FROM ESCAPE KEY
      MOVE 1 TO I
      IF LAST-KEY NOT = "01" DISPLAY(8, 1)ERASE
      DISPLAY TASK-PART, "  ", DEVICE-TITLE.
    IF LAST-KEY = "01" GO TO DISPLAY-CONTROLS-END.
    DISPLAY "       ",  TITLE-CONTROL,
      " ", TITLE-DESC.
    READ TITLE-FILE NEXT RECORD AT END
         GO TO DISPLAY-CONTROLS-END.
    GO TO DISPLAY-20-CONTROLS.
DISPLAY-CONTROLS-END.
    EXIT.
TIMER.
    PERFORM NO-OP 5000 TIMES.
NO-OP.
    EXIT.
FIND-STARTING-TASK.
    MOVE 0 TO EOF-DEVICE.
    MOVE 1 TO TYPE-PART.
    MOVE ZEROS TO TASK-NO.
    DISPLAY (5, 1)
     "Enter Starting Operational Equipment Task.Subtask ",
         "number  ".
    ACCEPT (LIN, COL) TASK-NO WITH AUTO-SKIP PROMPT.
    ACCEPT LAST-KEY FROM ESCAPE KEY.
    IF LAST-KEY = "02" OR LAST-KEY = "03" OR
      LAST-KEY = "04" OR LAST-KEY = "05"
      PERFORM DISPLAY-TASKS THRU DISPLAY-TASKS-END
      GO TO FIND-STARTING-TASK.
    MOVE TASK-NO TO TASK-PART.
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    MOVE TASK-KEY TO REQ-TASK-NO.
    MOVE TASK-KEY TO DEVICE-KEY.
    START DEVICE-FILE KEY IS EQUAL TO DEVICE-KEY
               INVALID KEY
                   DISPLAY (LIN, 1) ERASE
                   DISPLAY (LIN, 1)
                   "TASK.SUBTASK NOT FOUND IN DATA BASE "
                   PERFORM TIMER
                   GO TO FIND-STARTING-TASK.
READ-TASK.
    MOVE 0 TO EOF-DEVICE.
    READ DEVICE-FILE NEXT RECORD AT END MOVE 1 TO EOF-DEVICE
          GO TO READ-TASK-EXIT.
    MOVE DEVICE-KEY TO READ-TASK-NO.
    MOVE DEVICE-KEY TO TASK-KEY.
    IF TASK-PART = "   0.0000" GO TO READ-TASK.
    IF REQ-SUBTASK = "0000" AND READ-SUBTASK NOT = "0000"
      GO TO READ-TASK.
    IF REQ-SUBTASK NOT = "0000" AND READ-SUBTASK = "0000"
      GO TO READ-TASK.
    IF REQ-TYPE NOT = READ-TYPE GO TO READ-TASK.
READ-TASK-EXIT.
    EXIT.
RATE-TASKS.
    PERFORM READ-TASK THRU READ-TASK-EXIT.
    IF EOF-DEVICE = 1 GO TO RATE-TASKS-EXIT.
    PERFORM RATE-EACH-TASK THRU RATE-EACH-TASK-EXIT
    IF LAST-KEY = "01" GO TO RATE-TASKS-EXIT.
RATE-TASKS-EXIT.
    EXIT.
RATE-EACH-TASK.
    DISPLAY (23 , 1)ERASE.
    DISPLAY (LIN, 1) "Task.Subtask = ", TASK-PART, " ",
               DEVICE-TITLE
    MOVE DEVICE-ANALYSIS(5) TO RATING.
    IF RATING NOT = 999
      MOVE RATING TO PREVIOUS-RATING
      DISPLAY (LIN, 1) "Previous Rating = ", PREVIOUS-RATING.
    DISPLAY (LIN, COL) "    Enter Rating = "
    ACCEPT (LIN, COL) RATING WITH AUTO-SKIP UPDATE.
    ACCEPT LAST-KEY FROM ESCAPE KEY.
    IF LAST-KEY = "01" GO TO RATE-EACH-TASK-EXIT.
    IF RATING = PREVIOUS-RATING GO TO RATE-EACH-TASK-EXIT.
    MOVE RATING TO DEVICE-ANALYSIS(5)
    REWRITE DEVICE-RECORD INVALID KEY PERFORM BAD-KEY.
RATE-EACH-TASK-EXIT.
    EXIT.
COMMONALITY-ANALYSIS.
    DISPLAY (1, 1)ERASE.
    DISPLAY (3, 30)
        "(5) Commonality Analysis".
    PERFORM DISPLAY-FUNCTION-KEYS.
    PERFORM FIND-STARTING-TASK.
    IF LAST-KEY = "01" GO TO DISPLAY-MENU.
    DISPLAY (4, 1)ERASE.
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     DISPLAY " ".
     DISPLAY "     ",
      "Consider descriptions of the subtasks (tasks) that ",
      "comprise the".
     DISPLAY "     ",
      "training objective(s), the subtasks (tasks) that ",
      "comprise the".
     DISPLAY "     ",
      "operational performance objective(s), as well as ",
      "descriptions of the".
     DISPLAY "     ",
      "training device and operational equipment, including ",
      "their displays".
     DISPLAY "     and controls.".
     DISPLAY "     ",
     DISPLAY "     ",
      "For each subtask (task) in the operational performance ",
      "objective(s),".
     DISPLAY "     ",
      "enter a '1' if it is represented (simulated) in the ",
      "training".
     DISPLAY "     ",
      "objective(s); enter a '0' if it is not represented ",
      "(simulated) in the ".
     DISPLAY "     ",
      "training objective(s)."
     PERFORM RATE-TASKS THRU RATE-TASKS-EXIT VARYING I
       FROM 1 BY 1 UNTIL EOF-DEVICE = 1 OR LAST-KEY = "01".
     GO TO DISPLAY-MENU.
 SIMILARITY-ANALYSIS.
     DISPLAY (1, 1)ERASE.
     DISPLAY (3, 15)
      "(6) Similarity Matching".
     PERFORM DISPLAY-FUNCTION-KEYS.
 GET-OE-TASK-NO.
     MOVE 1 TO TYPE-PART.
     DISPLAY (6, 5)
        "Enter  Operational Equipment Task.Subtask number   ".
     MOVE 0 TO TASK-NO.
     ACCEPT (LIN, COL) TASK-NO WITH AUTO-SKIP PROMPT.
     ACCEPT LAST-KEY FROM ESCAPE KEY.
     IF LAST-KEY = "01" GO TO DISPLAY-MENU.
     IF LAST-KEY = "02" OR LAST-KEY = "03" OR
       LAST-KEY = "04" OR LAST-KEY = "05"
       PERFORM DISPLAY-TASKS THRU DISPLAY-TASKS-END
       GO TO GET-OE-TASK-NO.
     MOVE 1 TO TYPE-PART.
     MOVE TASK-NO TO TASK-PART.
     MOVE TASK-KEY TO DEVICE-KEY.
     MOVE DEVICE-KEY TO REQ-TASK-NO.
     READ DEVICE-FILE RECORD INVALID KEY
         PERFORM BAD-KEY
         GO TO SIMILARITY-ANALYSIS.
     DISPLAY (4, 1) ERASE.
     DISPLAY (5, 1)"Operational Equipment".
```

```
    DISPLAY (6, 5) "Task.Subtask = ", TASK-PART.
    DISPLAY (7, 5) "       Title = ", DEVICE-TITLE.
    IF DEVICE-ANALYSIS(5) NOT = 1
      DISPLAY (9, 1) "IS NOT COMMON IN TRAINING DEVICE"
      PERFORM TIMER
      GO TO SIMILARITY-ANALYSIS.
GET-SIM-CONTROL-TITLE.
    MOVE 1 TO TYPE-PART.
    MOVE REQ-TASK-NO TO TASK-KEY.
    DISPLAY (8, 1)ERASE.
    DISPLAY (9, 10)
               "Enter Control or Display number   ".
    MOVE "." TO PERIOD-PART.
    MOVE "          " TO CONTROL-PART.
    ACCEPT (LIN, COL) CONTROL-PART WITH UPDATE.
    ACCEPT LAST-KEY FROM ESCAPE KEY.
    IF LAST-KEY NOT = "00"
      GO TO SIMILARITY-ANALYSIS.
    MOVE TASK-KEY TO TITLE-KEY.
    READ TITLE-FILE RECORD INVALID KEY
      DISPLAY(8, 1)ERASE
      DISPLAY (8, 1) TASK-PART, ".", CONTROL-PART,
        "NOT FOUND IN DATABASE"
      PERFORM TIMER
      GO TO GET-SIM-CONTROL-TITLE.
    DISPLAY (8, 1)ERASE.
    DISPLAY (9, 5) "Control/Display =", TASK-PART, ".",
        CONTROL-PART.
    DISPLAY (10, 5) "          Title = ", TITLE-DESC.
    MOVE TITLE-KEY TO CONTROL-KEY.
GET-CORR-TASK-NO.
    DISPLAY (14, 5)ERASE.
    DISPLAY (16, 5)
       "Enter  Training Device Task.Subtask number   ".
    MOVE 0 TO TASK-NO.
    ACCEPT (LIN, COL) TASK-NO WITH AUTO-SKIP PROMPT.
    ACCEPT LAST-KEY FROM ESCAPE KEY.
    IF LAST-KEY NOT = "00" GO TO GET-SIM-CONTROL-TITLE.
    MOVE 0 TO TYPE-PART.
    MOVE TASK-NO TO TASK-PART.
    MOVE TASK-KEY TO DEVICE-KEY.
    READ DEVICE-FILE RECORD INVALID KEY
      DISPLAY(14, 1)ERASE
      DISPLAY (14, 1) TASK-PART, " ",
        "NOT FOUND IN DATABASE"
      PERFORM TIMER
        GO TO GET-CORR-TASK-NO.
    DISPLAY (14, 1) ERASE.
    DISPLAY (15, 1)"Training Device".
    DISPLAY (16, 5) "Task.Subtask = ", TASK-PART.
    DISPLAY (17, 5) "       Title = ", DEVICE-TITLE.
GET-CORR-CONTROL-TITLE.
    DISPLAY (18, 1)ERASE.
    DISPLAY (19, 10)
               "Enter Control or Display number   ".
```

```
    MOVE "." TO PERIOD-PART.
    MOVE "          " TO CONTROL-PART.
    ACCEPT (LIN, COL) CONTROL-PART WITH UPDATE.
    ACCEPT LAST-KEY FROM ESCAPE KEY.
    IF LAST-KEY NOT = "00"
      GO TO GET-CORR-TASK-NO.
    MOVE TASK-KEY TO TITLE-KEY.
    READ TITLE-FILE RECORD INVALID KEY
      DISPLAY(18, 1)ERASE
      DISPLAY (18, 1) TASK-PART, ".", CONTROL-PART,
        "NOT FOUND IN DATABASE"
      PERFORM TIMER
      GO TO GET-SIM-CONTROL-TITLE.
    DISPLAY (18, 1)ERASE.
    DISPLAY (19, 5) "Control/Display =", TASK-PART, ".",
        CONTROL-PART.
    DISPLAY (20, 5) "          Title = ", TITLE-DESC.
    MOVE TITLE-KEY TO CORR-CTL-KEY.
    DISPLAY(25, 50)"Hit any key to continue"
    ACCEPT(LIN, COL)NOTHING WITH AUTO-SKIP
    ACCEPT LAST-KEY FROM ESCAPE KEY
    IF LAST-KEY NOT = "00" GO TO SIMILARITY-ANALYSIS.
    MOVE 999 TO CONTROL-ANALYSIS(1).
    MOVE 999 TO CONTROL-ANALYSIS(2).
    WRITE CONTROL-RECORD INVALID KEY GO TO REWRITE-CONTROL-REC.
    GO TO GET-CORR-TASK-NO.
REWRITE-CONTROL-REC.
    REWRITE CONTROL-RECORD INVALID KEY
      DISPLAY (1, 1)ERASE
      DISPLAY "INVALID KEY ON CONTROL REWRITE ", CONTROL-KEY.
    GO TO GET-CORR-TASK-NO.
MOVE-NINES.
    MOVE 999 TO DEVICE-ANALYSIS(I).
DISPLAY-FUNCTION-KEYS.
    DISPLAY (21, 1)ERASE.
    DISPLAY (22, 5)
     "Hit 'F1' to List Training Device Tasks & Subtasks".
    DISPLAY (23, 5)
     "Hit 'F2' to List Operational Equipment Tasks & Subtasks".
    DISPLAY (24, 5)
     "Hit 'F3' to List Training Device Controls & Displays".
    DISPLAY (25, 5)
     "Hit 'F4' to List Operational Equipment ",
            "Controls & Displays".
```

```
 IDENTIFICATION DIVISION.
 PROGRAM-ID.   BUILD.
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*                                          (1979 MAR)
*-----------------------------------------------
* THIS IS THE ASTAR DATABASE BUILD PROGRAM.
*-----------------------------------------------
 AUTHOR. Timothy OConnor.
 INSTALLATION. American Institutes for Research.
 DATE-WRITTEN.  APR 1987.
 ENVIRONMENT DIVISION.
 CONFIGURATION SECTION.
 SOURCE-COMPUTER.
 OBJECT-COMPUTER.
 INPUT-OUTPUT SECTION.
 FILE-CONTROL.

       SELECT DEVICE-FILE ASSIGN TO DISK
            ORGANIZATION IS INDEXED
            ACCESS MODE IS DYNAMIC
            RECORD KEY IS DEVICE-KEY
            FILE STATUS IS DEVICE-STATUS-WORD.

      SELECT TITLE-FILE ASSIGN TO DISK
            ORGANIZATION IS INDEXED
            ACCESS MODE IS DYNAMIC
            RECORD KEY IS TITLE-KEY
            FILE STATUS IS TITLE-STATUS-WORD.

      SELECT CONTROL-FILE ASSIGN TO DISK
            ORGANIZATION IS INDEXED
            ACCESS MODE IS DYNAMIC
            RECORD KEY IS CONTROL-KEY
            FILE STATUS IS CTL-STATUS-WORD.


 DATA DIVISION.
 FILE SECTION.
 FD  DEVICE-FILE
        LABEL RECORD IS STANDARD;
        VALUE OF FILE-ID IS "B:DEVICE".
 01  DEVICE-RECORD.
     05 DEVICE-KEY   PIC X(10).
     05 DEVICE-ANALYSIS OCCURS 20 TIMES PIC 999.
     05 DEVICE-TITLE   PIC X(60).


 FD  TITLE-FILE
         LABEL RECORD IS STANDARD;
         VALUE OF FILE-ID IS "B:TITLE".
 01  TITLE-RECORD.
     05 TITLE-KEY.
```

```
        07 TITLE-TYPE      PIC 9.
        07 TITLE-TASK      PIC X(9).
        07 TITLE-PERIOD    PIC X.
        07 TITLE-CONTROL   PIC X(9).
      05 TITLE-DESC        PIC X(60).

FD  CONTROL-FILE
        LABEL RECORD IS STANDARD;
       VALUE OF FILE-ID IS "B:CONTROL".
01  CONTROL-RECORD.
    05 CONTROL-KEY.
       07 CTL-TYPE       PIC 9.
       07 CTL-TASK       PIC X(4).
       07 FILLER         PIC X.
       07 CTL-SUBTASK    PIC X(4).
       07 FILLER         PIC X.
       07 CTL-NO         PIC X(9).
    05 CONTROL-ANALYSIS OCCURS 2 TIMES  PIC 999.
    05 CORR-CTL-KEY    PIC X(20).


WORKING-STORAGE SECTION.
77  NOTHING PIC X.
77  CTL-STATUS-WORD      PIC XX.
77  DEVICE-STATUS-WORD   PIC XX.
77  TITLE-STATUS-WORD   PIC XX.
77  OPTION        PIC 9 COMP.
77  LAST-KEY      PIC XX.
77  ANSWER PIC X.

PROCEDURE DIVISION.
BEGIN.
    MOVE 0 TO OPTION.
    MOVE "00" TO LAST-KEY
    DISPLAY (1, 1)ERASE.
    DISPLAY (8, 10)
    "Building Task, Subtask, Device & Control Database".
    DISPLAY (11, 25)
    "Hit any key to continue             Esc to ABORT".
    ACCEPT (LIN, COL) ANSWER WITH AUTO-SKIP.
    ACCEPT LAST-KEY FROM ESCAPE KEY.
    IF LAST-KEY = "01" GO TO STOP-RUN.
    OPEN OUTPUT DEVICE-FILE.
    OPEN OUTPUT TITLE-FILE.
    OPEN OUTPUT CONTROL-FILE.
    CLOSE DEVICE-FILE.
    CLOSE TITLE-FILE.
    CLOSE CONTROL-FILE.
    DISPLAY(1, 1)ERASE.
    DISPLAY (8, 10)
    "Database build completed!".
    DISPLAY (11, 25)
    "Hit any key to continue".
    ACCEPT (LIN, COL) ANSWER WITH AUTO-SKIP.
STOP-RUN.
```

```
STOP RUN.
```

ANNEX 3

ASTAR QUESTIONS

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ZZ00 **

ASTAR 1

(1) Performance Deficit
(2) Learning Difficulty
(3) Quality of Training - Acquisition
(4) Residual Deficit
(5) Residual Learning Difficulty
(6) Physical Similarity
(7) Functional Similarity
(8) Quality of Training - Transfer
(9) Evaluation Summary
(10) MAIN MENU

ZZ01 **

PERFORMANCE DEFICIT ASTAR 1

Examine the training objectives and consider what you know about the typical trainee's background, work experience, and prior training.

What proportion of the skills and knowledge required by the training objectives will the typical trainee have to learn in order to reach criterion performance on the training device?

Enter this proportion using the following scale:

```
FMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMM5
0     10     20     30     40     50     60     70     80     90     100
```

0 = None - the trainee does not have to learn anything.

100 = All - the trainee has to learn all of the skills and knowledge needed to meet the training objectives.

ZZ02 **

LEARNING DIFFICULTY ASTAR 1

Consider the skills and knowledge needed to meet the training objectives that the trainee must learn (the Performance Deficit that you identified).

Rate the difficulty the typical trainee will have learning these skills and knowledge using the following scale:

```
FMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMM5
0     10     20     30     40     50     60     70     80     90     100
```

0 = Very easy - it will take practically no training or practice on the device to learn the skills and knowledge needed to meet the training objectives.

100 = Very difficult - it will take a lot of training or practice on the

device to learn the skills and knowledge needed to meet the training objectives.

ZQ03 **

QUALITY OF TRAINING - ACQUISITION ASTAR 1

Consider what you know about the training device, a typical instructor (if there is one), the skills and knowledge that the typical trainee must learn, and how the device will be used.

ZZ03 **

QUALITY OF TRAINING - ACQUISITION ASTAR 1

To provide good instruction, a training system (the device and the instructor) should:

- tell the trainees what they must learn to do,
- tell the trainees how they are doing in a way that they will understand,
- provide enough practice, and
- provide a record of trainee performance.

Enter one of the following ratings:

0 = the training system does NONE of these things.
25 = the training system does ONE of these things.
50 = the training system does TWO of these things.
75 = the training system does THREE of these things.
100 = the training system does ALL of these things.

ZZ04 **

RESIDUAL DEFICIT ASTAR 1

Assume that the trainees have completed training and are proficient on the training device.

Examine the operational performance objectives. What proportion of the operational skills and knowledge will typical trainees STILL have to learn in order to meet the performance objectives?

Enter this proportion using the following scale:

FMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMM5
0 10 20 30 40 50 60 70 80 90 100

0 = None - the trainees do not have to learn anything else.

100 = All - the trainees have to learn all of the skills and knowledge needed to meet the operational performance objectives.

ZZ05 **

RESIDUAL LEARNING DIFFICULTY ASTAR 1

Consider the skills and knowledge that a graduate of the training device STILL must learn in order to meet the operational performance objectives (the Residual Deficit that you identified).

Rate the difficulty the typical trainee will have learning these skills and knowledge using the following scale:

```
FMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMM5
0      10      20      30      40      50      60      70      80      90      100
```

0 = Very easy - it will take practically no training or practice on the operational equipment to learn the skills and knowledge.

100 = Very difficult - it will take a lot of training or practice on the operational equipment to learn the skills and knowledge.

ZQ06 **

PHYSICAL SIMILARITY ASTAR 1

Physical similarity is based on a comparison of the physical characteristics of the training system and the operational system.

Compare the location, appearance, and feel of controls and displays in the training system with the controls and displays in the operational system. Compare the environmental conditions (lighting, temperature, noise levels, etc.) in the training system with the conditions in the operational system.

ZZ06 **

PHYSICAL SIMILARITY ASTAR 1

Rate the physical similarity between the training device and the operational equipment using the following scale:

```
FMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMM5
0      10      20      30      40      50      60      70      80      90      100
```

0 = Different - the trainee will notice a large difference between the training device and the operational equipment.

100 = Identical - the trainee will not notice any difference between the training device and the operational equipment.

ZQ07 **
FUNCTIONAL SIMILARITY ASTAR 1

Functional similarity is based on how the controls and displays work in the training device and in the operational equipment.

Do the corresponding controls work the same way in the training device and in the operational equipment? Do the corresponding displays show the same information in the training device and in the operational equipment?

ZZ07 **
FUNCTIONAL SIMILARITY ASTAR 1

Rate the functional similarity between the training device and the operational equipment using the following scale:

FMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMM5
0 10 20 30 40 50 60 70 80 90 100

0 = Different - all the controls and displays work differently in the training device and in the operational equipment.

100 = Identical - all the controls and displays work the same way in the training device and in the operational equipment.

ZQ08 **
QUALITY OF TRAINING - TRANSFER ASTAR 1

Consider what you know about the training device and operational situation, a typical instructor (if there is one), and how the device will be used.

ZZ08 **
QUALITY OF TRAINING - TRANSFER ASTAR 1

To provide good transfer, a device should:

- train tasks that are similar to the operational tasks,

- provide training conditions that are similar to the operational conditions, and

- provide extensive practice for difficult tasks.

Enter one of the following ratings:

0 = the training system does NONE of these things.
33 = the training system does ONE of these things.
67 = the training system does TWO of these things.
100 = the training system does ALL of these things.

ZZ09 **

ASTAR 1 - EVALUATION SUMMARY

ZZ99 **

ZZ00 **

ASTAR 2

(1) Performance Deficit
(2) Learning Difficulty
(3) Quality of Training - Acquisition
(4) Residual Deficit
(5) Residual Learning Difficulty
(6) Physical Similarity
(7) Functional Similarity
(8) Quality of Training - Transfer
(9) Evaluation Summary
(10) MAIN MENU

ZZ01 **

PERFORMANCE DEFICIT ASTAR 2

Examine the training objectives and the description of this task. Consider what you know about the typical trainee's background, work experience, and prior training.

What proportion of the skills and knowledge required to perform this task to criterion in the training device will the typical trainee have to learn?

Enter this proportion using the following scale:

FMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMM5
0 10 20 30 40 50 60 70 80 90 100

0 = None - the trainee does not have to learn anything.

100 = All - the trainee has to learn all of the skills and knowledge needed to meet the training objectives for this task.

ZZ02 **

LEARNING DIFFICULTY ASTAR 2

Consider the skills and knowledge needed to meet the training objectives for this task that the trainee must learn (the Performance Deficit that you identified).

Rate the difficulty the typical trainee will have in learning to perform this task using the following scale:

FMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMM5
0 10 20 30 40 50 60 70 80 90 100

0 = Very easy - it will take practically no training or practice on the device to learn the skills and knowledge needed to meet the training objectives for this task.

100 = Very difficult - it will take a lot of training or practice on the device to learn the skills and knowledge needed to meet the training objectives for this task.

ZQ03 ***

QUALITY OF TRAINING - ACQUISITION ASTAR 2

Consider what you know about the training device, a typical instructor (if there is one), the skills and knowledge that the typical trainee must learn, and how the device will be used.

Rate the training system using the following four scales.

ZZ03 ***

QUALITY OF TRAINING - ACQUISITION ASTAR 2

1. For what percentage of the tasks does the training system tell the trainees exactly what they must learn to do?

FMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMM5

0 10 20 30 40 50 60 70 80 90 100

0 = None - trainees are not told what they must learn to do for any of the tasks.

100 = All - trainees are told what they must learn to do for all of the tasks.

ZZ03 ***

QUALITY OF TRAINING - ACQUISITION ASTAR 2

2. For what percentage of the tasks does the training system provide enough practice?

FMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMM5

0 10 20 30 40 50 60 70 80 90 100

0 = None - practice is not provided on any of the tasks that must be learned.

100 = All - enough practice is provided on all of the tasks that must be learned.

ZZ03 ***

QUALITY OF TRAINING - ACQUISITION ASTAR 2

3. For what percentage of the tasks does the training system tell the trainees how they are doing (provide feedback) in a way that they will understand?

FMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMM5
0 10 20 30 40 50 60 70 80 90 100

0 = None - feedback about performance is not provided on any of the tasks that must be learned.

100 = All - feedback about performance is provided on all of the tasks that must be learned.

ZZ03 **
QUALITY OF TRAINING - ACQUISITION ASTAR 2

4. For what percentage of the tasks does the training system provide a record of trainee performance?

FMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMM5
0 10 20 30 40 50 60 70 80 90 100

0 = None - records of trainee performance are not provided for any of the tasks that must be learned.

100 = All - records of performance are provided for all of the tasks that must be learned.

ZZ04 **
RESIDUAL DEFICIT ASTAR 2

Assume that the trainees have completed training and are proficient on this task in the training device.

Examine the operational performance objectives for this task. What proportion of the skills and knowledge required to perform this operational task will the trainees STILL have to learn?

Enter this proportion using the following scale:

FMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMM5
0 10 20 30 40 50 60 70 80 90 100

0 = None - the trainees do not have to learn anything else to perform this task.

100 = All - the trainees have to learn all of the skills and knowledge needed to meet the operational performance objectives for this task.

ZZ05 **
RESIDUAL LEARNING DIFFICULTY ASTAR 2

Consider the skills and knowledge that a graduate of the training device

STILL must learn in order to meet the operational performance objectives for this task (the Residual Deficit that you identified).

Rate the difficulty the typical trainee will have learning these skills and knowledge using the following scale:

FMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMM5
0 10 20 30 40 50 60 70 80 90 100

0 = Very easy - it will take practically no training or practice on the operational equipment to learn the skills and knowledge.

100 = Very difficult - it will take a lot of training or practice on the operational equipment to learn the skills and knowledge.

ZQ06 **
PHYSICAL SIMILARITY ASTAR 2

Physical similarity is based on a comparison of the physical characteristics of the training system and the operational system.

Compare the location, appearance, and feel of controls and displays in the training system with the controls and displays in the operational system. Compare the environmental conditions (lighting, temperature, noise levels, etc.) in the training system with the conditions in the operational system.

ZZ06 **
PHYSICAL SIMILARITY ASTAR 2

For this task, rate the physical similarity between the training device and the operational equipment using the following scale:

FMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMM5
0 10 20 30 40 50 60 70 80 90 100

0 = Different - the trainee will notice a large difference between the training and operational equipment for this task.

100 = Identical - the trainee will not notice any difference between the training device and the operational equipment for this task.

ZQ07 **
FUNCTIONAL SIMILARITY ASTAR 2

Functional similarity is based on how the controls and displays work in the training device and in the operational equipment.

Do the corresponding controls work the same way in the training device and in the operational equipment? Do the corresponding displays show the same information in the training device and in the operational equipment?

ZZ07 ***

FUNCTIONAL SIMILARITY ASTAR 2

For this task, rate the functional similarity between the training device and the operational equipment using the following scale:

FMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMM5
0 10 20 30 40 50 60 70 80 90 100

0 = Different - for this task, all the controls and displays work differently in the training device and in the operational equipment.

100 = Identical - for this task, all the controls and displays work the same way in the training device and in the operational equipment.

ZQ08 ***

QUALITY OF TRAINING - TRANSFER ASTAR 2

Consider what you know about the training device and operational situation, a typical instructor (if there is one), and how the device will be used.

Considering the training system as a whole, answer the following three questions.

ZZ08 ***

QUALITY OF TRAINING - TRANSFER ASTAR 2

1. What percentage of the tasks that must be learned in the training device are similar to the tasks that are performed in the operational situation?

FMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMM5
0 10 20 30 40 50 60 70 80 90 100

0 = None - none of the training tasks are similar to the operational tasks.

100 = All - all of the training tasks are identical to the operational tasks.

ZZ08 ***

QUALITY OF TRAINING - TRANSFER ASTAR 2

2. For what percentage of the tasks that must be learned in the training device are the conditions of performance similar to the operational situation?

FMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMM5
0 10 20 30 40 50 60 70 80 90 100

0 = None - conditions in training are not similar to the operational situation for any of the tasks.

100 = All - conditions in training are similar to the operational situation for all of the tasks.

ZZ08 **
QUALITY OF TRAINING - TRANSFER ASTAR 2

3. For what percentage of the tasks that must be learned in the training device is an extensive amount of practice given?

FMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMM5
0 10 20 30 40 50 60 70 80 90 100

0 = None - not even a single task is practiced extensively.

100 = All - every task that trainees must learn in the device is practiced extensively.

ZZ09 **
ASTAR 2 - EVALUATION SUMMARY

ZZ99 **

ZZ00 **

(1) Performance Deficit
(2) Learning Difficulty
(3) Quality of Training-Acquisition
(4) Residual Deficit
(5) Residual Learning Difficulty
(6) Physical Similarity
(7) Functional Similarity
(8) Quality of Training-Transfer
(9) Evaluation Summary

ZQ01 **

PERFORMANCE DEFICIT ASTAR 3

Examine the training objectives and the description of each training subtask. Consider what you know about the typical trainee's background, work experience, and prior training.

Rate how well the typical trainee will be able to perform each subtask in the training device. Enter your ratings using the following definitions.

ZZ01 **

PERFORMANCE DEFICIT ASTAR 3

Rating Definition

0 = Cannot perform this subtask.
Has had no previous training.

1 = Cannot perform this subtask.
Has had orientation training only.

2 = Can perform this subtask only if assisted in every step.
Has had familiarization training only.

3 = Can perform this subtask but needs more training.
Has had procedural training.

4 = Can perform this subtask completely and accurately.
Has received skill training.

ZZ02 **

LEARNING DIFFICULTY ASTAR 3

Consider the skills and knowledge needed to meet the training objectives for this subtask that the trainee must learn (the Performance Deficit that you identified). Answer the following six questions.

1. Will the trainee use job aids or memory aids to perform this subtask in the training device?

Definition - Job and memory aids assist in doing a subtask correctly. Some examples are:

- Documents (Tech Manuals, etc.),
- Instructions printed on the equipment, and
- Memory joggers (S-A-L-U-T-E).

Enter one of these ratings:

0 = Job or memory aids ARE used
1 = Job or memory aids ARE NOT used.

ZZ02 **
LEARNING DIFFICULTY ASTAR 3

2. How many steps are required to do this subtask?

Definition - A step is a separate physical activity with well defined, observable beginning and end points. A subtask may have one step (identify enemy vehicles) or many steps (those involved in disassembling a rifle).

Enter one of these ratings:

0 = The subtask contains LESS than 10 steps.
1 = The subtask contains MORE than 10 steps.

ZZ02 **
LEARNING DIFFICULTY ASTAR 3

3. Must the trainee perform the steps in this subtask in sequence?

Enter one of these ratings:

0 = The subtask steps DO NOT have to be performed in order.
1 = The subtask steps MUST BE performed in a specific order.

ZZ02 **
LEARNING DIFFICULTY ASTAR 3

4. Does the subtask have a built-in logic so that the trainees know when they are doing it correctly?

Definition - Some subtasks consist of steps that form a logical or natural sequence, like fixing a tire or changing a light bulb. Other subtasks have steps that seem arbitrary, like many trouble-shooting subtasks. Some subtasks contain a mixture of "natural" and "unnatural" steps. For example, safety steps often break the natural flow and logic of a subtask.

Enter one of these ratings:

0 = The subtask HAS a built-in logic.
1 = The subtask DOES NOT HAVE a built-in logic.

ZZ02 ***

LEARNING DIFFICULTY ASTAR 3

5. What are the mental requirements of the subtask?

Definition - Repetitive, physical subtasks require almost no mental work. Many subtasks that look easy require a lot of mental work, such as planning an attack or trouble-shooting a complex piece of equipment. Consider the number of decisions or calculations that must be made in choosing your answer. Also consider the impact of any job aid.

Enter one of these ratings:

0 = The subtask IS NOT mentally demanding.
3 = The subtask IS mentally demanding.

ZZ02 ***

LEARNING DIFFICULTY ASTAR 3

6. What are the motor control demands of the subtask?

Definition - Motor control refers to precise finger, hand, or arm movements, not to large body movement. Sheer physical strength does not require much motor control. Tracking a target and repairing a gauge require a lot of motor control.

Enter one of these ratings:

0 = The motor control demands are SMALL.
3 = The motor control demands are LARGE.

ZQ03 ***

QUALITY OF TRAINING - ACQUISITION ASTAR 3

Consider what you know about the training device, a typical instructor (if there is one), the skills and knowledge that the typical trainee must learn, and how device will be used.

For this subtask, answer the following 11 questions.

ZZ03 ***

QUALITY OF TRAINING - ACQUISITION ASTAR 3

1. To what extent will the training system tell trainees, at key stages of training, the training objective of this subtask and their current standing relative to the objective?

FMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMM5
0 10 20 30 40 50 60 70 80 90 100

0 = Not at all - trainees are never told the training objective nor are they told their standing relative to the objective.

100 = Completely - trainees are told the training objective and their standing relative to the objective throughout training.

ZZ03 **
QUALITY OF TRAINING - ACQUISITION ASTAR 3

2. To what extent will the trainee begin with easy examples of this subtask and progress to more difficult examples?

FMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMM5
0 10 20 30 40 50 60 70 80 90 100

0 = Not at all - the material to be learned is not sequenced in terms of difficulty.

100 = Completely - the material to be learned is sequenced in terms of difficulty from easy to hard.

ZZ03 **
QUALITY OF TRAINING - ACQUISITION ASTAR 3

3. To what extent will the training system tell the trainees what they did and how well they did it?

FMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMM5
0 10 20 30 40 50 60 70 80 90 100

0 = Not at all - the training system provides trainees with no information about their performance.

100 = Completely - the training system provides trainees with explicit information about what they did and how well they did it.

ZZ03 **
QUALITY OF TRAINING - ACQUISITION ASTAR 3

4. To what extent will the training system provide enough practice of this subtask?

FMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMM5
0 10 20 30 40 50 60 70 80 90 100

0 = Minimum practice - there is no practice, rehearsal, or repetition of this subtask.

100 = Maximum practice - there is extensive practice, rehearsal, or repetition of this subtask.

ZZ03 **
QUALITY OF TRAINING - ACQUISITION ASTAR 3

5. To what extent will the training system provide help (such as prompts and cues) to trainees early in training and gradually fade this help out as training progresses?

FMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMM5
0 10 20 30 40 50 60 70 80 90 100

0 = Not at all - training help is not provided.

100 = Completely - the training system provides help early in training and gradually fades it out late in training.

ZZ03 **
QUALITY OF TRAINING - ACQUISITION ASTAR 3

6. To what extent will the training system organize the material to be learned into small blocks or steps?

FMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMM5
0 10 20 30 40 50 60 70 80 90 100

0 = Not at all - the material to be learned is not well organized.

100 = Completely - the material to be learned is well organized.

ZZ03 **
QUALITY OF TRAINING - ACQUISITION ASTAR 3

7. To what extent does the training system use memory aids to help train?

FMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMM5
0 10 20 30 40 50 60 70 80 90 100

0 = Not at all - although memory aids could be used, the training system does not use them.

100 = Completely - the training system uses memory aids to help learning when they are appropriate.

ZZ03 **

QUALITY OF TRAINING - ACQUISITION ASTAR 3

8. To what extent does the training system start with a wide tolerance for errors, narrowing the tolerance as training progresses?

FMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMM5
0 10 20 30 40 50 60 70 80 90 100

0 = Not at all - error tolerances are not varied as training progresses.

100 = Completely - error boundaries are broad at the start of training and become narrow late in training.

ZZ03 **
QUALITY OF TRAINING - ACQUISITION ASTAR 3

9. To what extent does the training device provide a variety of examples of this subtask?

FMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMM5
0 10 20 30 40 50 60 70 80 90 100

0 = Not at all - the device presents only one version of this subtask.

100 = Completely - the device presents a wide variety of examples of this subtask.

ZZ03 **
QUALITY OF TRAINING - ACQUISITION ASTAR 3

10. To what extent does the training system present difficult examples of this subtask?

FMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMM5
0 10 20 30 40 50 60 70 80 90 100

0 = Not at all - the device presents only easy examples of this subtask.

100 = Completely - the device presents the most difficult examples of this subtask.

ZZ03 **
QUALITY OF TRAINING - ACQUISITION ASTAR 3

11. To what extent can the training system present different examples of this subtask as a function of the trainee's performance?

FMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMM5
0 10 20 30 40 50 60 70 80 90 100

0 = Not at all - the device provides lock-step instruction; training is not interactive.

100 = Completely - the program of instruction is varied as a function of trainee performance; the device provides for interactive training.

ZQ04**
RESIDUAL DEFICIT ASTAR 3

Assume that the trainees have completed training and are proficient on all subtasks in the training device. Examine the performance objectives and the description of each operational subtask.

Rate how well the typical trainee will be able to perform each subtask in the operational situation. Enter your rating using the following definitions.

ZZ04 ***
RESIDUAL DEFICIT ASTAR 3

Rating Definition

0 = Cannot perform this subtask.
Has had no previous training.

1 = Cannot perform this subtask.
Has had orientation training only.

2 = Can perform this subtask only if assisted in every step.
Has had familiarization training only.

3 = Can perform this subtask but needs more training.
Has had procedural training.

4 = Can perform this subtask completely and accurately.
Has received skill training.

ZQ05 ***
RESIDUAL LEARNING DIFFICULTY ASTAR 3

Consider the skills and knowledge that a graduate of the training device STILL must learn in order to meet the operational performance objectives for this subtask (the Residual Deficit that you identified).

Answer the following six questions.

ZZ05 ***
RESIDUAL LEARNING DIFFICULTY ASTAR 3

1. Will the trainee use job aids or memory aids to perform this subtask in the operational setting?

   Definition - Job and memory aids assist in doing a subtask correctly. Some examples are:

   - Documents (SM, Tech Manuals, etc.),
   - Instructions printed on the equipment, and
   - Memory joggers (S-A-L-U-T-E).

Enter one of these ratings:

0 = Job or memory aids ARE used
1 = Job or memory aids ARE NOT used.

ZZ05 **
RESIDUAL LEARNING DIFFICULTY ASTAR 3

2. How many steps are required to do this subtask?

   Definition - A step is a separate physical activity with well defined, observable beginning and end points. A subtask may have one step (identify enemy vehicles) or many steps (those involved in disassembling a rifle).

Enter one of these ratings:

0 = The subtask contains LESS than 10 steps.
1 = The subtask contains MORE than 10 steps.

ZZ05 **
RESIDUAL LEARNING DIFFICULTY ASTAR 3

3. Must the trainee perform the steps in this subtask in sequence?

Enter one of these ratings:

0 = The subtask steps DO NOT have to be performed in order.
1 = The subtask steps MUST BE performed in a specific order.

ZZ05 **
RESIDUAL LEARNING DIFFICULTY ASTAR 3

4. Does the subtask have a built-in logic so that the trainees know when they are doing it correctly?

   Definition - Some subtasks consist of steps that form a logical or natural sequence, like fixing a tire or changing a light bulb. Other subtasks have steps that seem arbitrary, like many trouble-shooting subtasks. Some subtasks contain a mixture of "natural" and "unnatural" steps. For example, safety steps often break the natural flow and logic of a subtask.

Enter one of these ratings:

0 = The subtask HAS a built-in logic.
1 = The subtask DOES NOT HAVE a built-in logic.

ZZ05 **

RESIDUAL LEARNING DIFFICULTY ASTAR 3

5. What are the mental requirements of the subtask?

Definition - Repetitive, physical subtasks require almost no mental work. Many subtasks that look easy require a lot of mental work, such as planning an attack or trouble-shooting a complex piece of equipment. Consider the number of decisions or calculations that must be made in choosing your answer. Also consider the impact of any job aid.

Enter one of these ratings:

0 = The subtask IS NOT mentally demanding.
3 = The subtask IS mentally demanding.

ZZ05 **

RESIDUAL LEARNING DIFFICULTY ASTAR 3

6. What are the motor control demands of the subtask?

Definition - Motor control refers to precise finger, hand, or arm movements, not to large body movement. Sheer physical strength does not require much motor control. Tracking a target and repairing a gauge require a lot of motor control.

Enter one of these ratings:

0 = The motor control demands are SMALL.
3 = The motor control demands are LARGE.

ZQ06 **

PHYSICAL SIMILARITY ASTAR 3

Physical similarity is based on a comparison of the physical characteristics of the training system and the operational system.

Compare the location, appearance, and feel of the controls and displays in the training system with the controls and displays in the operational system. Compare the environmental conditions (lighting, temperature, noise levels, etc.) in the training system with the conditions in the operational system.

ZZ06 **
PHYSICAL SIMILARITY ASTAR 3

For this subtask, rate the physical similarity between this operational control or display and its corresponding control or display in the training system. Use the following scale:

FMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMM5
0 10 20 30 40 50 60 70 80 90 100

0 = Different - the trainee will notice a large difference between this control/display in the training device and in the operational equipment.

100 = Identical - the trainee will not notice any difference between this control/display in the training device and in the operational equipment.

ZQ07 **
FUNCTIONAL SIMILARITY ASTAR 3

Functional similarity is based on how the controls and displays work in the training device and in the operational equipment.

Do the corresponding controls work the same way in the training device and in the operational equipment? Do the corresponding displays show the same information in the training device and in the operational equipment?

ZZ07 **
FUNCTIONAL SIMILARITY ASTAR 3

For this subtask, rate the functional similarity between this operational control or display and its corresponding control or display in the training device. Use the following scale:

FMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMM5
0 10 20 30 40 50 60 70 80 90 100

0 = Different - this control/display works differently in the training device and in the operational equipment.

100 = Identical - this control/display works the same way in the training device and in the operational equipment.

ZQ08 **
QUALITY OF TRAINING - TRANSFER ASTAR 3

Consider what you know about the training device and operational situation, a typical instructor (if there is one), and how the device will be used.

For this subtask, answer the following eight questions.

ZZ08 **

QUALITY OF TRAINING - TRANSFER ASTAR 3

1. To what extent is the subtask that must be learned in the training device similar to the subtask that is performed in the operational situation?

FMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMM5

0 10 20 30 40 50 60 70 80 90 100

0 = Not at all - the device subtask is not similar to the operational subtask.

100 = Completely - the device subtask is identical to the operational subtask.

ZZ08 **

QUALITY OF TRAINING - TRANSFER ASTAR 3

2. To what extent are features of the operational setting presented in the training device?

FMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMM5

0 10 20 30 40 50 60 70 80 90 100

0 = Not at all - the device does not present any features of the operational setting for this subtask.

100 = Completely - the device presents all the features of the operational setting for this subtask.

ZZ08 **

QUALITY OF TRAINING - TRANSFER ASTAR 3

3. To what extent will the training system make clear to the trainee the relationship between the training objective and the operational objective for this subtask?

FMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMM5

0 10 20 30 40 50 60 70 80 90 100

0 = Not at all - the relationship of training objective to the operational objective is not made clear to the trainee.

100 = Completely - the relationship of the training objective to the operational objective is made clear to the trainee.

ZZ08 **
QUALITY OF TRAINING - TRANSFER ASTAR 3

4. To what extent later in training does the training system gradually reduce training help for this subtask?

FMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMM5
0 10 20 30 40 50 60 70 80 90 100

0 = Not at all - training help is not reduced toward the end of training.

100 = Completely - training help is gradually faded out.

ZZ08 **
QUALITY OF TRAINING - TRANSFER ASTAR 3

5. By the end of training on the device, to what extent do the trainees see and do the the same things that they will see and do in the operational situation?

FMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMM5
0 10 20 30 40 50 60 70 80 90 100

0 = Not at all - trainees see and do different things in the training device than they see and do in the operational situation at the end of training.

100 = Completely - trainees see and do the same things in the training device that they see and do in the operational situation at the end of training.

ZZ08 **
QUALITY OF TRAINING - TRANSFER ASTAR 3

6. To what extent will the training system permit trainees to practice in the device until they can demonstrate a job entry level of skill on this subtask?

FMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMM5
0 10 20 30 40 50 60 70 80 90 100

0 = Not at all - the amount of practice trainees receive will not enable them to perform at a job entry skill level.

100 = Completely - the amount of practice trainees receive will enable them to perform at a job entry skill level.

ZZ08 **

QUALITY OF TRAINING - TRANSFER ASTAR 3

7. To what extent will the training system provide overlearning to enable trainees to cope with stressful real-world situations when performing this subtask?

FMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMM5
0 10 20 30 40 50 60 70 80 90 100

0 = Not at all - the training system does not provide overlearning of this subtask.

100 = Completely - the training system will permit trainees to overlearn this subtask.

ZZ08 **

QUALITY OF TRAINING - TRANSFER ASTAR 3

8. To what extent will the training system provide for practice that spans the range of operational situations for this subtask? (For example, easy to difficult problems, various signal sources and patterns, etc.)

FMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMM5
0 10 20 30 40 50 60 70 80 90 100

0 = Not at all - the conditions under which practice occurs are constant and represent a small portion of the operational situation.

100 = Completely - practice occurs under a broad range of conditions that span the operational situation.

ZZ09 **

(10) ASTAR 3 - EVALUATION SUMMARY

ZZ99 **

ANNEX 4

ORIGINAL ASTAR FLOW DIAGRAMS AND SUPPORTING DATA

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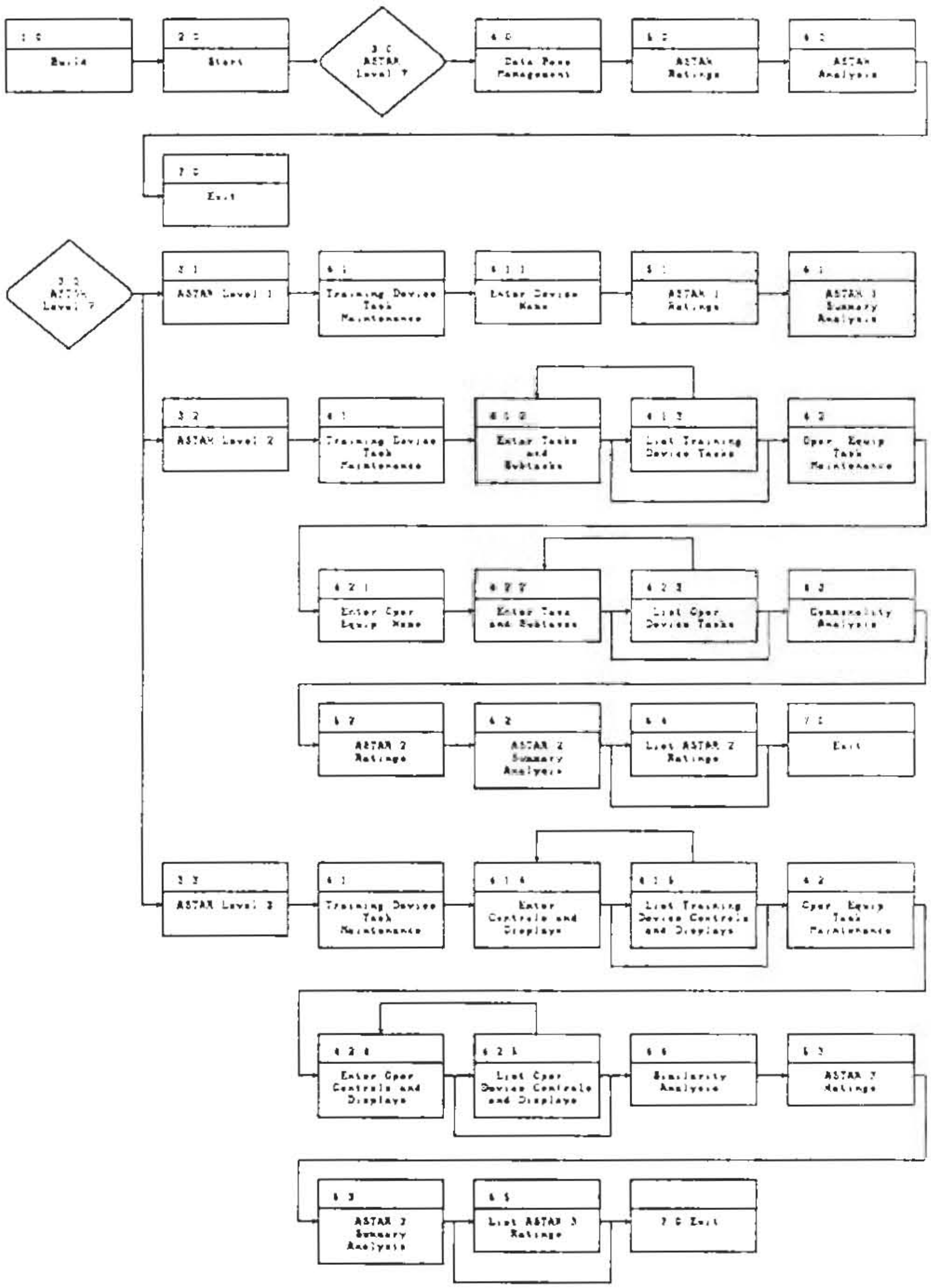
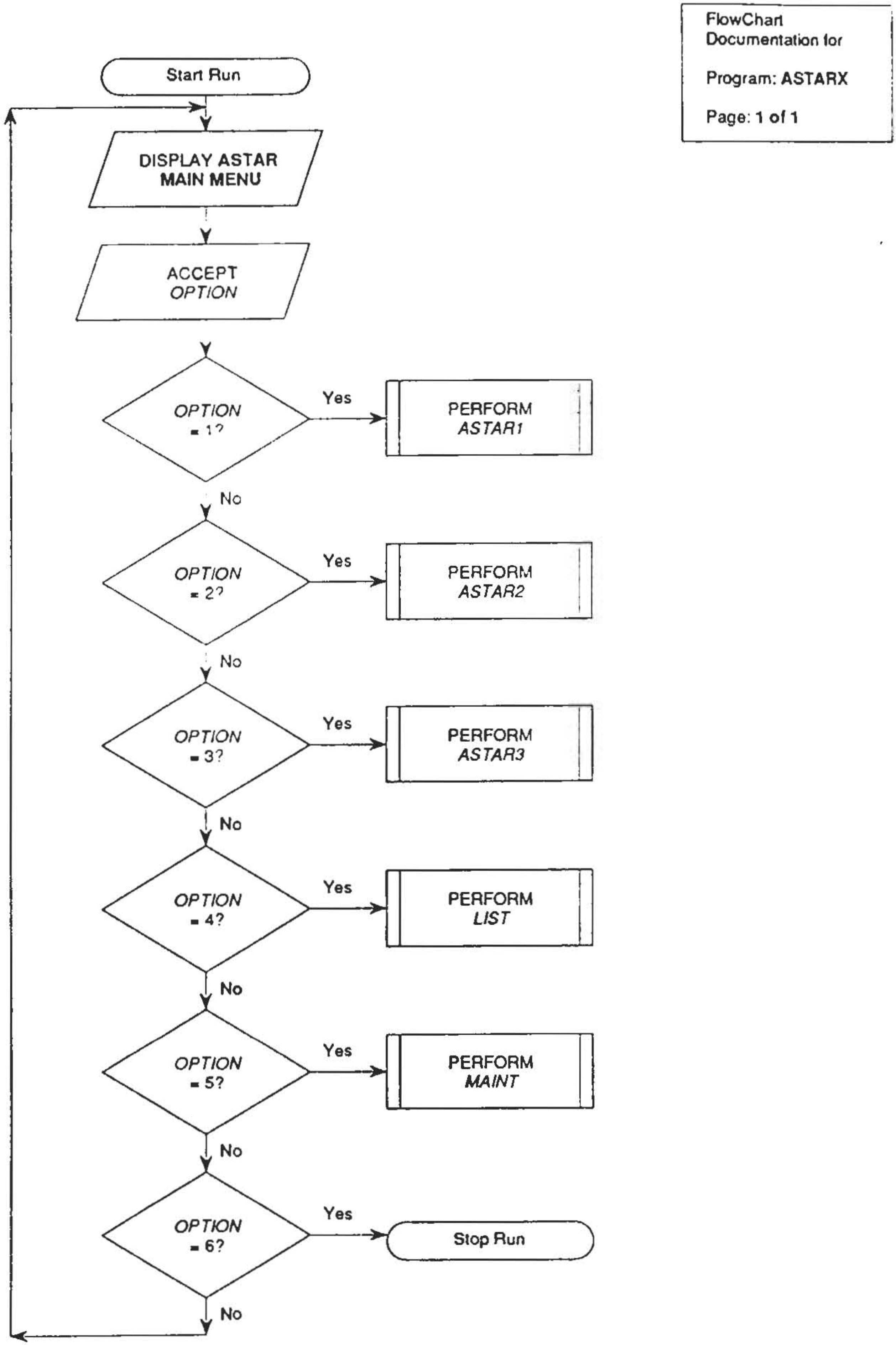
ASTAR 2.0



Build
Start
ASTAR Level ?
Data Base Management
ASTAR Ratings
ASTAR Analysis
Exit
ASTAR Level ?
ASTAR Level 1
Training Device Task Maintenance
Enter Device Name
ASTAR 1 Ratings
ASTAR 1 Summary Analysis
ASTAR Level 2
Training Device Task Maintenance
Enter Tasks and Subtasks
List Training Device Tasks
Oper. Equip Task Maintenance
Enter Oper Equip. Name
Enter Tasks and Subtasks
List Oper Device Tasks
Commonality Analysis
ASTAR 2 Ratings
ASTAR 2 Summary Analysis
List ASTAR 2 Ratings
Exit
ASTAR Level 3
Training Device Task Maintenance
Enter Controls and Displays
List Training Device Controls and Displays
Oper. Equip Task Maintenance
Enter Oper Controls and Displays
List Oper Device Controls and Displays
Similarity Analysis
ASTAR 3 Ratings
ASTAR 3 Summary Analysis
List ASTAR 3 Ratings
7.0 Exit


FlowChart
Documentation for
Program: ASTARX
Page: 1 of 1
Start Run
DISPLAY ASTAR
MAIN MENU
ACCEPT
OPTION
OPTION
= 1?
Yes
PERFORM
ASTAR1
No
OPTION
= 2?
Yes
PERFORM
ASTAR2
No
OPTION
= 3?
Yes
PERFORM
ASTAR3
No
OPTION
= 4?
Yes
PERFORM
LIST
No
OPTION
= 5?
Yes
PERFORM
MAINT
No
OPTION
= 6?
Yes
Stop Run
No

ASTAR MAIN MENU

```
                ASTAR MAIN MENU
                    ver 2.0

                 (1) ASTAR 1

                 (2) ASTAR 2

                 (3) ASTAR 3

                 (4) Display Ratings

                 (5) Database Maintenance

                 (6) EXIT PROGRAM

          Enter option
```

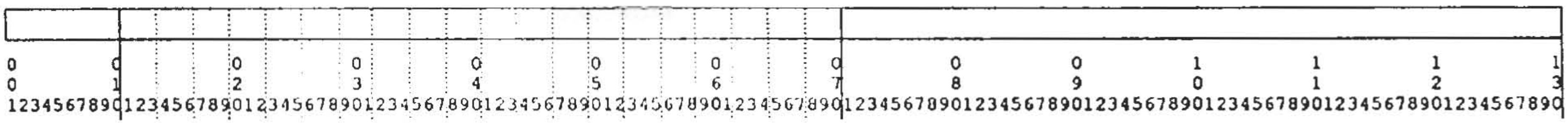
File Structure Documentation for

Program: ASTAR1

Page: 1 of 1

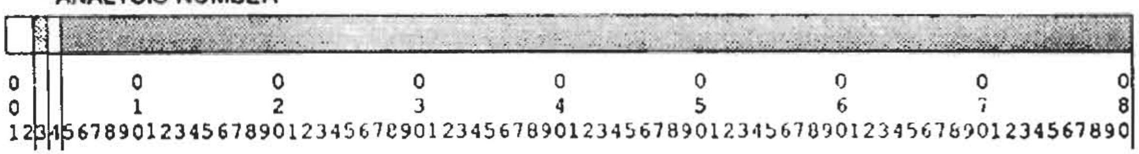
DEVICE-RECORD ("B:DEVICE")

DEVICE-KEY DEVICE-ANALYSIS OCCURS 20 TIMES DEVICE-TITLE



TEXT-RECORD ("ASTAR1.DOC")

REC-INDICATOR
ANALYSIS-NUMBER



ASTAR1 MENU

```
                        ASTAR 1

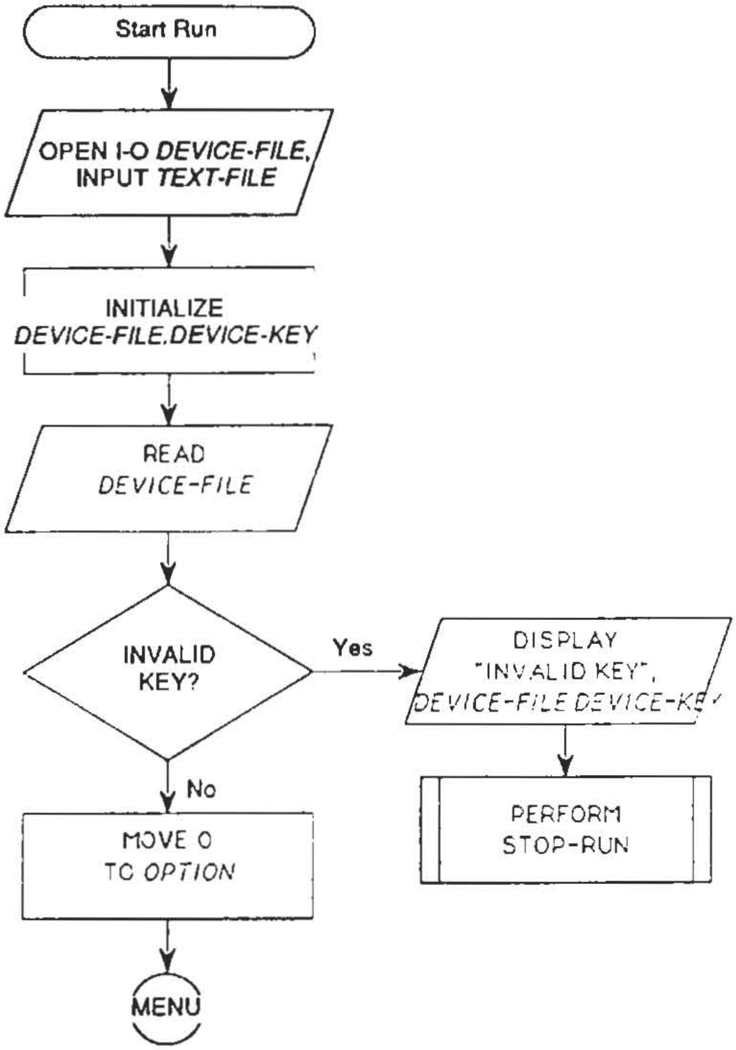
                (1)  Performance Deficit
                (2)  Learning Difficulty
                (3)  Quality of Training-Acquisition
                (4)  Residual Deficit
                (5)  Residual Learning Difficulty
                (6)  Physical Similarity
                (7)  Functional Similarity
                (8)  Quality of Training-Transfer
                (9)  Evaluation Summary


    Enter Option Number
```

EVALUATION SUMMARY SCREEN

```
                         Evaluation Summary

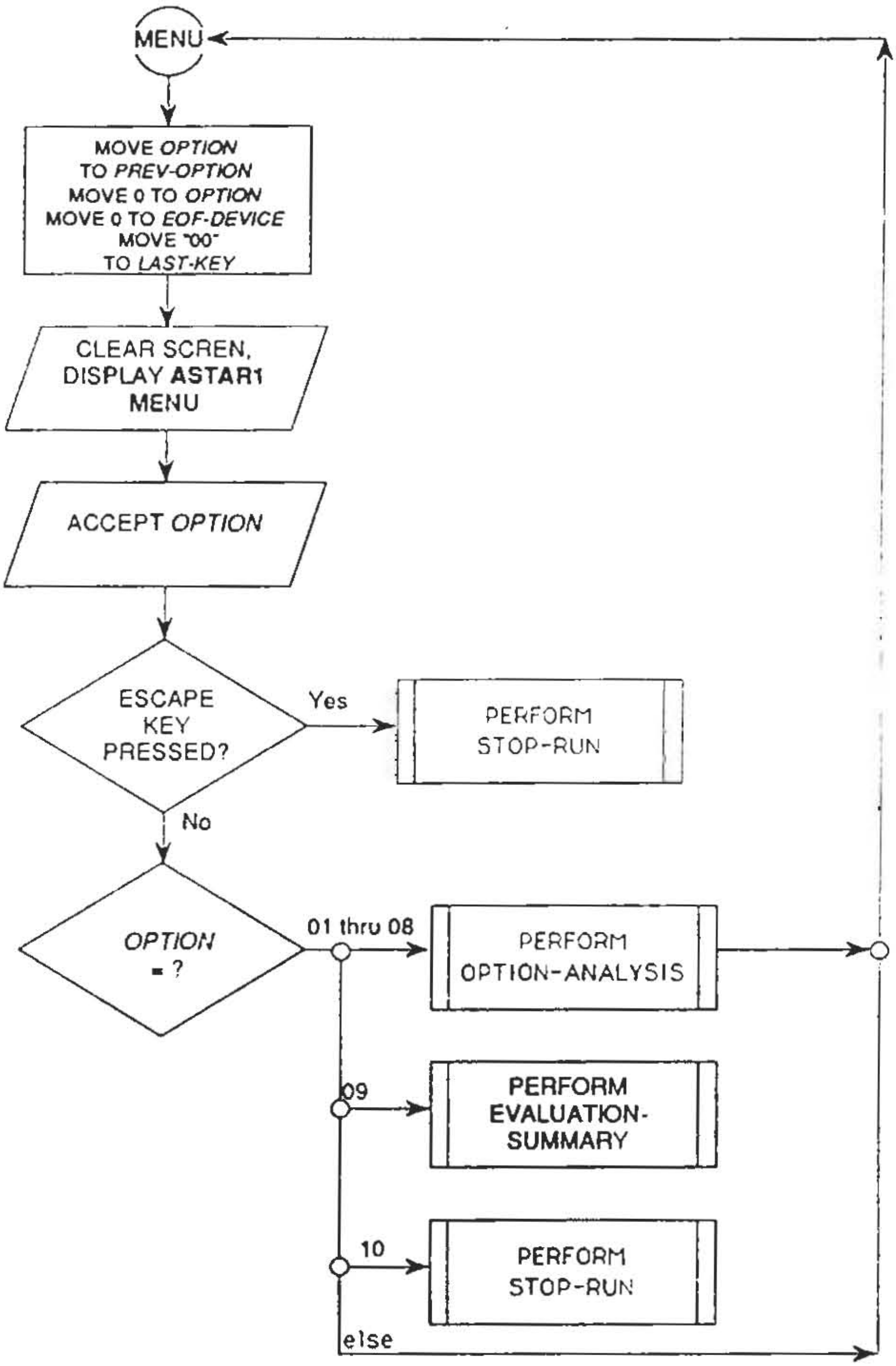
  Performance Deficit               ZZ9
  Learning Difficulty               ZZ9
       Training Problem                 ZZ,ZZZ.99
  Quality of Training Acquisition   ZZ9
       Acquisition-Efficiency           ZZ,ZZZ.99
                 Acquisition                          ZZ,ZZZ.99
  Residual Deficit                   ZZ9
  Residual Learning Diffuculty       ZZ9
  Physical Similarity                ZZ9
  Functional Similarity              ZZ9
       Transfer Problem                 ZZ,ZZZ.99
  Quality of Training-Transfer       ZZ9
       Transfer Efficiency              ZZ,ZZZ.99
                 Transfer                             ZZ,ZZZ.99
                     d                                ZZ,ZZZ.99
```

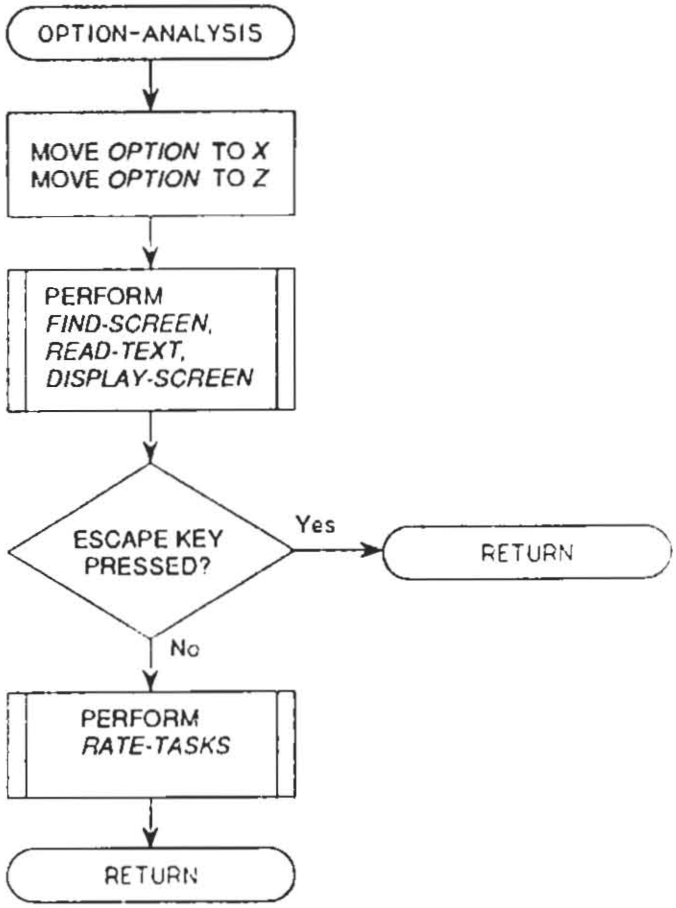

Start Run
OPEN I-O DEVICE-FILE, INPUT TEXT-FILE
INITIALIZE DEVICE-FILE.DEVICE-KEY
READ DEVICE-FILE
INVALID KEY?
Yes
DISPLAY "INVALID KEY", DEVICE-FILE DEVICE-KEY
PERFORM STOP-RUN
No
MOVE 0 TO OPTION
MENU

Generalized FlowChart Documentation for

Program: **ASTAR1**

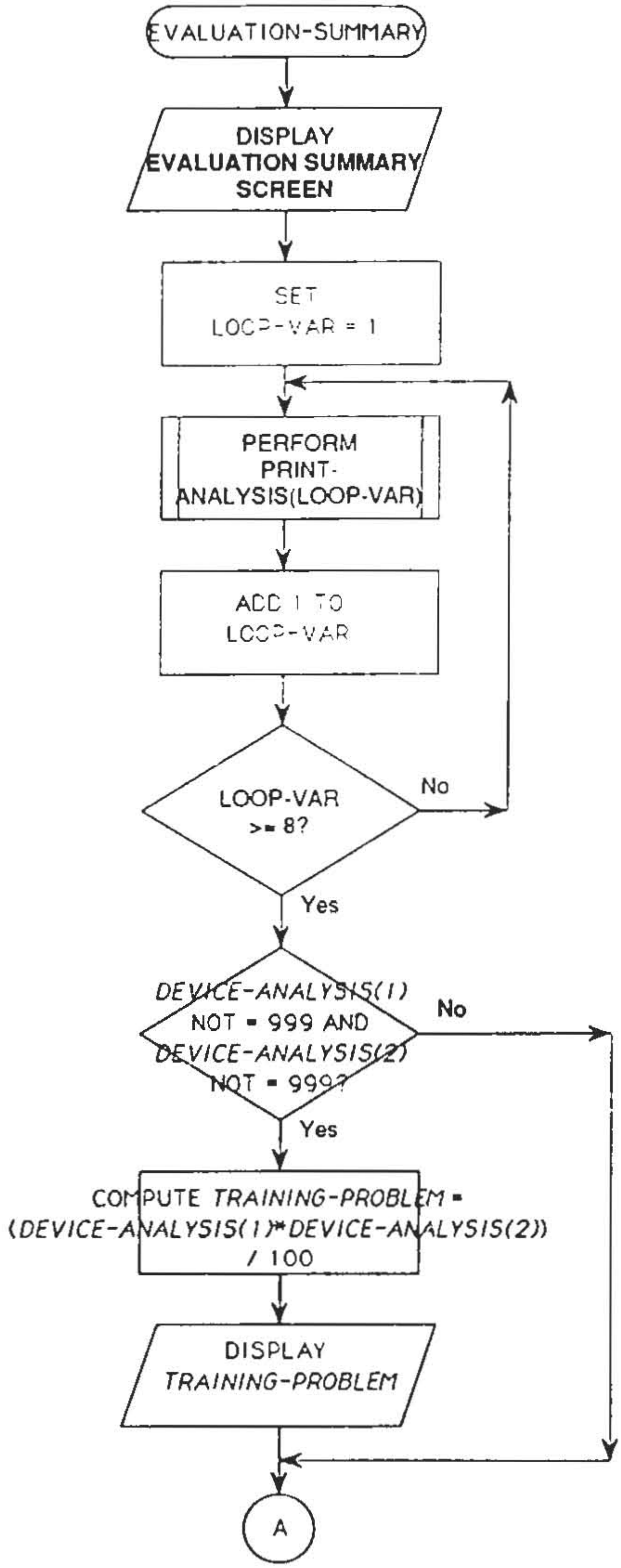
Page: 2 of 13

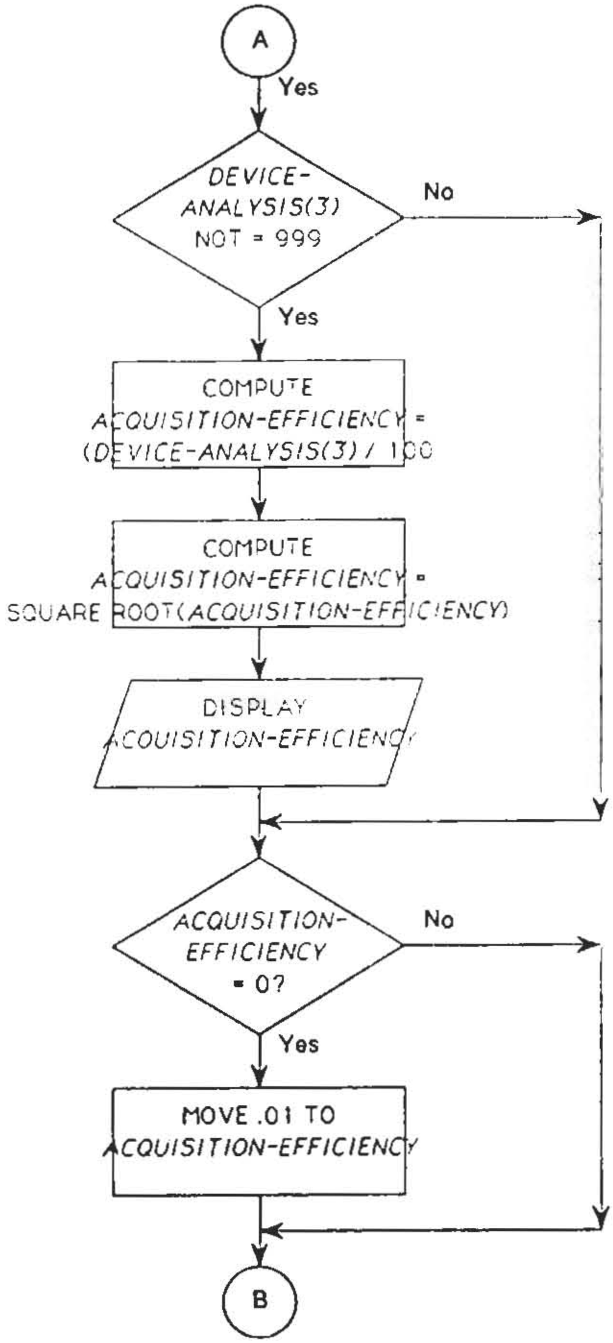


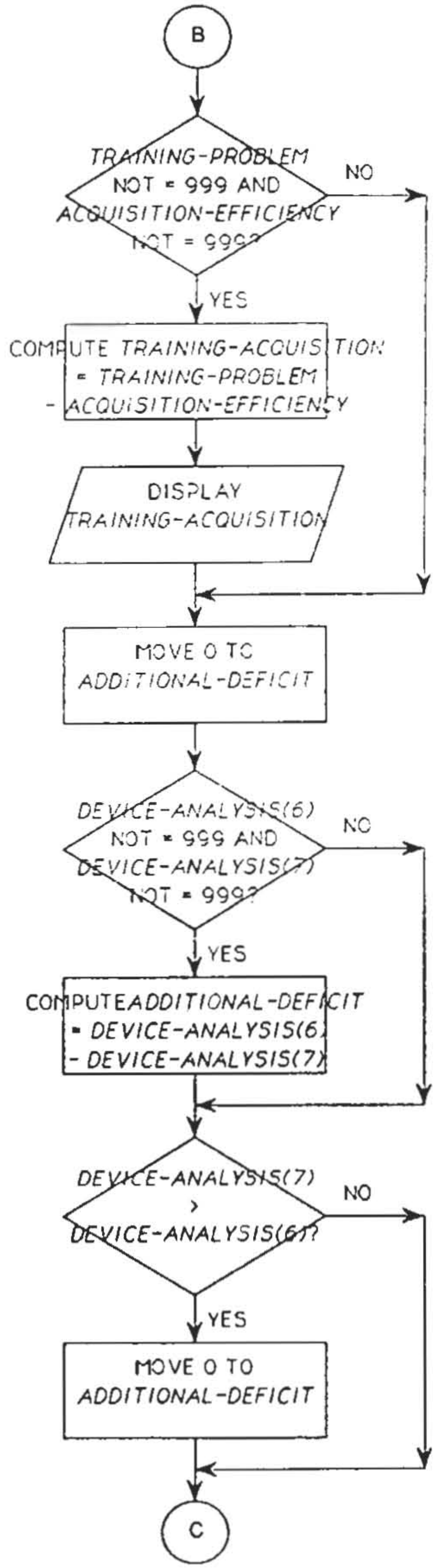

OPTION-ANALYSIS
MOVE *OPTION* TO *X*
MOVE *OPTION* TO *Z*
PERFORM
FIND-SCREEN,
READ-TEXT,
DISPLAY-SCREEN
ESCAPE KEY PRESSED?
Yes
RETURN
No
PERFORM
RATE-TASKS
RETURN

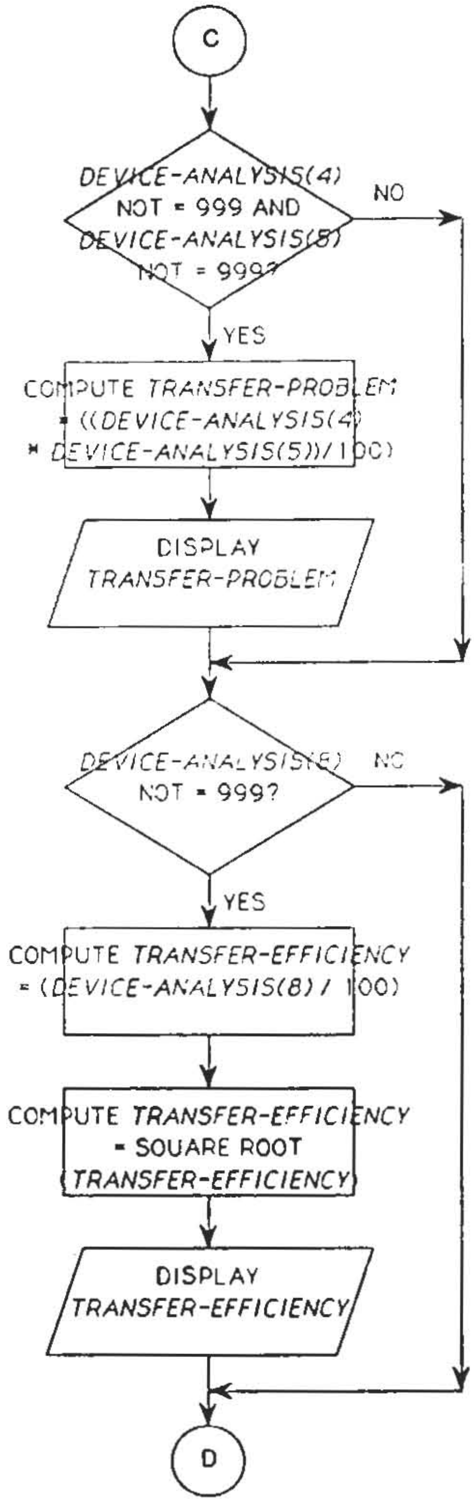
Generalized FlowChart Documentation for

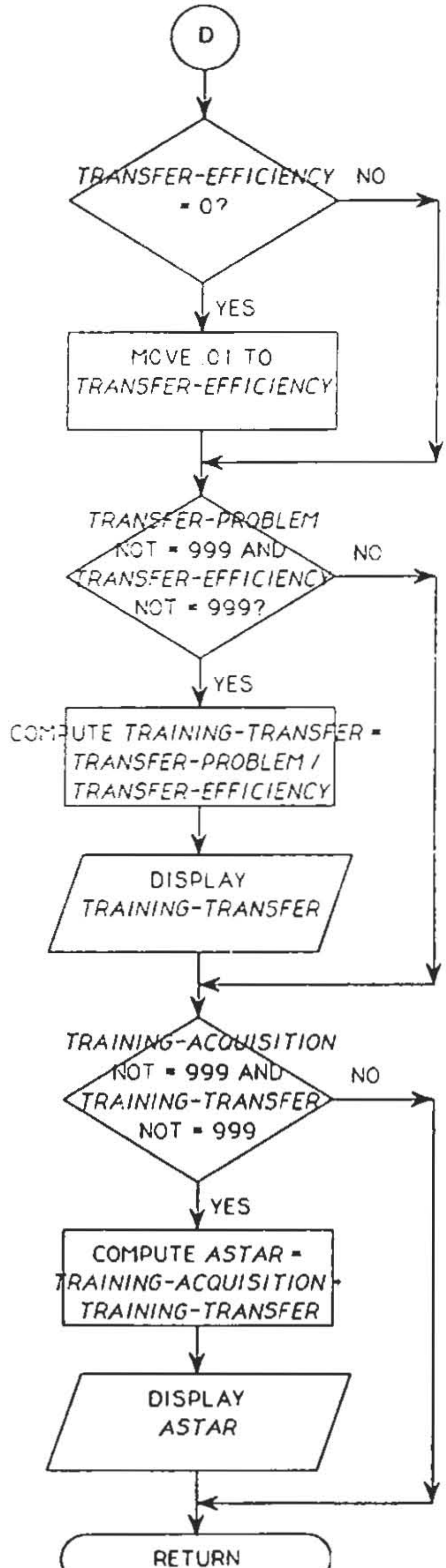
Program: ASTAR1

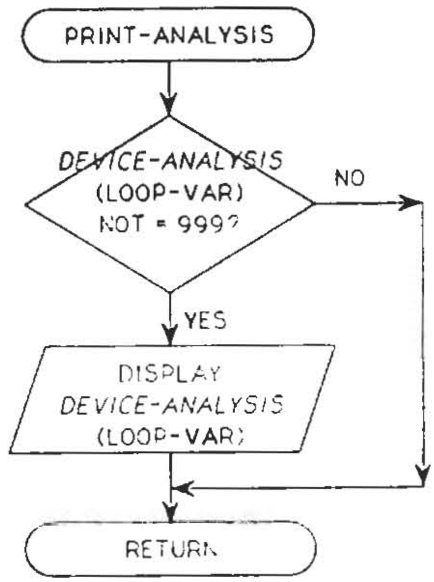


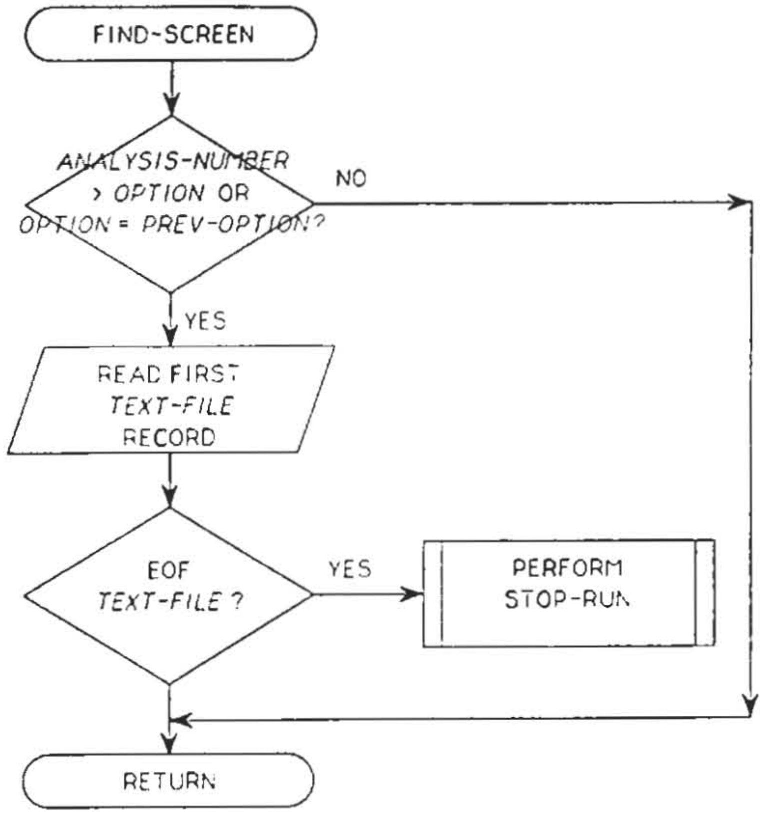

A
Yes
DEVICE-ANALYSIS(3) NOT = 999
No
Yes
COMPUTE ACQUISITION-EFFICIENCY = (DEVICE-ANALYSIS(3) / 100
COMPUTE ACQUISITION-EFFICIENCY = SQUARE ROOT(ACQUISITION-EFFICIENCY)
DISPLAY ACQUISITION-EFFICIENCY
ACQUISITION-EFFICIENCY = 0?
No
Yes
MOVE .01 TO ACQUISITION-EFFICIENCY
B


B
TRAINING-PROBLEM NOT = 999 AND ACQUISITION-EFFICIENCY NOT = 999?
NO
YES
COMPUTE TRAINING-ACQUISITION = TRAINING-PROBLEM - ACQUISITION-EFFICIENCY
DISPLAY TRAINING-ACQUISITION
MOVE 0 TO ADDITIONAL-DEFICIT
DEVICE-ANALYSIS(6) NOT = 999 AND DEVICE-ANALYSIS(7) NOT = 999?
NO
YES
COMPUTE ADDITIONAL-DEFICIT = DEVICE-ANALYSIS(6) - DEVICE-ANALYSIS(7)
DEVICE-ANALYSIS(7) > DEVICE-ANALYSIS(6)?
NO
YES
MOVE 0 TO ADDITIONAL-DEFICIT
C

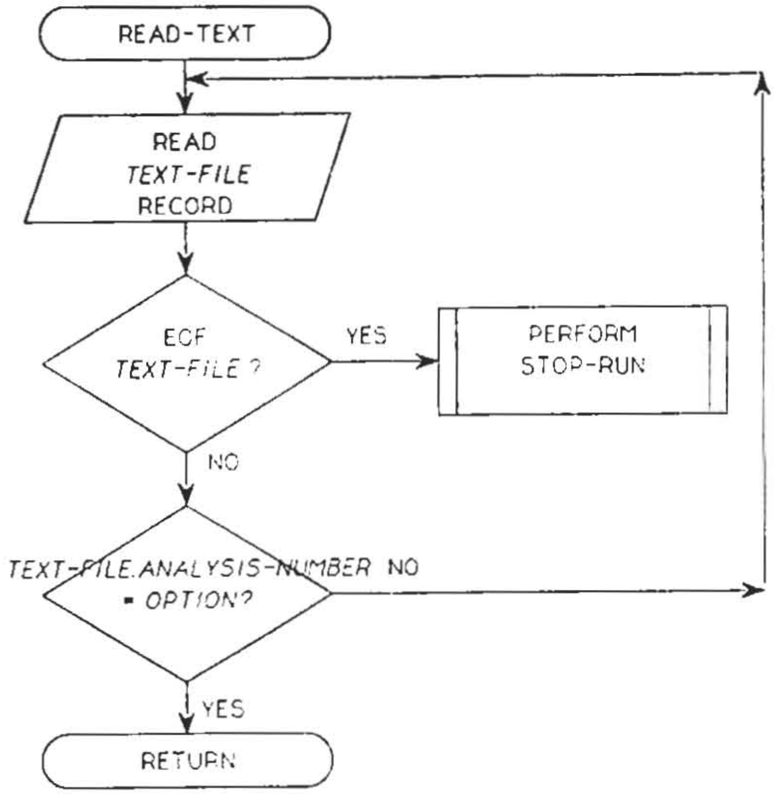

C
DEVICE-ANALYSIS(4) NOT = 999 AND DEVICE-ANALYSIS(5) NOT = 999?
NO
YES
COMPUTE TRANSFER-PROBLEM = ((DEVICE-ANALYSIS(4) * DEVICE-ANALYSIS(5))/100)
DISPLAY TRANSFER-PROBLEM
DEVICE-ANALYSIS(8) NOT = 999?
NO
YES
COMPUTE TRANSFER-EFFICIENCY = (DEVICE-ANALYSIS(8) / 100)
COMPUTE TRANSFER-EFFICIENCY = SQUARE ROOT (TRANSFER-EFFICIENCY)
DISPLAY TRANSFER-EFFICIENCY
D

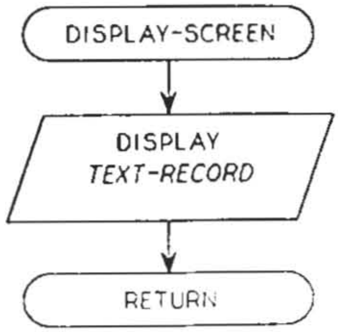

D
TRANSFER-EFFICIENCY = 0?
NO
YES
MOVE .01 TO TRANSFER-EFFICIENCY
TRANSFER-PROBLEM NOT = 999 AND TRANSFER-EFFICIENCY NOT = 999?
NO
YES
COMPUTE TRAINING-TRANSFER = TRANSFER-PROBLEM / TRANSFER-EFFICIENCY
DISPLAY TRAINING-TRANSFER
TRAINING-ACQUISITION NOT = 999 AND TRAINING-TRANSFER NOT = 999
NO
YES
COMPUTE ASTAR = TRAINING-ACQUISITION - TRAINING-TRANSFER
DISPLAY ASTAR
RETURN


PRINT-ANALYSIS
DEVICE-ANALYSIS (LOOP-VAR) NOT = 999?
NO
YES
DISPLAY DEVICE-ANALYSIS (LOOP-VAR)
RETURN


FIND-SCREEN
ANALYSIS-NUMBER > OPTION OR OPTION = PREV-OPTION?
NO
YES
READ FIRST TEXT-FILE RECORD
EOF TEXT-FILE ?
YES
PERFORM STOP-RUN
RETURN

RETURN

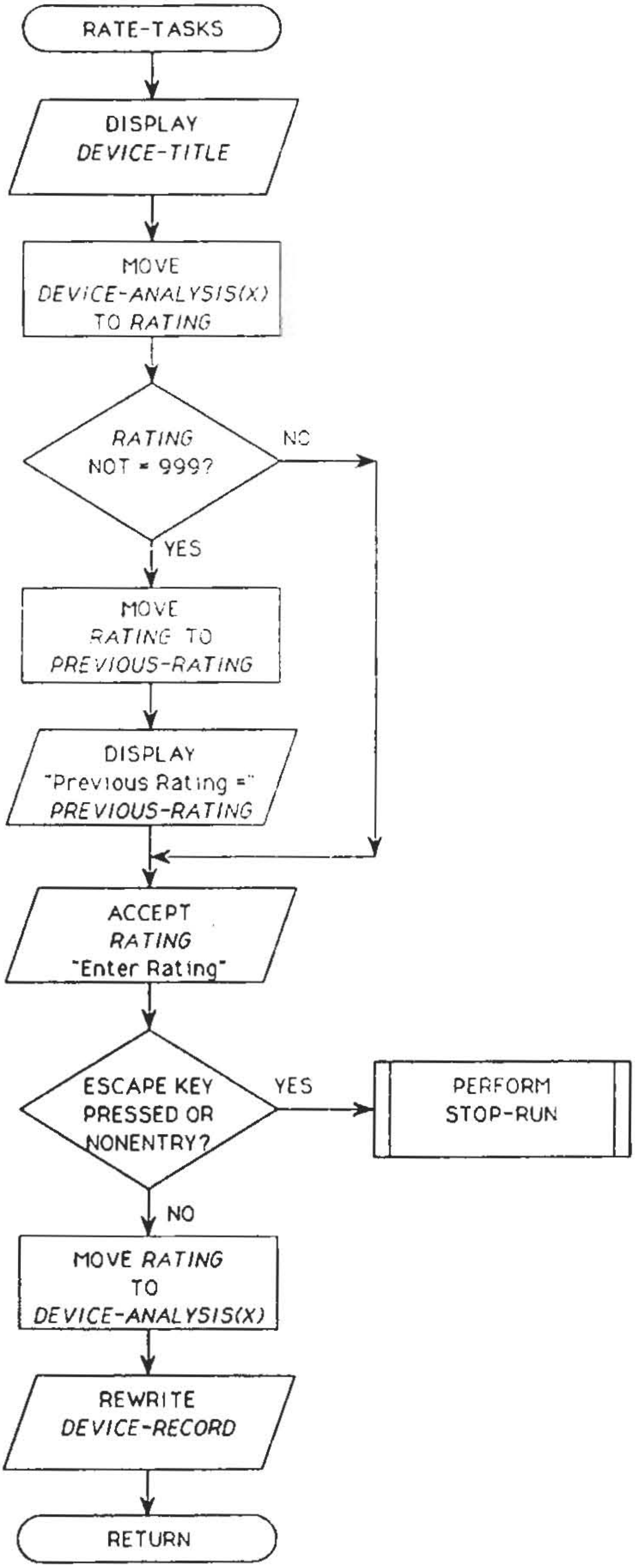

READ-TEXT
READ
TEXT-FILE
RECORD
EOF
TEXT-FILE ?
YES
PERFORM
STOP-RUN
NO
TEXT-FILE.ANALYSIS-NUMBER
= OPTION?
NO
YES
RETURN


DISPLAY-SCREEN
DISPLAY
TEXT-RECORD
RETURN

Generalized FlowChart Documentation for

Program: **ASTAR1**

Page: **13 of 13**

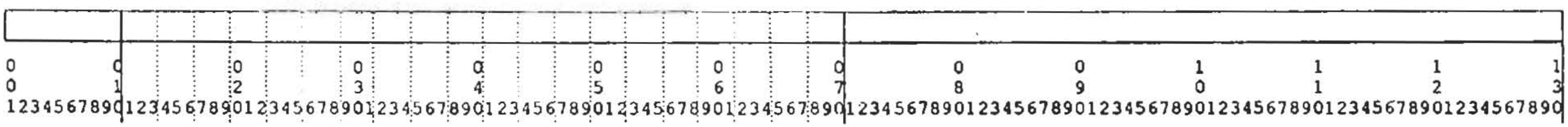


File Structure Documentation for

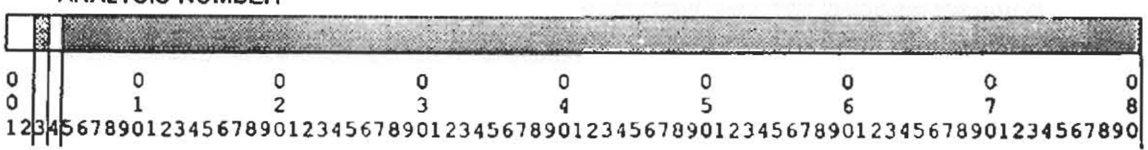
Program: ASTAR2

Page: 1 of 1

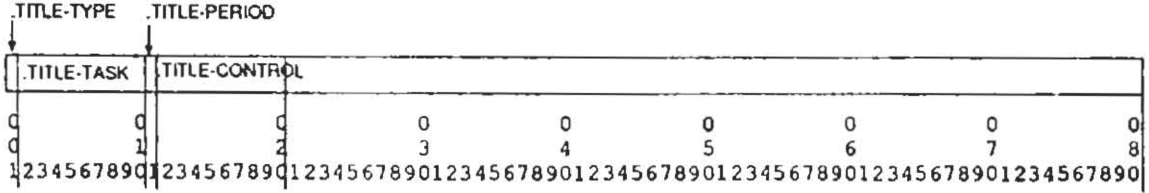
DEVICE-RECORD ("B:DEVICE")



TEXT-RECORD ("ASTAR2.DOC")



TITLE-RECORD ("B:TITLE")



ASTAR2 MENU

```
                    ASTAR 2

                    (1)  Performance Deficit
                    (2)  Learning Difficulty
                    (3)  Quality of Training-Acquisition
                    (4)  Residual Deficit
                    (5)  Residual Learning Difficulty
                    (6)  Physical Similarity
                    (7)  Functional Similarity
                    (8)  Quality of Training-Transfer
                    (9)  Evaluation Summary


          Enter Option Number
```

EVALUATION SUMMARY SCREEN

```
                              Evaluation Summary
     Training Problem                      ZZ,ZZZ.99

               Acquisition-Efficiency                ZZ,ZZZ.99


               Acquisition                          ZZ,ZZZ.99

     Transfer Problem                      ZZ,ZZZ.99

     Transfer Efficiency                   ZZ,ZZZ.99

               Transfer                              ZZ,ZZZ.99


                  d                                  ZZ,ZZZ.99
```

STARTING TASK SCREEN

```
 Enter Starting Training Device Task.Subtask number

or
Enter Starting Operational Equipment Task.Subtask number

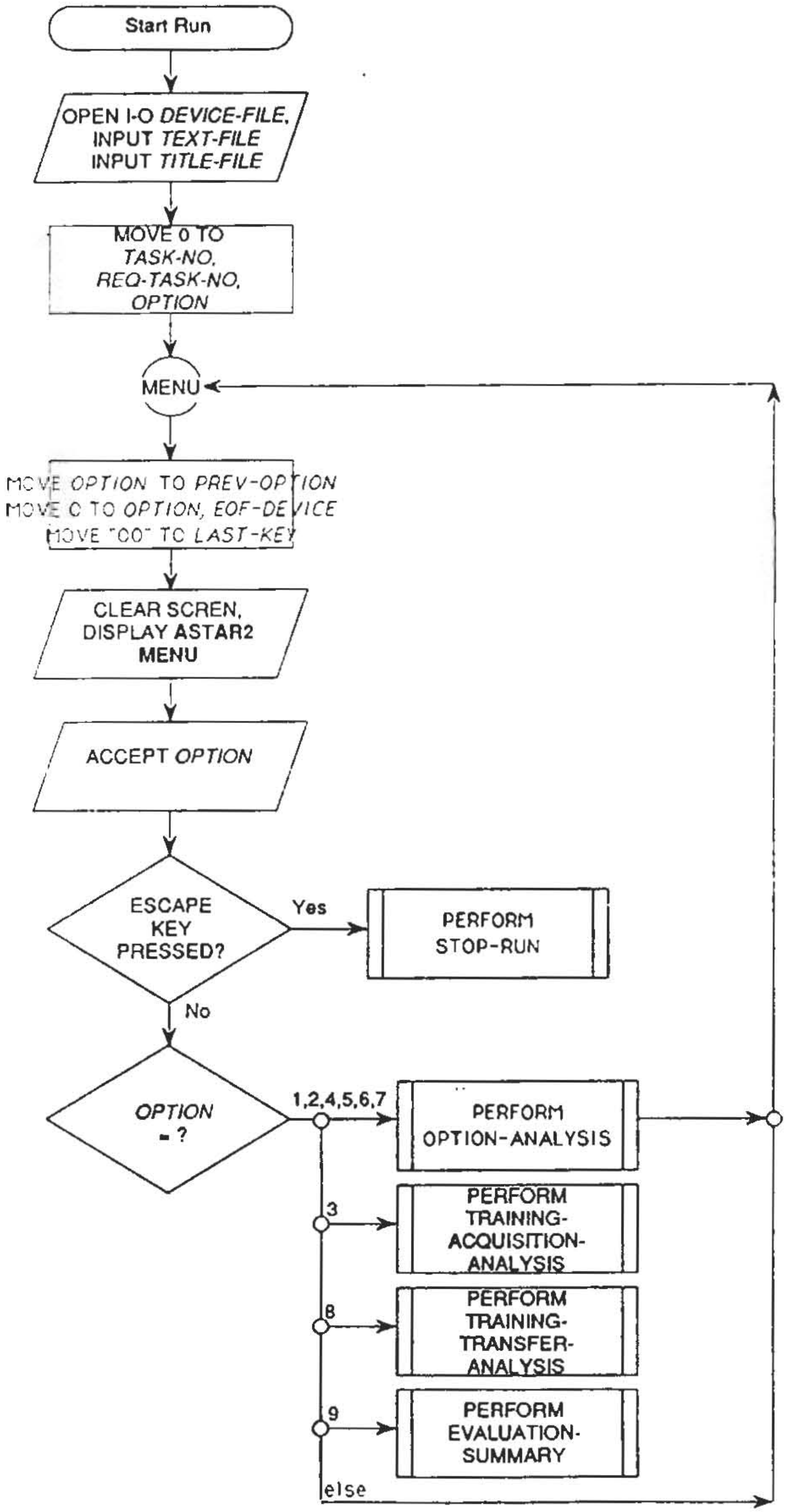


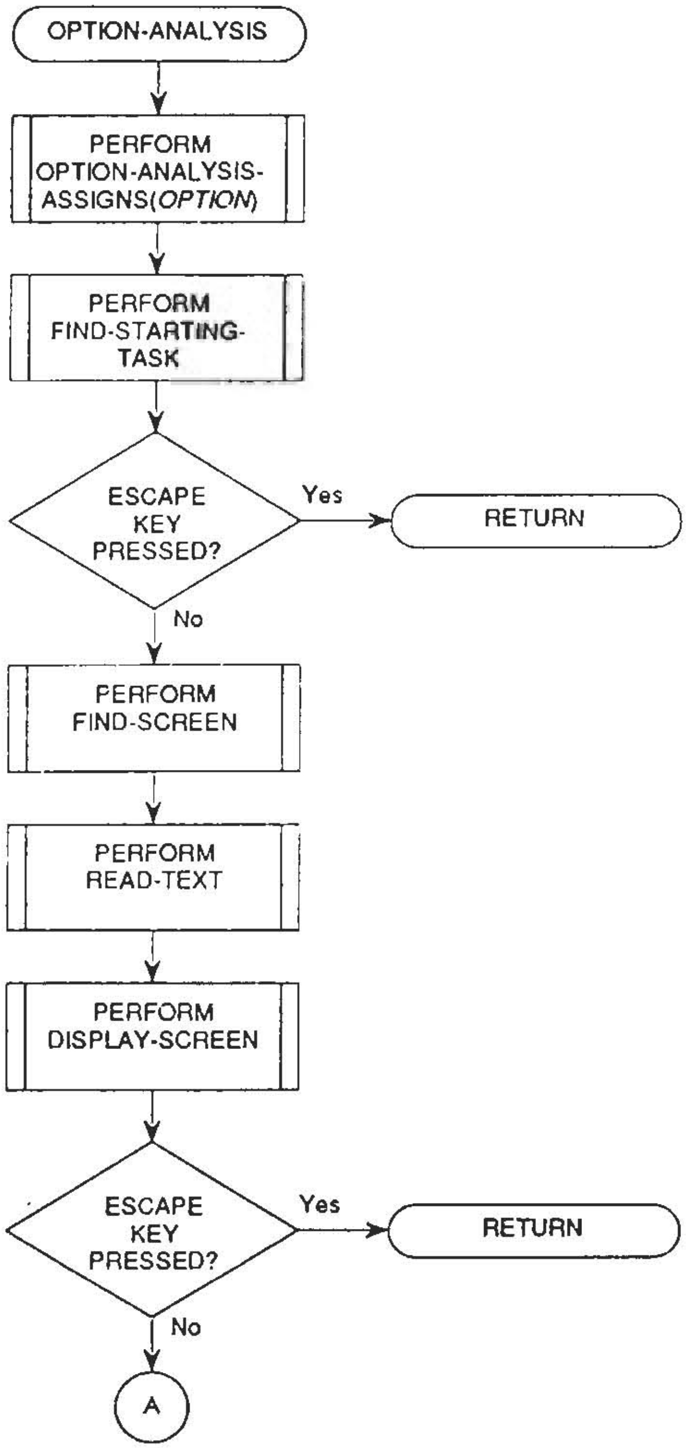

      Hit 'F1' to List Training Device Tasks & Subtasks
      Hit 'F2' to List Operational Equipment Tasks & Subtasks
      Hit 'F3' to List Training Device Controls & Displays
      Hit 'F4' to List Operational Equipment Controls and Displays
```

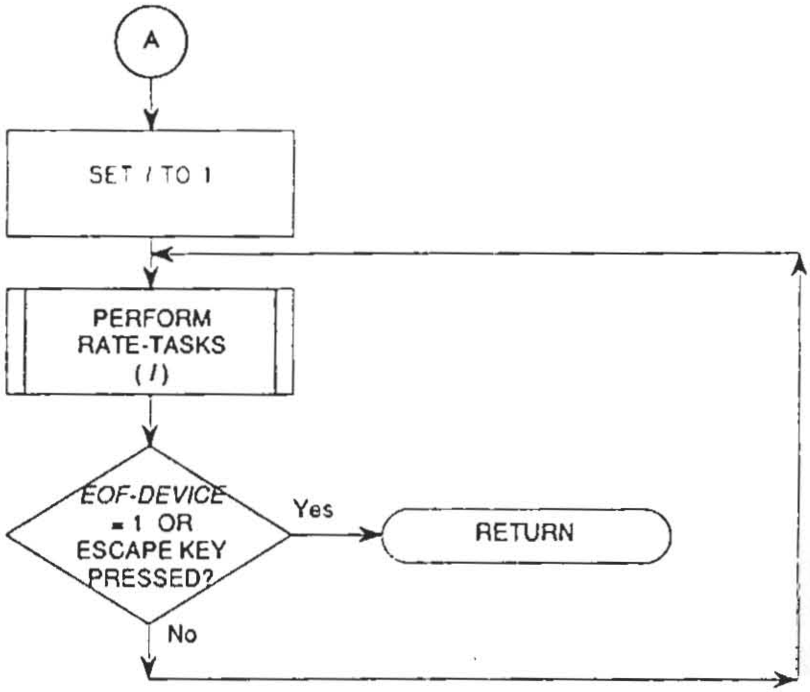
Generalized FlowChart Documentation for

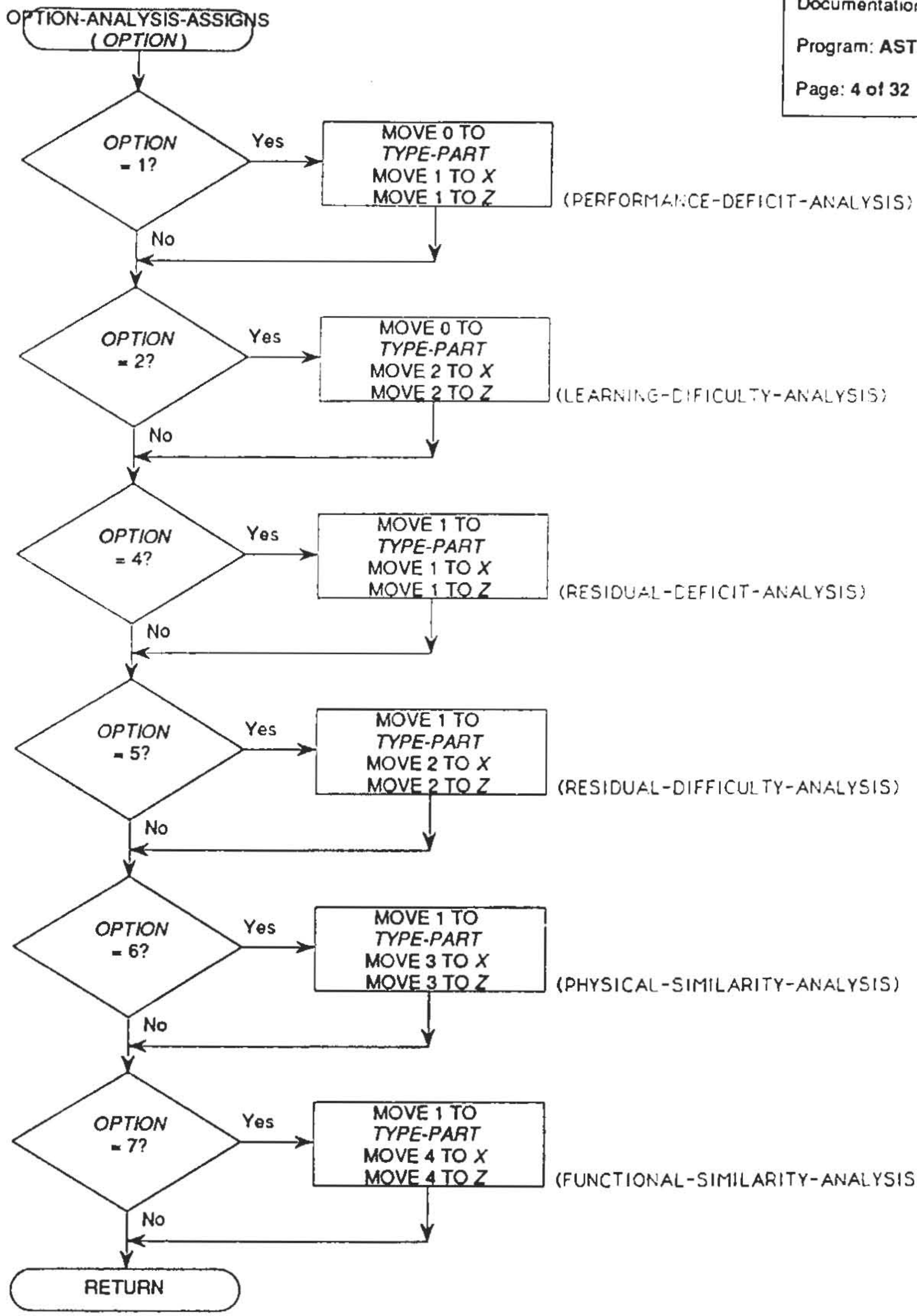
Program: **ASTAR2**

Page: **1 of 32**




OPTION-ANALYSIS
PERFORM
OPTION-ANALYSIS-
ASSIGNS(*OPTION*)
PERFORM
FIND-STARTING-
TASK
ESCAPE
KEY
PRESSED?
Yes
RETURN
No
PERFORM
FIND-SCREEN
PERFORM
READ-TEXT
PERFORM
DISPLAY-SCREEN
ESCAPE
KEY
PRESSED?
Yes
RETURN
No
A

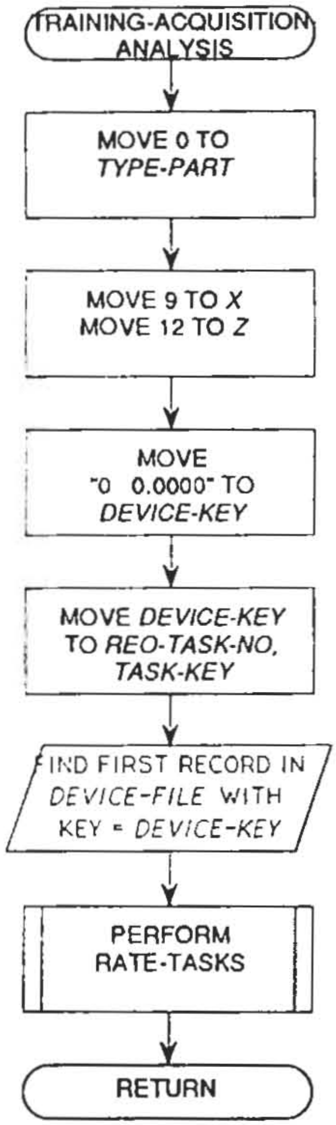

A
SET I TO 1
PERFORM RATE-TASKS (I)
EOF-DEVICE = 1 OR ESCAPE KEY PRESSED?
Yes
RETURN
No

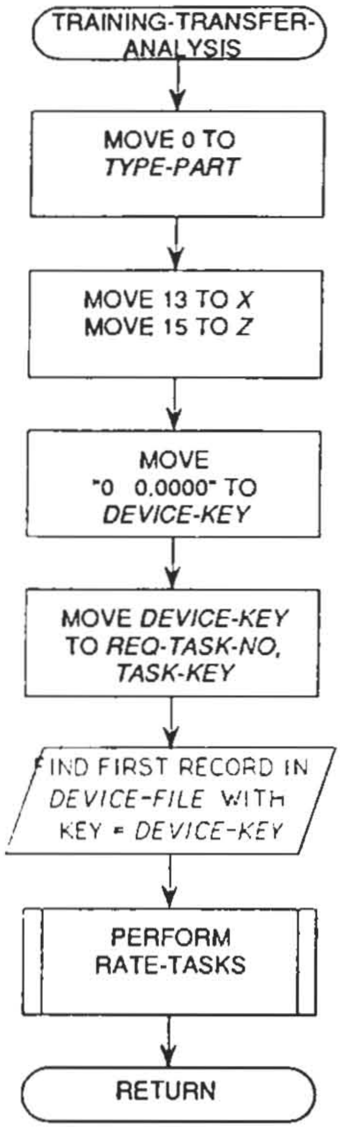

OPTION-ANALYSIS-ASSIGNS
(OPTION)
OPTION = 1?
Yes
MOVE 0 TO TYPE-PART
MOVE 1 TO X
MOVE 1 TO Z
(PERFORMANCE-DEFICIT-ANALYSIS)
No
OPTION = 2?
Yes
MOVE 0 TO TYPE-PART
MOVE 2 TO X
MOVE 2 TO Z
(LEARNING-DIFICULTY-ANALYSIS)
No
OPTION = 4?
Yes
MOVE 1 TO TYPE-PART
MOVE 1 TO X
MOVE 1 TO Z
(RESIDUAL-DEFICIT-ANALYSIS)
No
OPTION = 5?
Yes
MOVE 1 TO TYPE-PART
MOVE 2 TO X
MOVE 2 TO Z
(RESIDUAL-DIFFICULTY-ANALYSIS)
No
OPTION = 6?
Yes
MOVE 1 TO TYPE-PART
MOVE 3 TO X
MOVE 3 TO Z
(PHYSICAL-SIMILARITY-ANALYSIS)
No
OPTION = 7?
Yes
MOVE 1 TO TYPE-PART
MOVE 4 TO X
MOVE 4 TO Z
(FUNCTIONAL-SIMILARITY-ANALYSIS)
No
RETURN

Generalized FlowChart Documentation for

Program: ASTAR2

Page: 5 of 32

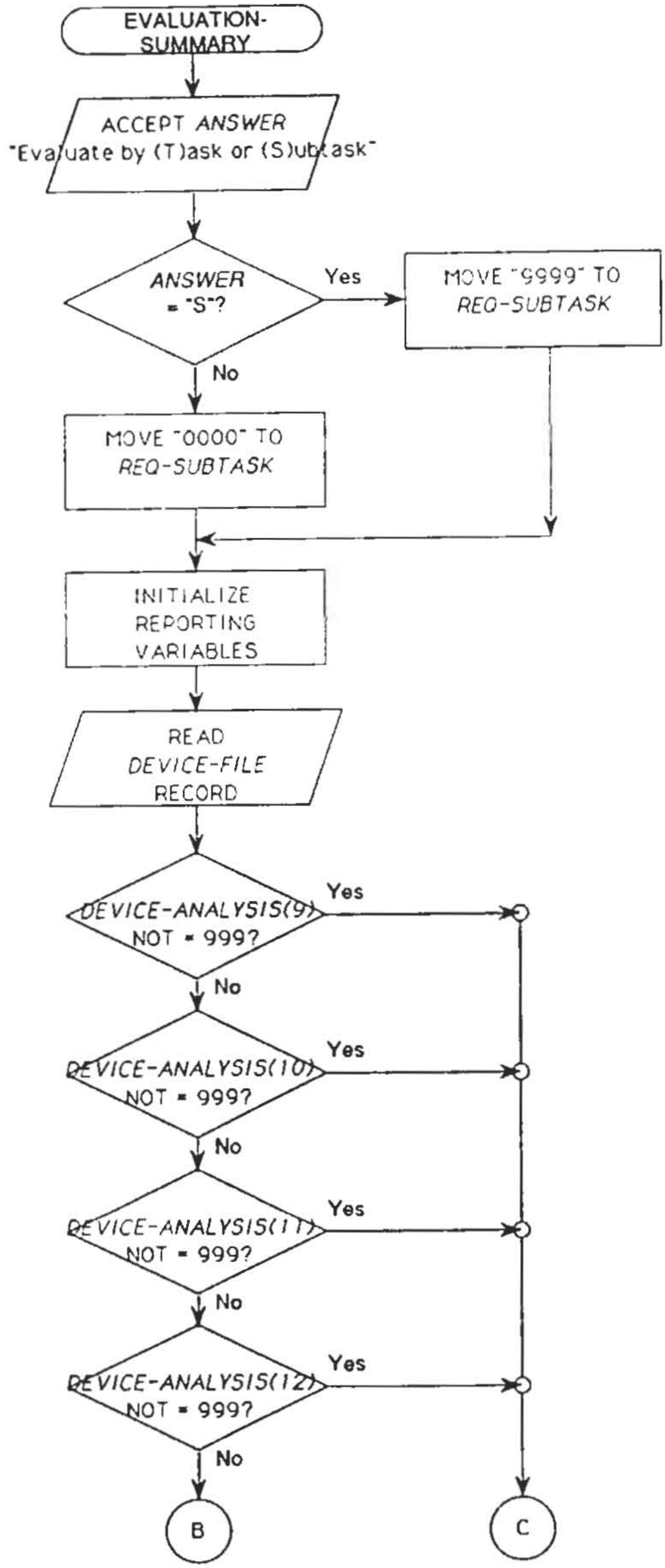


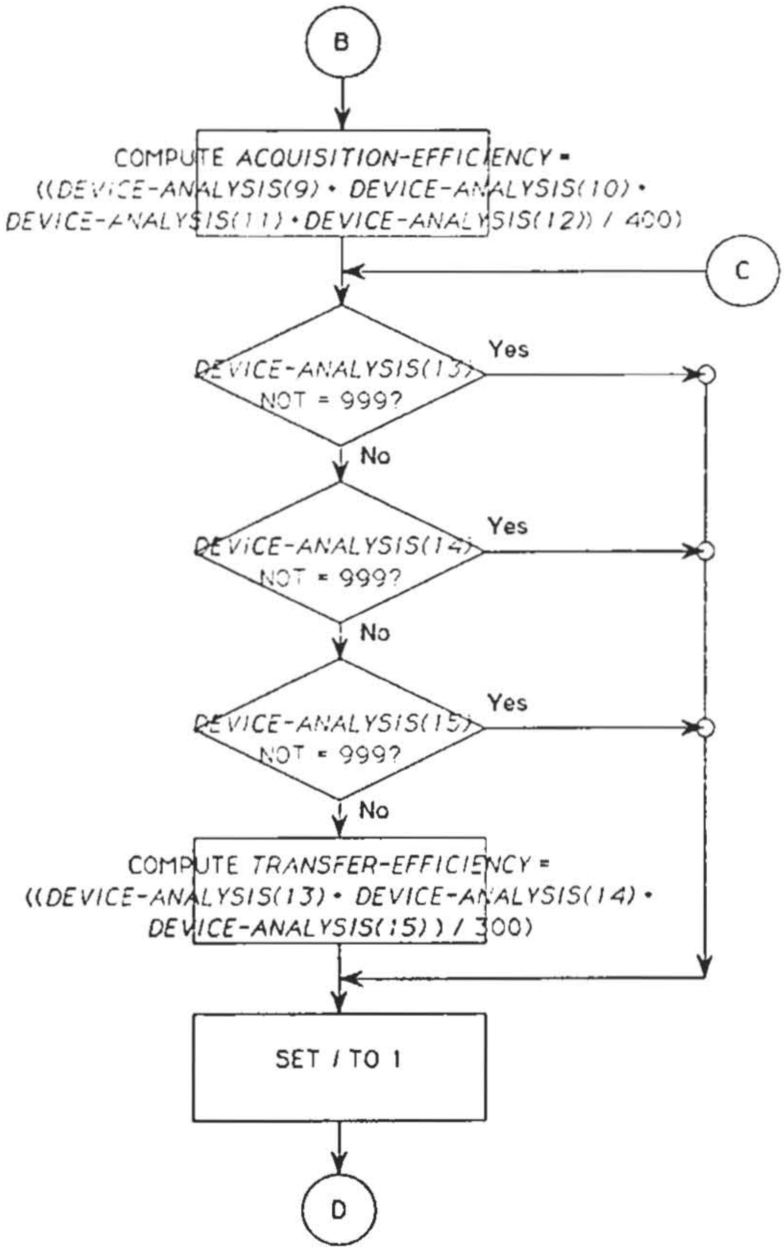

TRAINING-TRANSFER-ANALYSIS
MOVE 0 TO *TYPE-PART*
MOVE 13 TO *X*
MOVE 15 TO *Z*
MOVE "0 0.0000" TO *DEVICE-KEY*
MOVE *DEVICE-KEY* TO *REQ-TASK-NO*, *TASK-KEY*
FIND FIRST RECORD IN *DEVICE-FILE* WITH KEY = *DEVICE-KEY*
PERFORM RATE-TASKS
RETURN

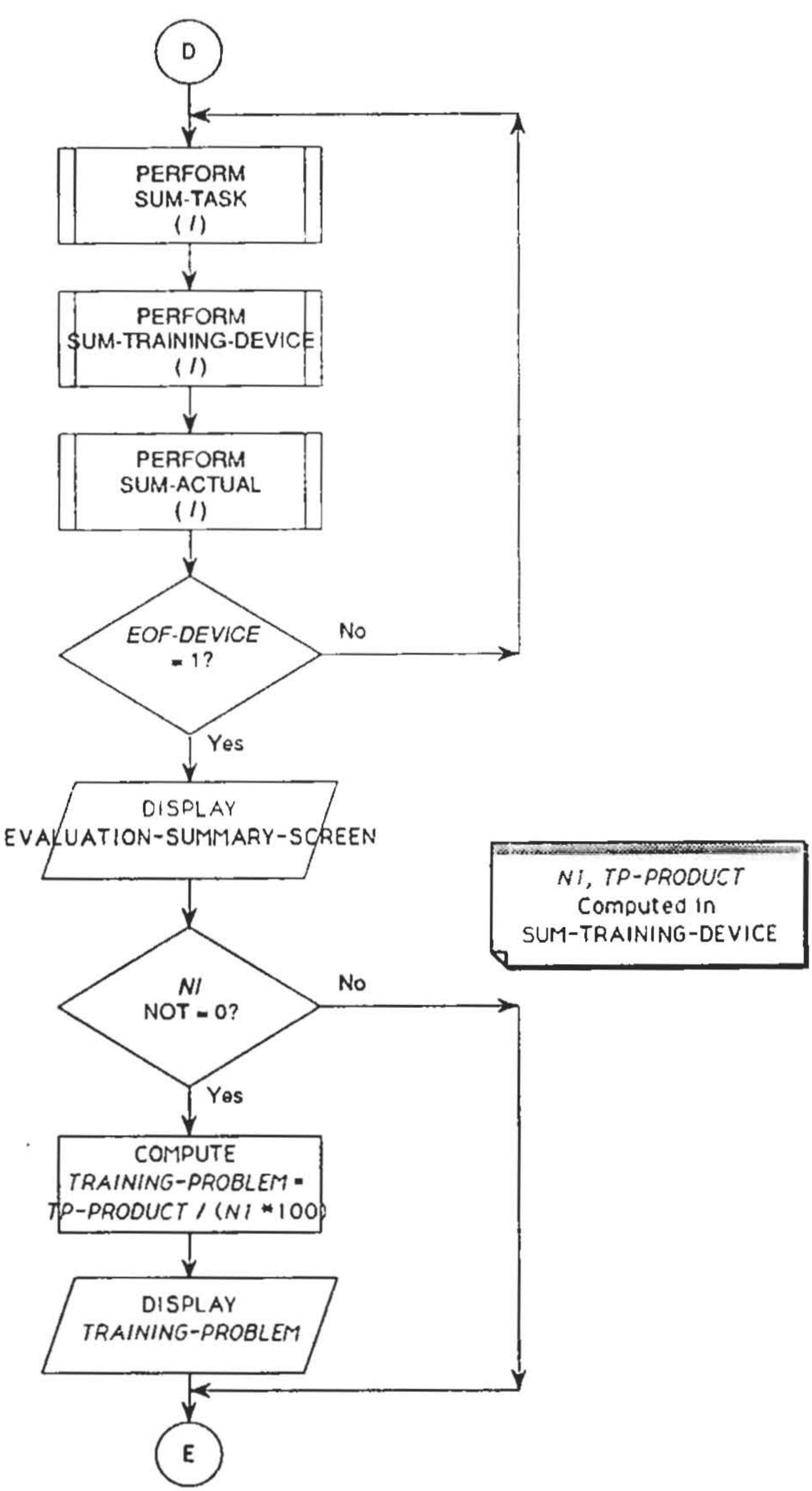
Generalized FlowChart Documentation for

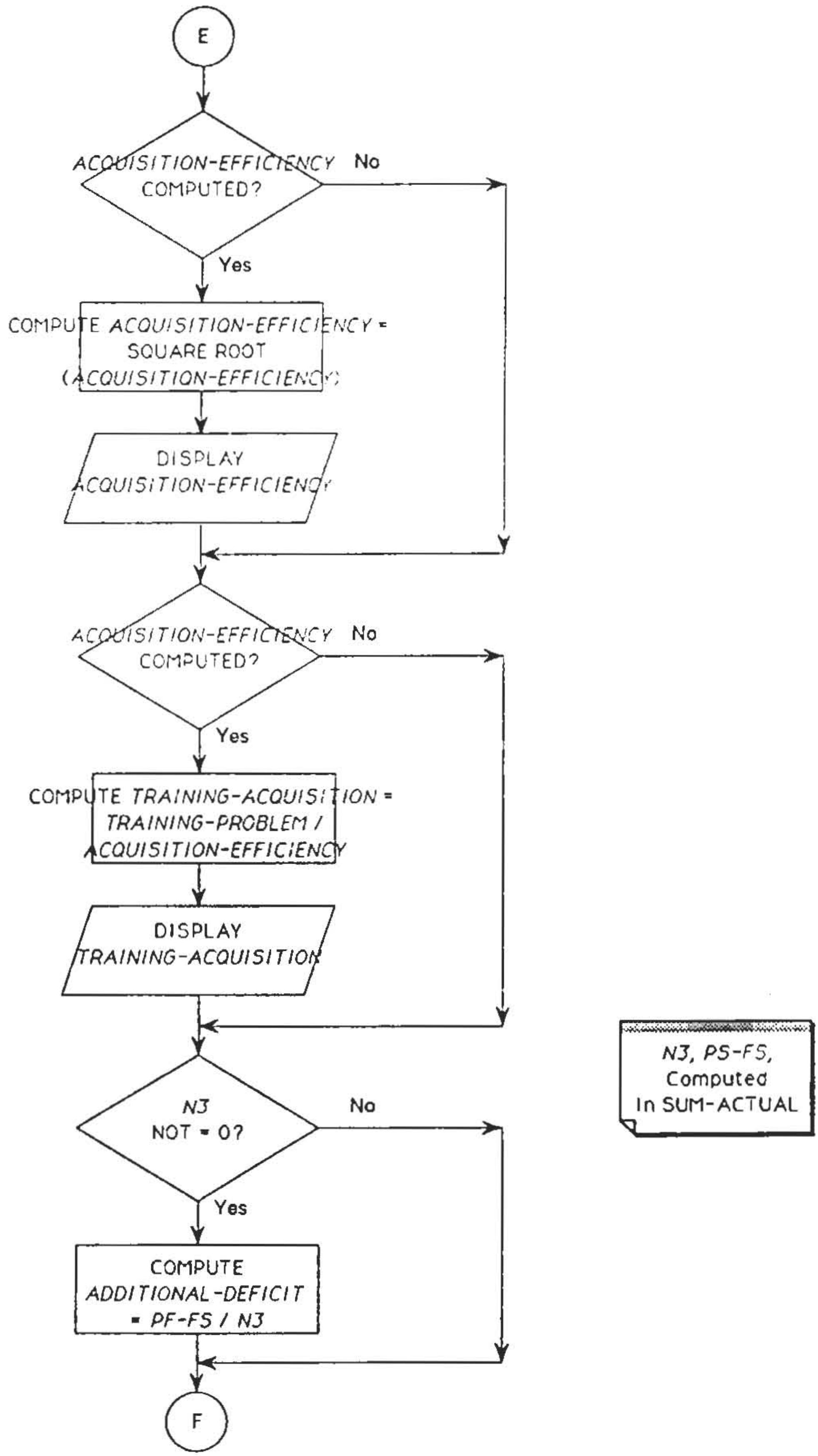
Program: ASTAR2

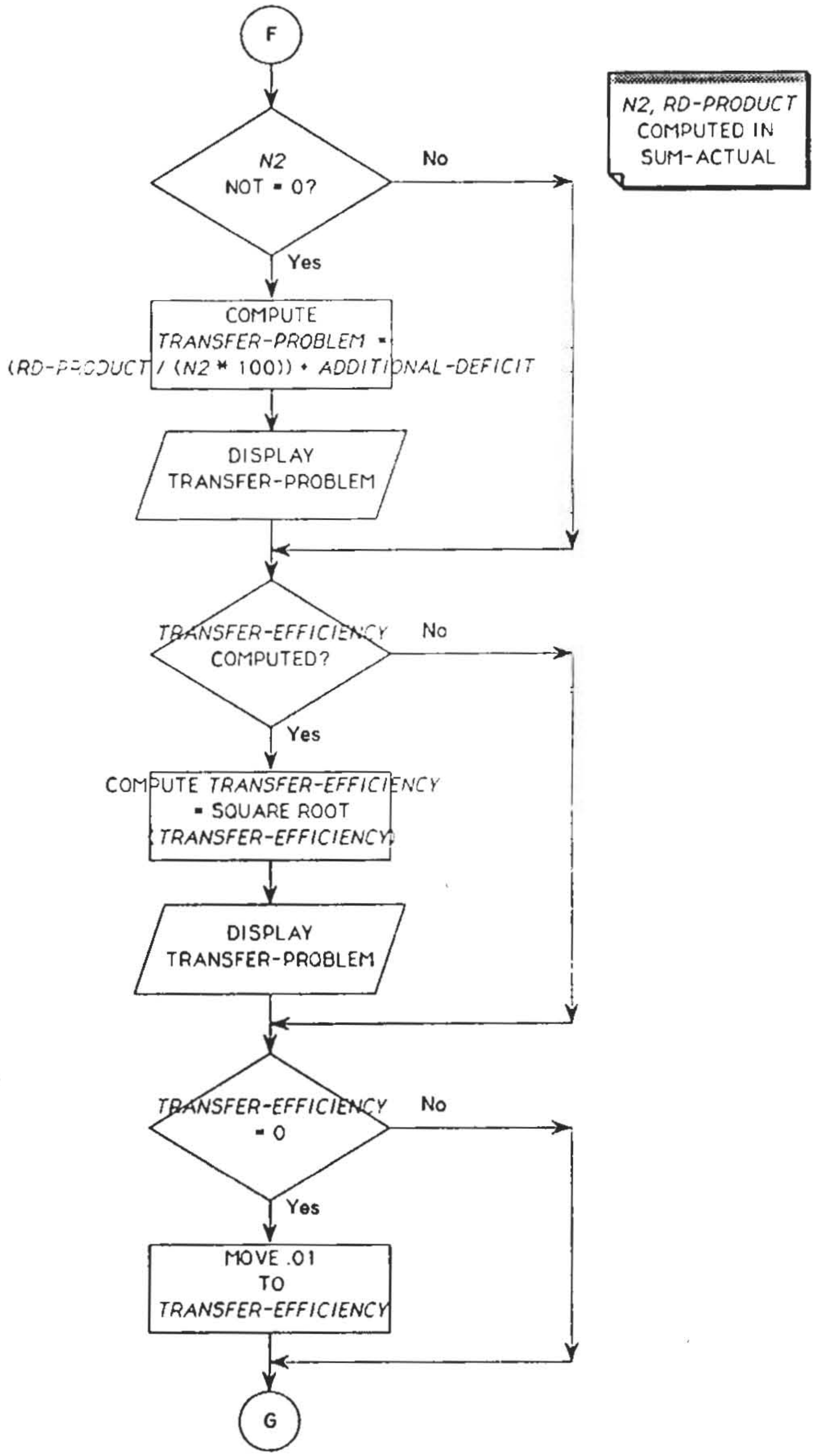
Page: 7 of 32

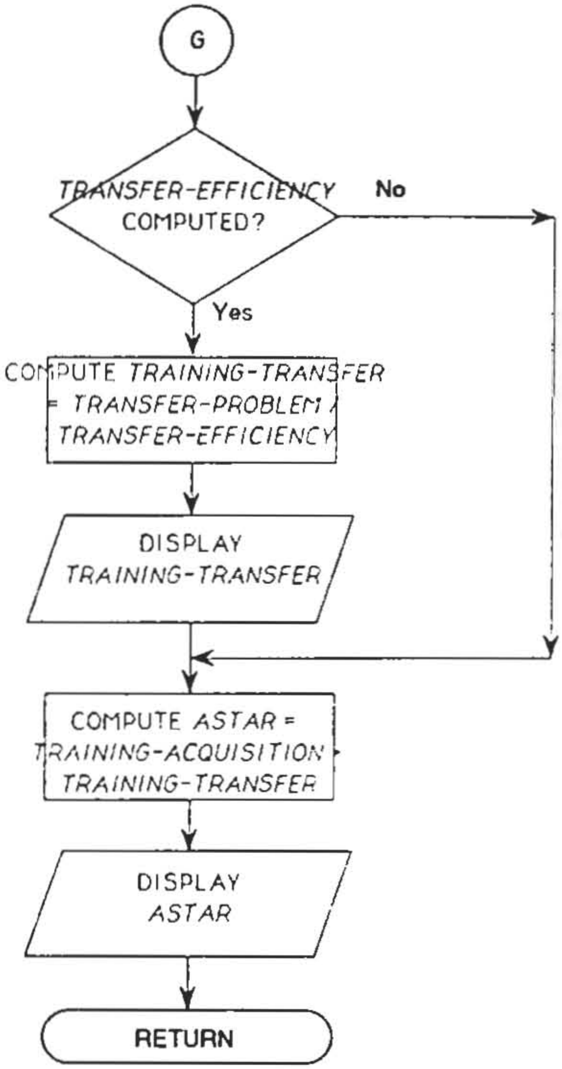


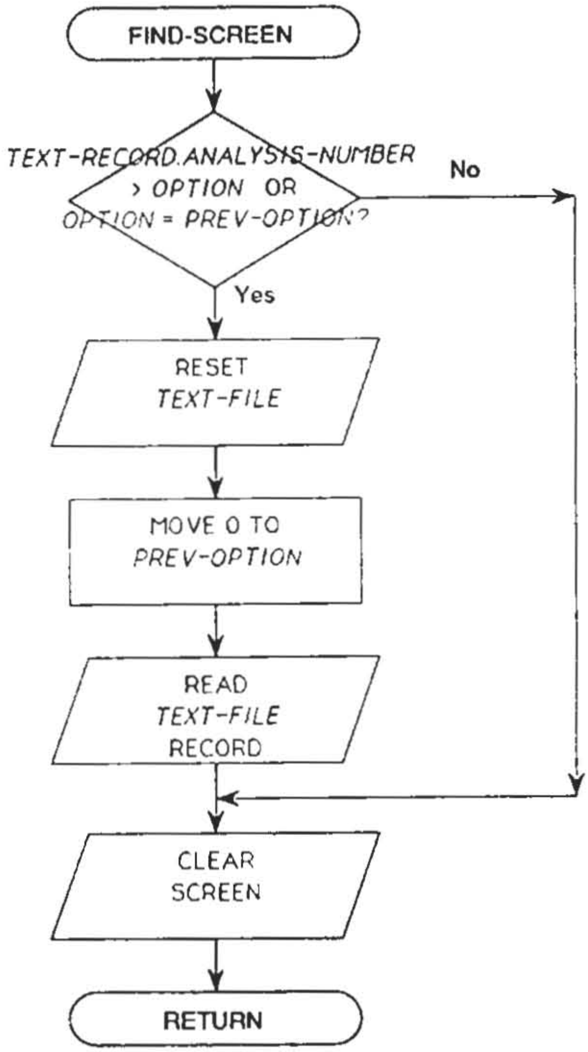

B
COMPUTE ACQUISITION-EFFICIENCY =
((DEVICE-ANALYSIS(9) • DEVICE-ANALYSIS(10) •
DEVICE-ANALYSIS(11) • DEVICE-ANALYSIS(12)) / 400)
C
DEVICE-ANALYSIS(13)
NOT = 999?
Yes
No
DEVICE-ANALYSIS(14)
NOT = 999?
Yes
No
DEVICE-ANALYSIS(15)
NOT = 999?
Yes
No
COMPUTE TRANSFER-EFFICIENCY =
((DEVICE-ANALYSIS(13) • DEVICE-ANALYSIS(14) •
DEVICE-ANALYSIS(15)) / 300)
SET I TO 1
D

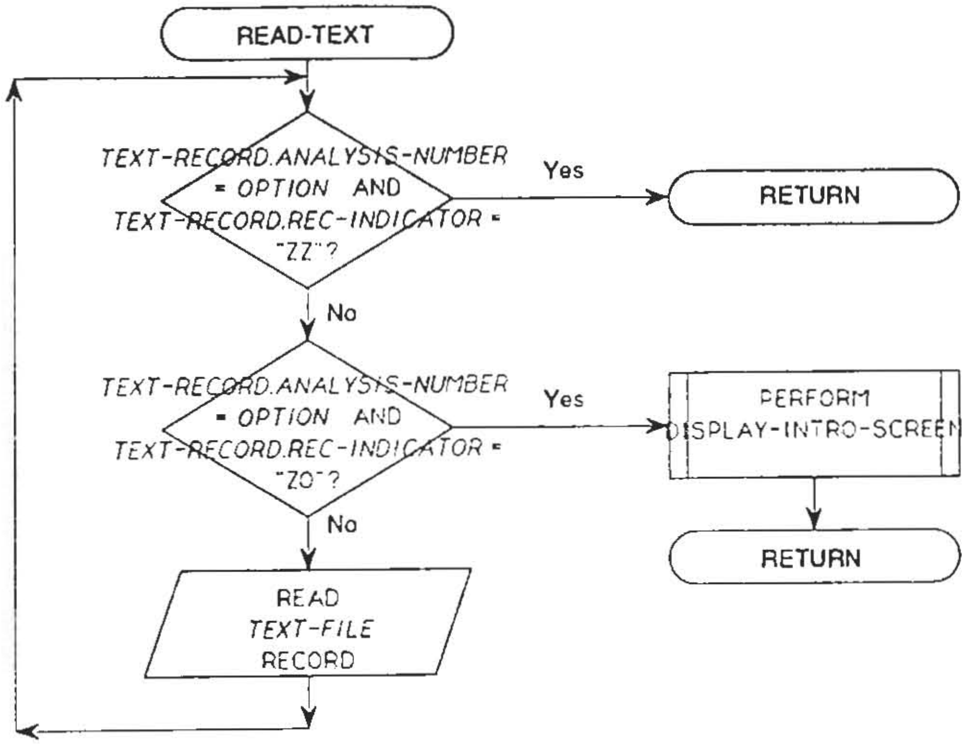

D
PERFORM
SUM-TASK
(/)
PERFORM
SUM-TRAINING-DEVICE
(/)
PERFORM
SUM-ACTUAL
(/)
EOF-DEVICE
= 1?
No
Yes
DISPLAY
EVALUATION-SUMMARY-SCREEN
NI, TP-PRODUCT
Computed in
SUM-TRAINING-DEVICE
NI
NOT = 0?
No
Yes
COMPUTE
TRAINING-PROBLEM =
TP-PRODUCT / (NI * 100)
DISPLAY
TRAINING-PROBLEM
E

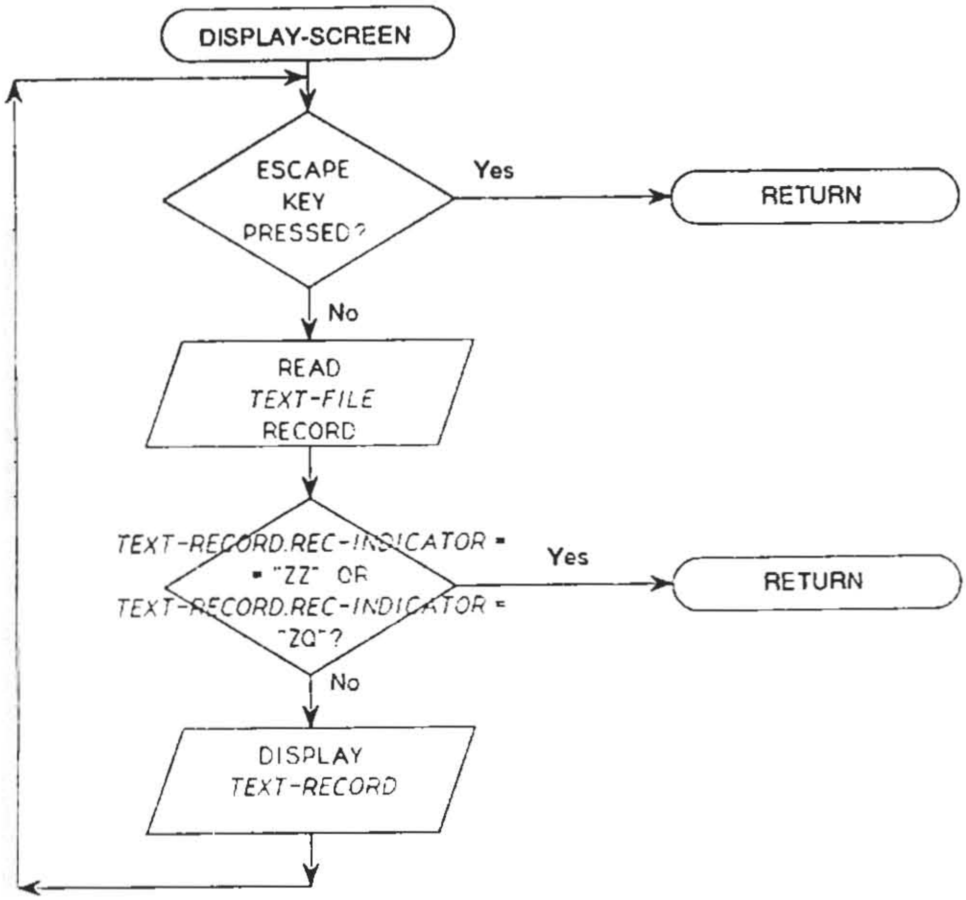

E
ACQUISITION-EFFICIENCY COMPUTED?
No
Yes
COMPUTE ACQUISITION-EFFICIENCY = SQUARE ROOT (ACQUISITION-EFFICIENCY)
DISPLAY ACQUISITION-EFFICIENCY
ACQUISITION-EFFICIENCY COMPUTED?
No
Yes
COMPUTE TRAINING-ACQUISITION = TRAINING-PROBLEM / ACQUISITION-EFFICIENCY
DISPLAY TRAINING-ACQUISITION
N3 NOT = 0?
No
Yes
COMPUTE ADDITIONAL-DEFICIT = PF-FS / N3
F
N3, PS-FS, Computed In SUM-ACTUAL

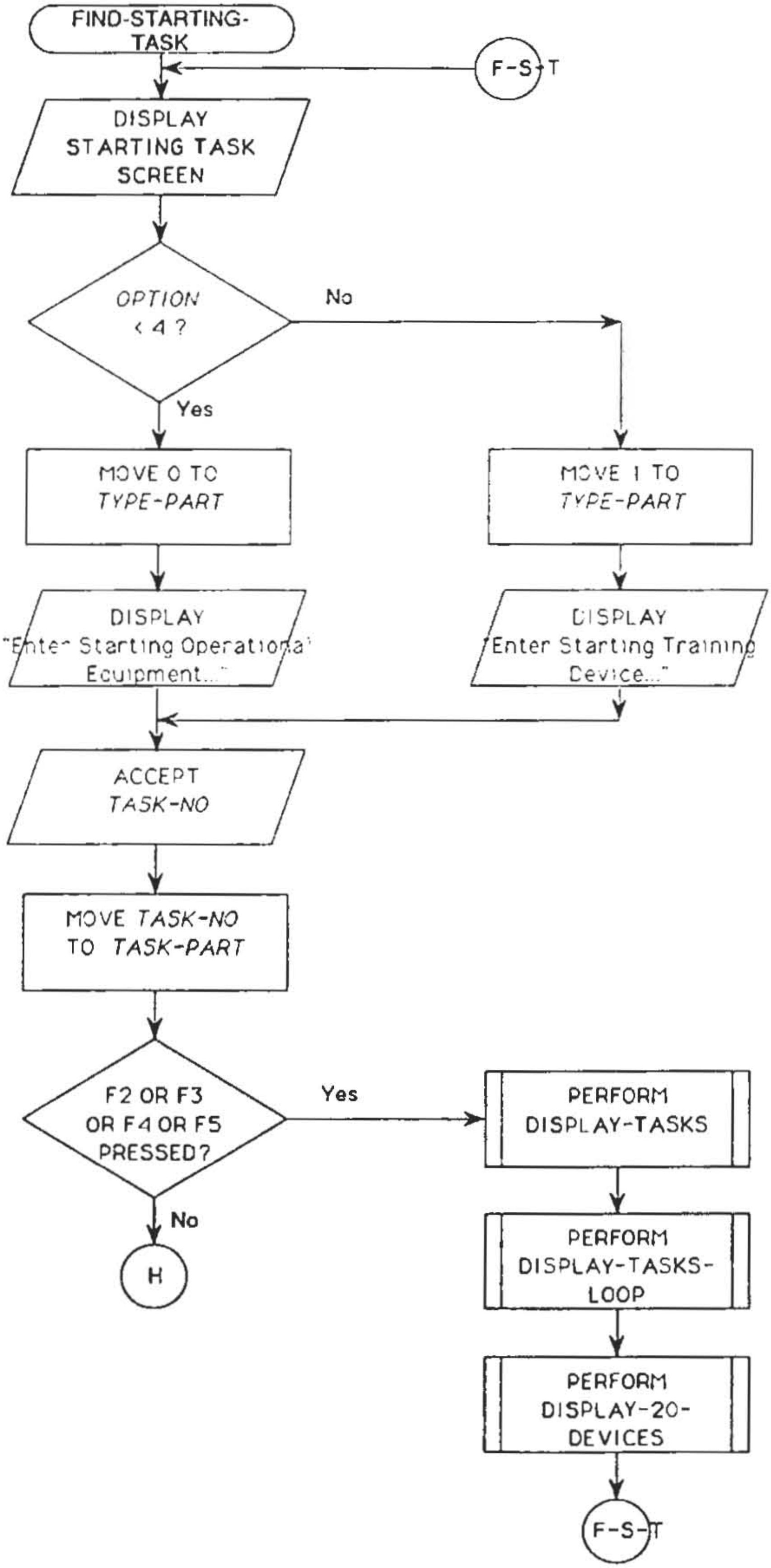

F
N2, RD-PRODUCT
COMPUTED IN
SUM-ACTUAL
N2
NOT = 0?
No
Yes
COMPUTE
TRANSFER-PROBLEM =
(RD-PRODUCT / (N2 * 100)) + ADDITIONAL-DEFICIT
DISPLAY
TRANSFER-PROBLEM
TRANSFER-EFFICIENCY
COMPUTED?
No
Yes
COMPUTE TRANSFER-EFFICIENCY
= SQUARE ROOT
(TRANSFER-EFFICIENCY)
DISPLAY
TRANSFER-PROBLEM
TRANSFER-EFFICIENCY
= 0
No
Yes
MOVE .01
TO
TRANSFER-EFFICIENCY
G

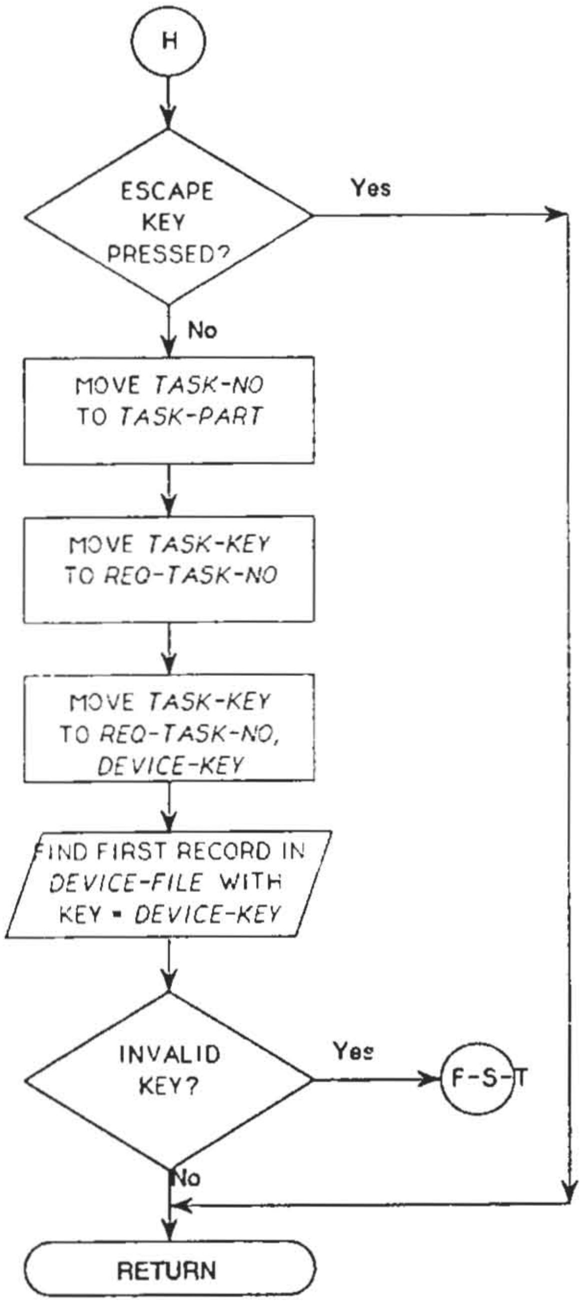

G
TRANSFER-EFFICIENCY COMPUTED?
No
Yes
COMPUTE TRAINING-TRANSFER = TRANSFER-PROBLEM / TRANSFER-EFFICIENCY
DISPLAY TRAINING-TRANSFER
COMPUTE ASTAR = TRAINING-ACQUISITION + TRAINING-TRANSFER
DISPLAY ASTAR
RETURN

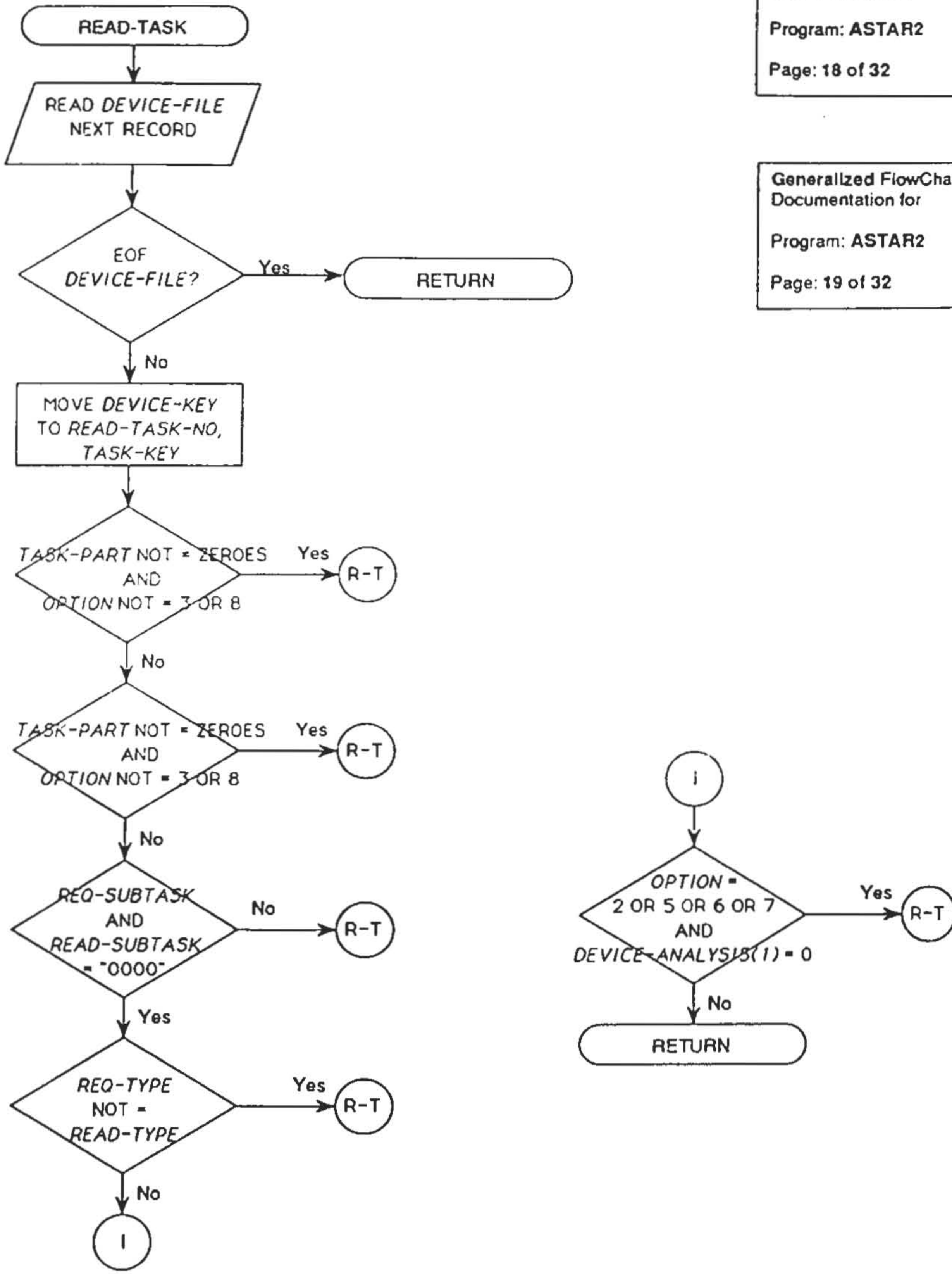

FIND-SCREEN
TEXT-RECORD.ANALYSIS-NUMBER > OPTION OR OPTION = PREV-OPTION?
No
Yes
RESET TEXT-FILE
MOVE 0 TO PREV-OPTION
READ TEXT-FILE RECORD
CLEAR SCREEN
RETURN

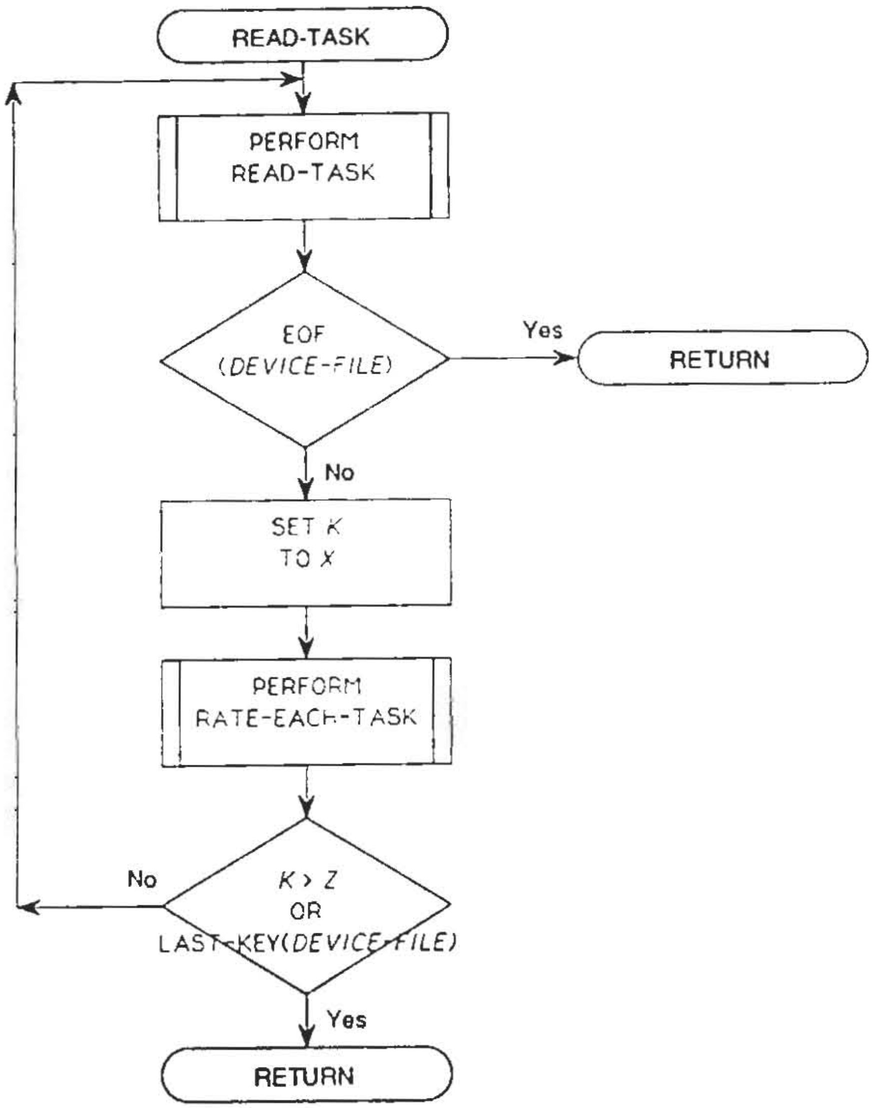

READ-TEXT
TEXT-RECORD.ANALYSIS-NUMBER = OPTION AND TEXT-RECORD.REC-INDICATOR = "ZZ"?
Yes
RETURN
No
TEXT-RECORD.ANALYSIS-NUMBER = OPTION AND TEXT-RECORD.REC-INDICATOR = "ZO"?
Yes
PERFORM DISPLAY-INTRO-SCREEN
RETURN
No
READ TEXT-FILE RECORD

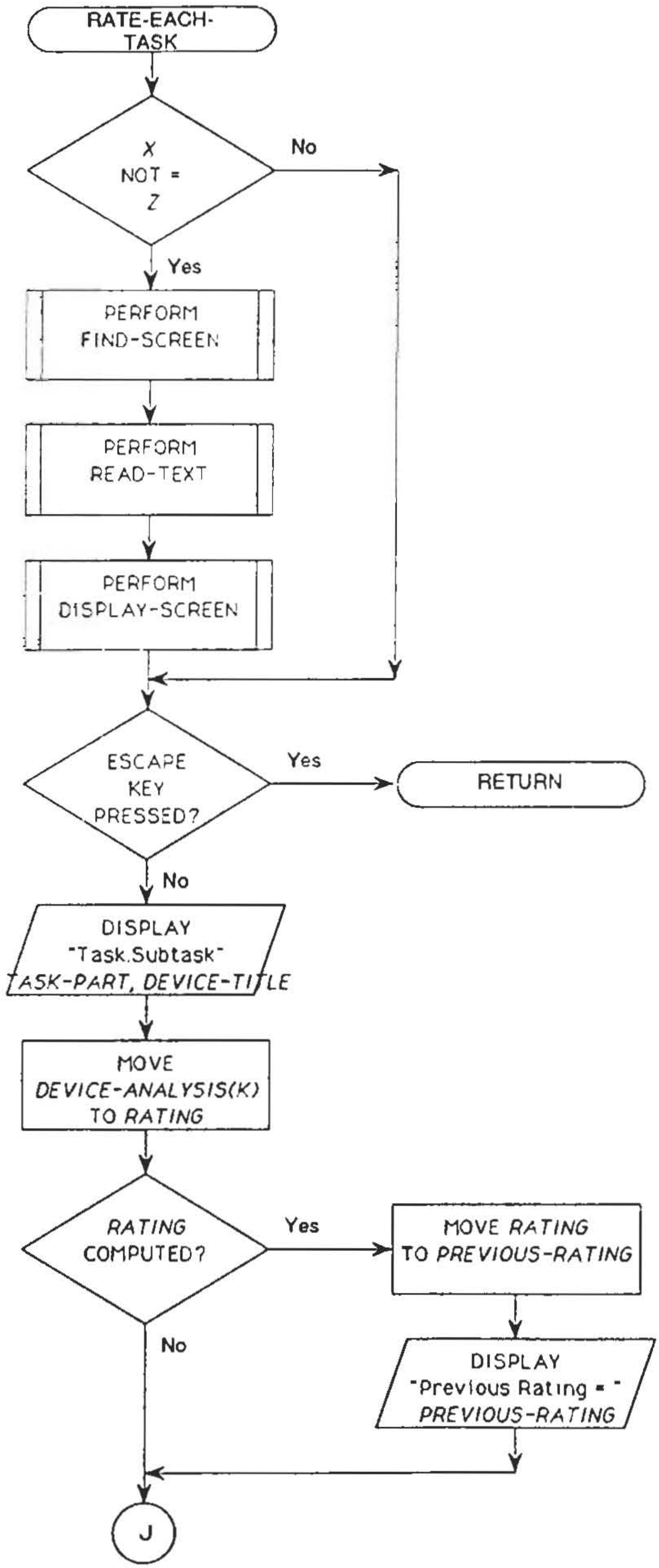

DISPLAY-SCREEN
ESCAPE KEY PRESSED?
Yes
RETURN
No
READ TEXT-FILE RECORD
TEXT-RECORD.REC-INDICATOR = "ZZ" OR TEXT-RECORD.REC-INDICATOR = "ZQ"?
Yes
RETURN
No
DISPLAY TEXT-RECORD

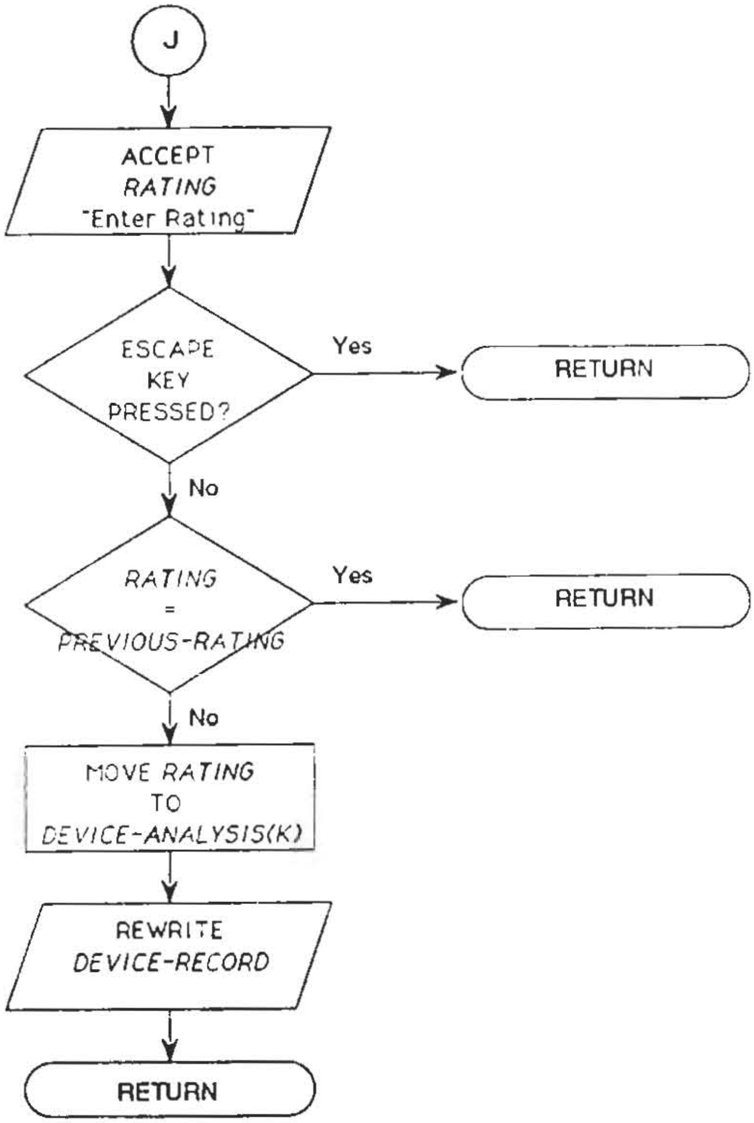

FIND-STARTING-TASK
F-S-T
DISPLAY STARTING TASK SCREEN
OPTION < 4 ?
No
Yes
MOVE 0 TO TYPE-PART
MOVE 1 TO TYPE-PART
DISPLAY "Enter Starting Operational Equipment..."
DISPLAY "Enter Starting Training Device..."
ACCEPT TASK-NO
MOVE TASK-NO TO TASK-PART
F2 OR F3 OR F4 OR F5 PRESSED?
Yes
No
H
PERFORM DISPLAY-TASKS
PERFORM DISPLAY-TASKS-LOOP
PERFORM DISPLAY-20-DEVICES
F-S-T

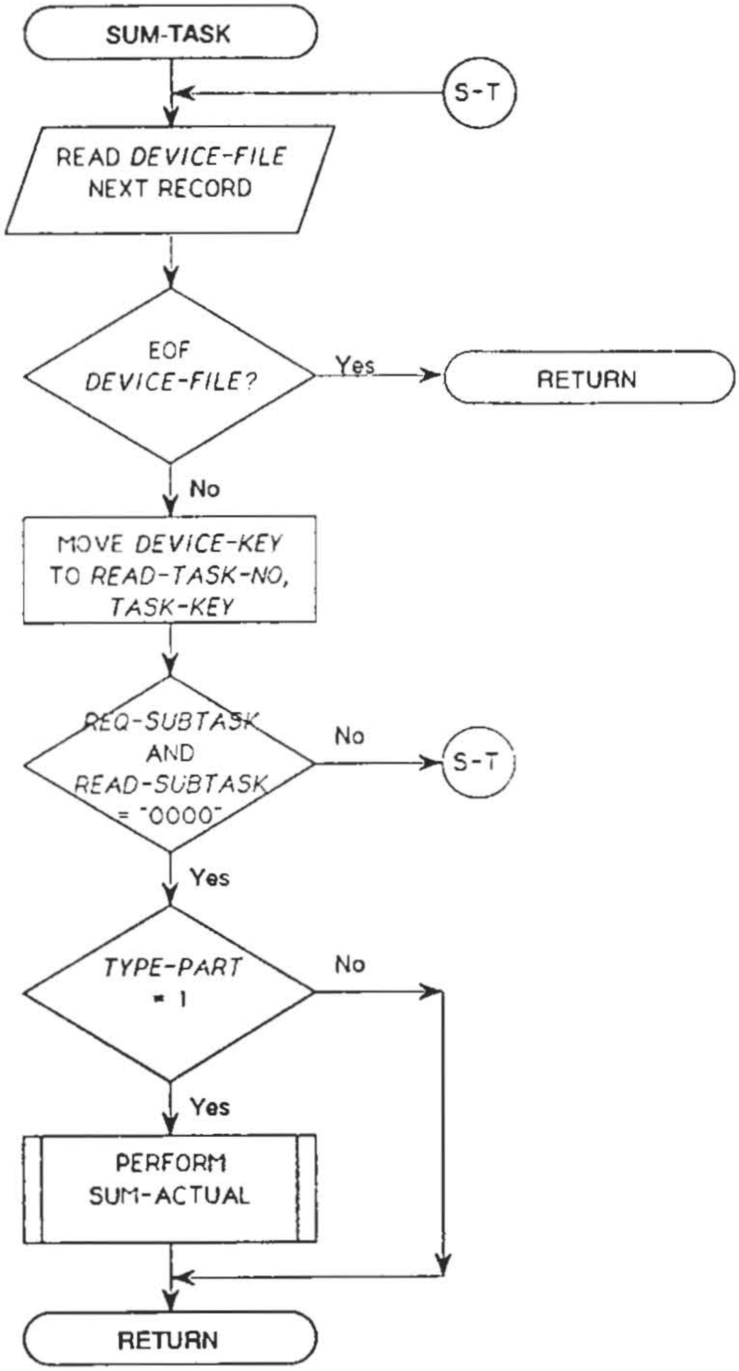

H
ESCAPE KEY PRESSED?
Yes
No
MOVE TASK-NO TO TASK-PART
MOVE TASK-KEY TO REQ-TASK-NO
MOVE TASK-KEY TO REQ-TASK-NO, DEVICE-KEY
FIND FIRST RECORD IN DEVICE-FILE WITH KEY = DEVICE-KEY
INVALID KEY?
Yes
F-S-T
No
RETURN

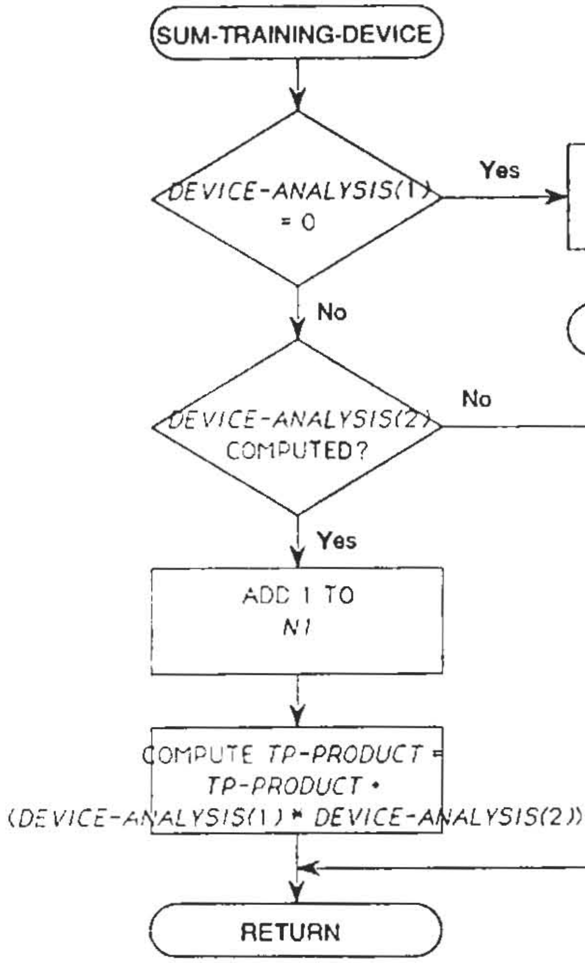

READ-TASK
READ DEVICE-FILE NEXT RECORD
EOF DEVICE-FILE?
Yes
RETURN
No
MOVE DEVICE-KEY TO READ-TASK-NO, TASK-KEY
TASK-PART NOT = ZEROES AND OPTION NOT = 3 OR 8
Yes
R-T
No
TASK-PART NOT = ZEROES AND OPTION NOT = 3 OR 8
Yes
R-T
No
REQ-SUBTASK AND READ-SUBTASK = "0000"
No
R-T
Yes
REQ-TYPE NOT = READ-TYPE
Yes
R-T
No
I
I
OPTION = 2 OR 5 OR 6 OR 7 AND DEVICE-ANALYSIS(1) = 0
Yes
R-T
No
RETURN


READ-TASK
PERFORM READ-TASK
EOF (DEVICE-FILE)
Yes
RETURN
No
SET K TO X
PERFORM RATE-EACH-TASK
K > Z OR LAST-KEY(DEVICE-FILE)
No
Yes
RETURN


RATE-EACH-TASK
X NOT = Z
No
Yes
PERFORM FIND-SCREEN
PERFORM READ-TEXT
PERFORM DISPLAY-SCREEN
ESCAPE KEY PRESSED?
Yes
RETURN
No
DISPLAY "Task.Subtask" TASK-PART, DEVICE-TITLE
MOVE DEVICE-ANALYSIS(K) TO RATING
RATING COMPUTED?
Yes
MOVE RATING TO PREVIOUS-RATING
DISPLAY "Previous Rating = " PREVIOUS-RATING
No
J


J
ACCEPT
RATING
"Enter Rating"
ESCAPE
KEY
PRESSED?
Yes
RETURN
No
RATING
=
PREVIOUS-RATING
Yes
RETURN
No
MOVE RATING
TO
DEVICE-ANALYSIS(K)
REWRITE
DEVICE-RECORD
RETURN

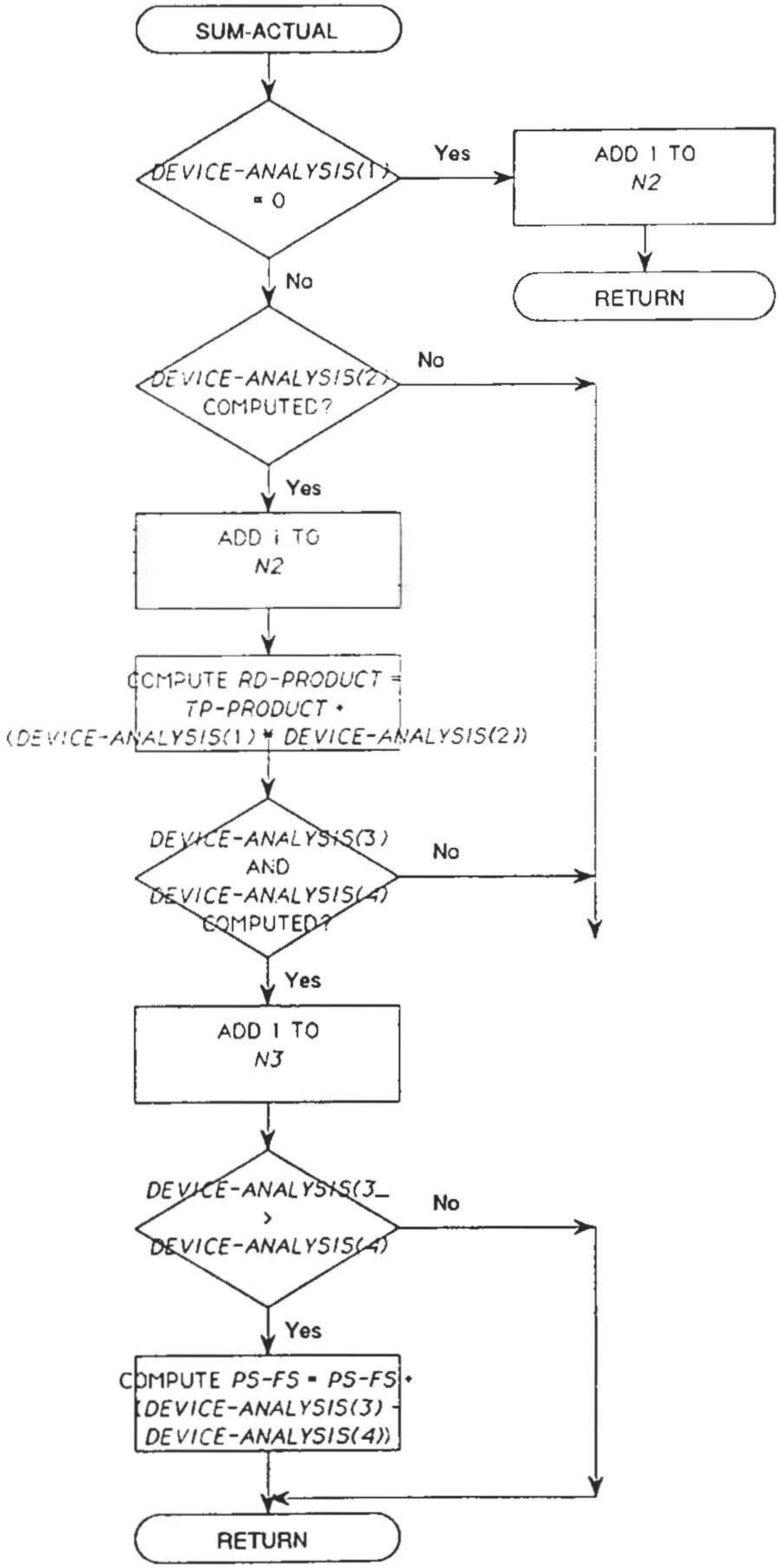

SUM-TASK
S-T
READ DEVICE-FILE NEXT RECORD
EOF DEVICE-FILE?
Yes
RETURN
No
MOVE DEVICE-KEY TO READ-TASK-NO, TASK-KEY
REQ-SUBTASK AND READ-SUBTASK = "0000"
No
S-T
Yes
TYPE-PART = 1
No
Yes
PERFORM SUM-ACTUAL
RETURN

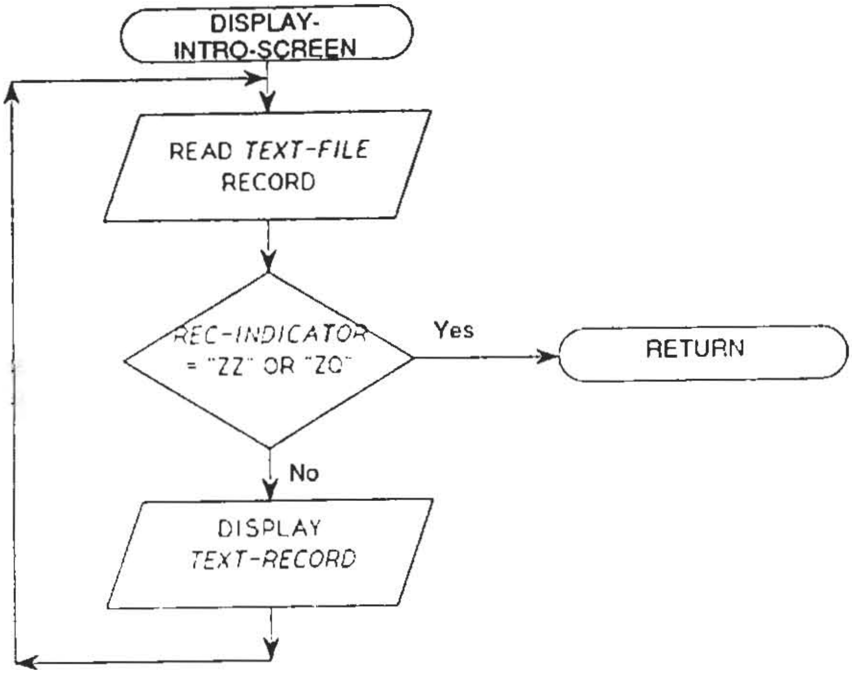

SUM-TRAINING-DEVICE
DEVICE-ANALYSIS(1) = 0
Yes
ADD 1 TO N1
RETURN
No
DEVICE-ANALYSIS(2) COMPUTED?
No
Yes
ADD 1 TO N1
COMPUTE TP-PRODUCT = TP-PRODUCT * (DEVICE-ANALYSIS(1) * DEVICE-ANALYSIS(2))
RETURN

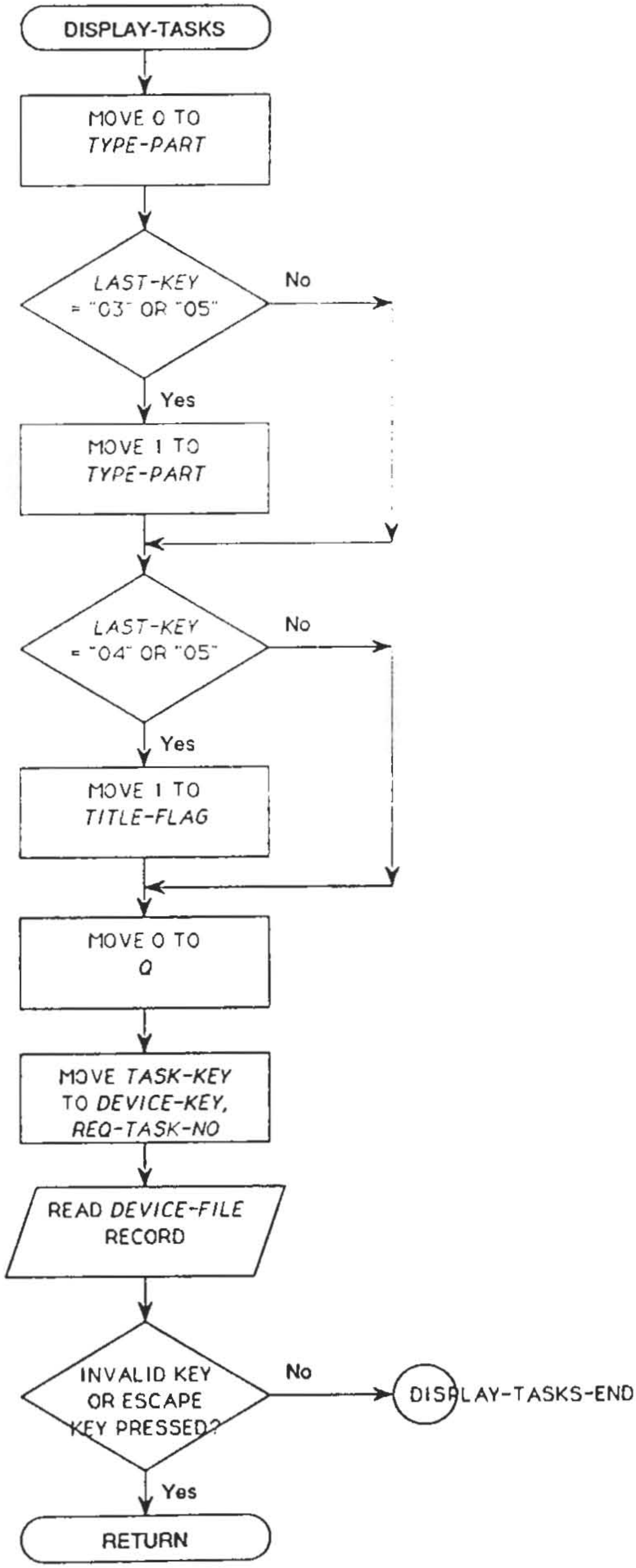
Generalized FlowChart Documentation for

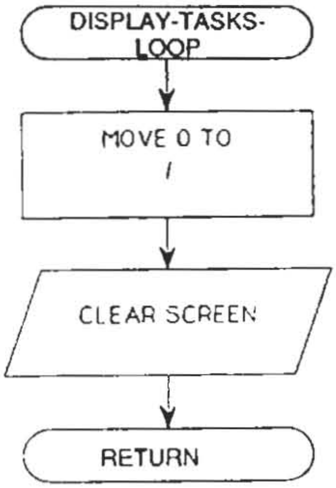
Program: ASTAR2

Page: 25 of 32




DISPLAY-INTRO-SCREEN
READ TEXT-FILE RECORD
REC-INDICATOR = "ZZ" OR "ZO"
Yes
RETURN
No
DISPLAY TEXT-RECORD

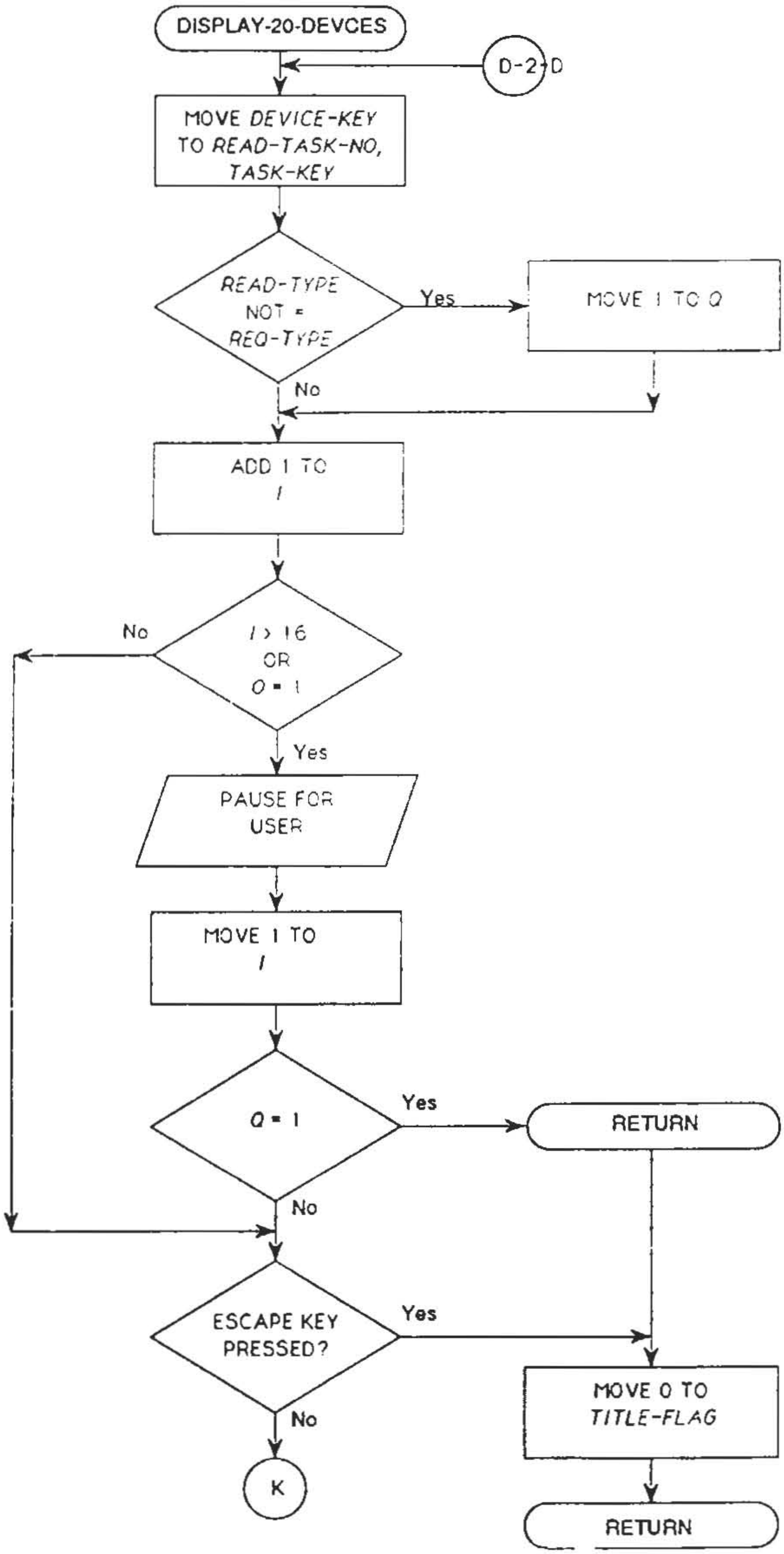

DISPLAY-TASKS
MOVE 0 TO TYPE-PART
LAST-KEY = "03" OR "05"
No
Yes
MOVE 1 TO TYPE-PART
LAST-KEY = "04" OR "05"
No
Yes
MOVE 1 TO TITLE-FLAG
MOVE 0 TO Q
MOVE TASK-KEY TO DEVICE-KEY, REQ-TASK-NO
READ DEVICE-FILE RECORD
INVALID KEY OR ESCAPE KEY PRESSED?
No
DISPLAY-TASKS-END
Yes
RETURN


DISPLAY-TASKS-LOOP
MOVE 0 TO I
CLEAR SCREEN
RETURN

Generalized FlowChart Documentation for

Program: **ASTAR2**

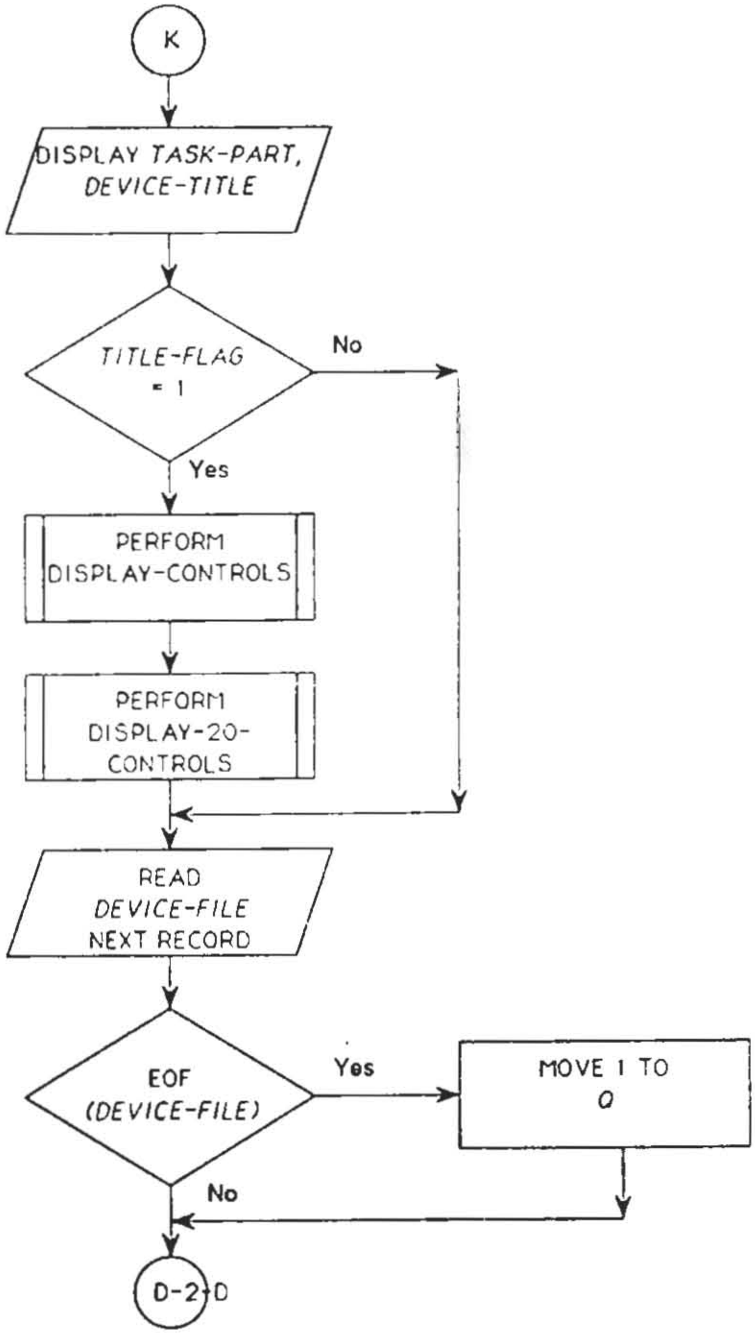
Page: **29 of 32**

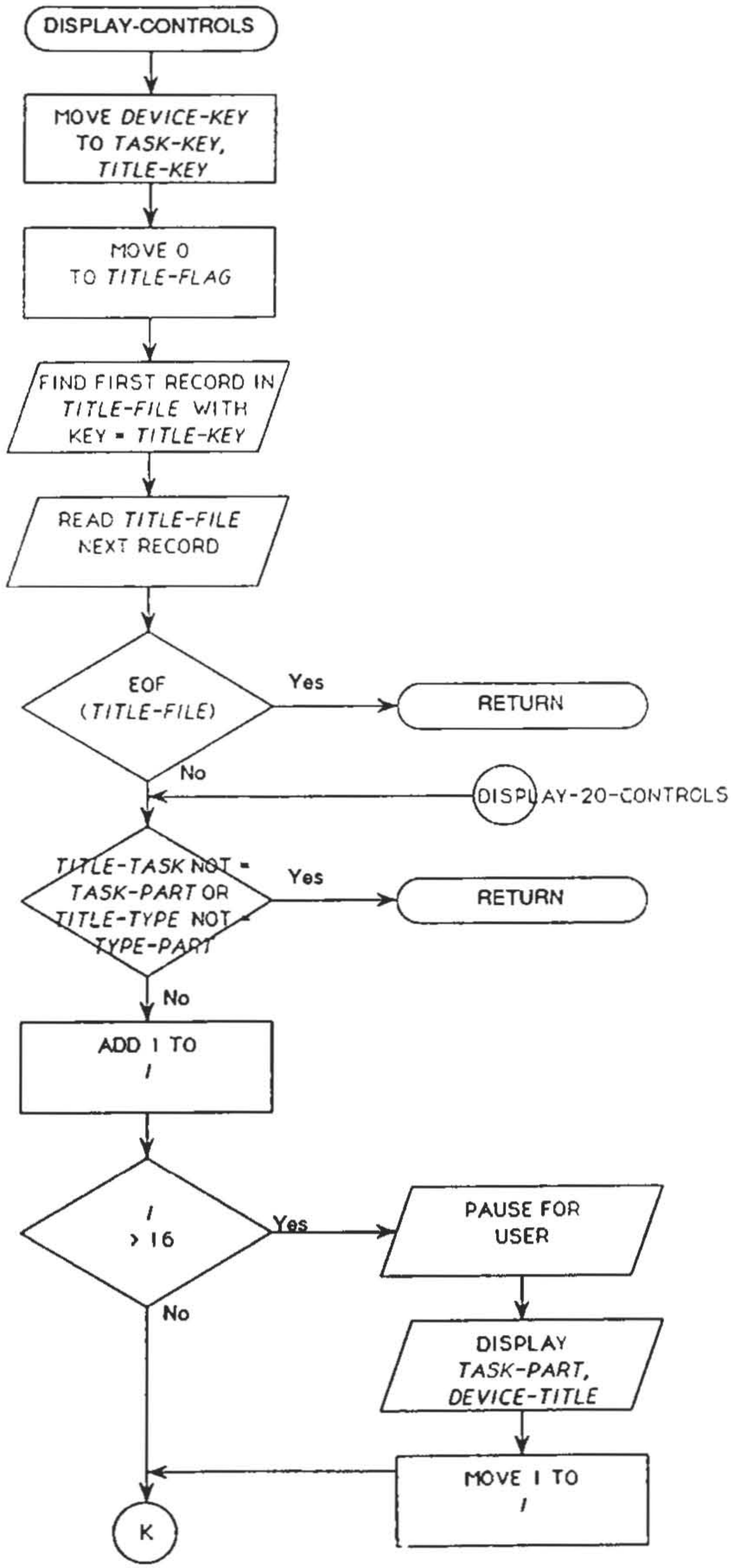


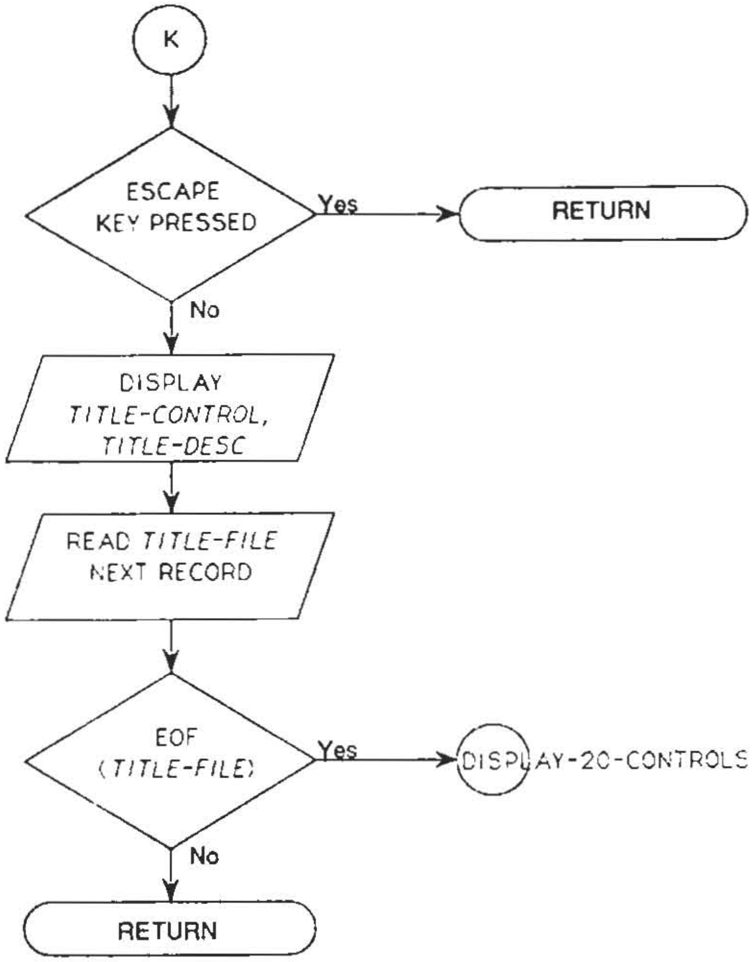
Generalized FlowChart Documentation for

Program: ASTAR2

Page: 30 of 32




DISPLAY-CONTROLS
MOVE DEVICE-KEY TO TASK-KEY, TITLE-KEY
MOVE 0 TO TITLE-FLAG
FIND FIRST RECORD IN TITLE-FILE WITH KEY = TITLE-KEY
READ TITLE-FILE NEXT RECORD
EOF (TITLE-FILE)
Yes
RETURN
No
DISPLAY-20-CONTROLS
TITLE-TASK NOT = TASK-PART OR TITLE-TYPE NOT = TYPE-PART
Yes
RETURN
No
ADD 1 TO I
I > 16
Yes
PAUSE FOR USER
DISPLAY TASK-PART, DEVICE-TITLE
MOVE 1 TO I
No
K


K
ESCAPE KEY PRESSED
Yes
RETURN
No
DISPLAY *TITLE-CONTROL, TITLE-DESC*
READ *TITLE-FILE* NEXT RECORD
EOF (*TITLE-FILE*)
Yes
DISPLAY-20-CONTROLS
No
RETURN

ASTAR3 SUBROUTINE CALLS

ASTAR3 file descriptions:

```
1.    B:DEVICE (DEVICE-FILE)
      DEVICE-KEY              alphanumeric 10
      DEVICE-ANALYSIS(1)      integer 3
      DEVICE-ANALYSIS(2)      integer 3
              .                   .
              .                   .
      DEVICE-ANALYSIS(20)     integer 3
      DEVICE-TITLE            alphanumeric 60

2.    B:TITLE (TITLE-FILE)
      TITLE-KEY
           TITLE-TYPE         integer 1
           TITLE-TASK         alphanumeric 9
           TITLE-PERIOD       alphanumeric 1
           TITLE-CONTROL      alphanumeric 9
      TITLE-DESC              alphanumeric 60

3.    B:CONTROL (CONTROL-FILE)
      CONTROL KEY
           CTL-TYPE           integer 1
           CTL-TASK           alphanumeric 4
           FILLER             alphanumeric 1
           CTL-SUBTASK        alphanumeric 4
           FILLER             alphanumeric 1
           CTL-NO             alphanumeric 9
      CONTROL-ANALYSIS(1)     integer 3
      CONTROL-ANALYSIS(2)     integer 3
      CORR-CTL-KEY            alphanumeric 20

4.    ASTAR3.DOC (TEXT-FILE)
      REC-INDICATOR           alphanumeric 2
      FILLER                  alphanumeric 1
      ANALYSIS-NUMBER         alphanumeric 1
      FILLER                  alphanumeric 75
```

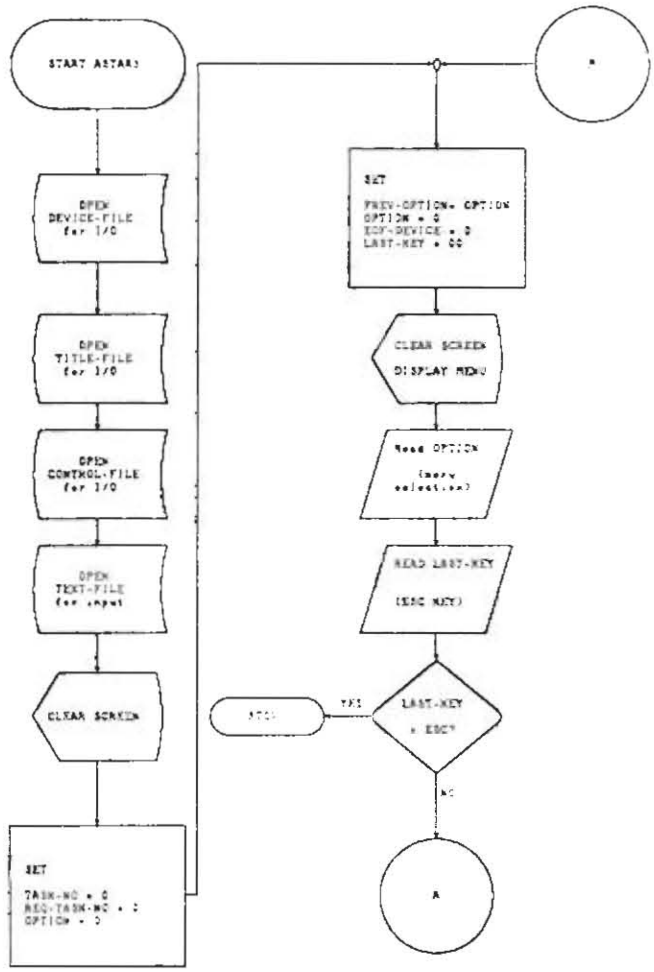
ASTAR3 Variable Dictionary

Field Name	Type & Length	Contents
ACQUISITION-EFFICIENCY	numeric 99999.99	
ADDITIONAL-DEFICIT	numeric 9999	
AE-PRODUCT	numeric 99999999.99	
ANSWER	alphanumeric 1	
ASTAR	numeric 99999.99	
CTL-STATUS-WORD	alphanumeric 2	
DEVICE-STATUS-WORD	alphanumeric 2	
DIFFICULTY	integer 4	
DISPLAY-NUMBER	numeric 00,000.99	
EOF-CONTROL	interger 1	0
EOF-DEVICE	integer 1	0
I	integer 4	
J	numeric 9	
K	integer 4	
LAST-KEY	alphanumeric 2	
N1	integer 4	
N2	integer 4	
N3	integer 4	
N4	integer 4	
N5	integer 4	
NOTHING	alphanumeric 1	
OPTION	integer 1	
PREV-OPTION	integer 1	
PREVIOUS-RATING	numeric 009	
PS-FS	integer 8	
Q	integer 4	
RATING	integer 3	
RD-PRODUCT	integer 8	
READ-TASK-NO		
READ-TYPE	integer 1	
READ-TASK1	integer 4	
FILLER	alphanumeric 1	
READ-SUBTASK	alphanumeric 4	
REQ-CTL-KEY		
REQ-CTL-TYPE	integer 1	
REQ-CTL-TASK	alphanumeric 4	
FILLER	alphanumeric 1	
REQ-CTL-SUBTASK	alphanumeric 4	
FILLER	alphanumeric 1	
REQ-CTL-NO	alphanumeric 9	
REQ-TASK-NO		
REQ-TYPE	integer 1	
REQ-TASK	integer 4	
FILLER	alphanumeric 1	
REQ-SUBTASK	alphanumeric 4	
SQR1	numeric 9	
SQR-ROOT	numeric 99999.99	
TASK-KEY		
TYPE-PART	alphanumeric 1	
TASK-PART	alphanumeric 9	
PERIOD-PART	alphanumeric 1	.
CONTROL-PART	alphanumeric 9	

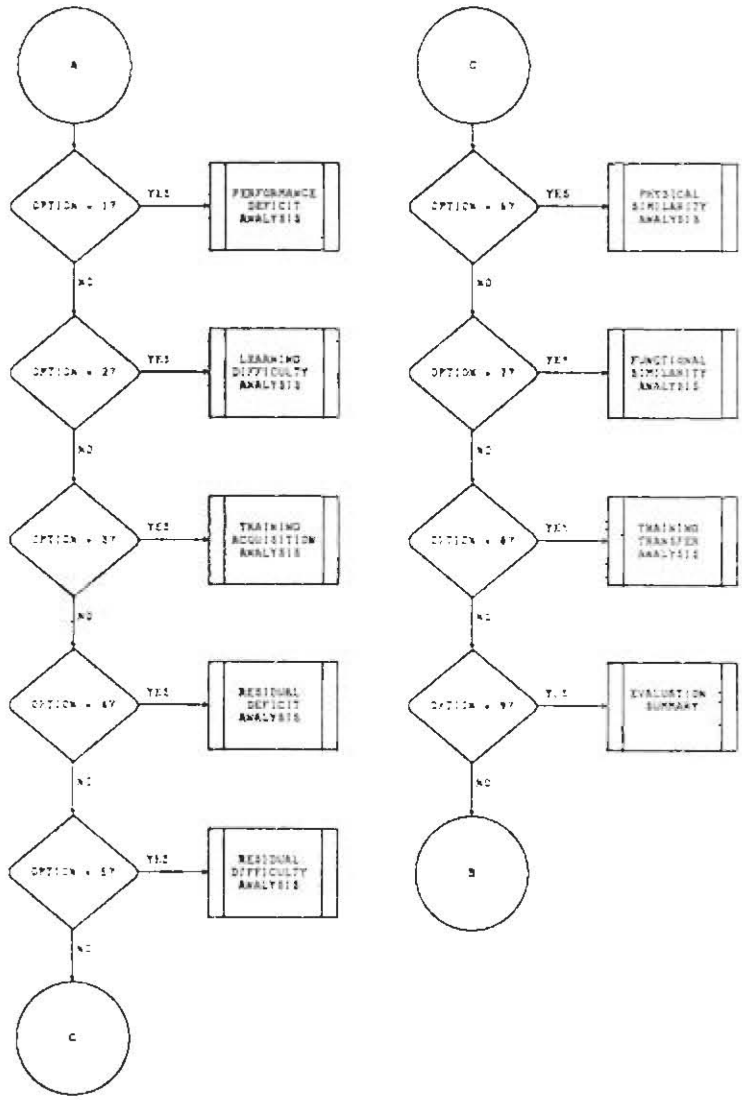
ASTAR3 Variable Dictionary

Field Name	Type & Length	Contents
TASK-NO	numeric 0009.9999	
TE-PRODUCT	numeric 99999999.99	
TITLE-FLAG	integer 4	0
TITLE-STATUS-WORD	alphanumeric 2	
TP-PRODUCT	integer 8	
TRAINING-ACQUISITION	numeric 99999.99	
TRAINING-PROBLEM	numeric 99999.99	
TRAINING-TRANSFER	numeric 99999.99	
TRANSFER-EFFICIENCY	numeric 99999.99	
TRANSFER-PROBLEM	numeric 99999.99	
X	integer 4	
Z	integer 4	

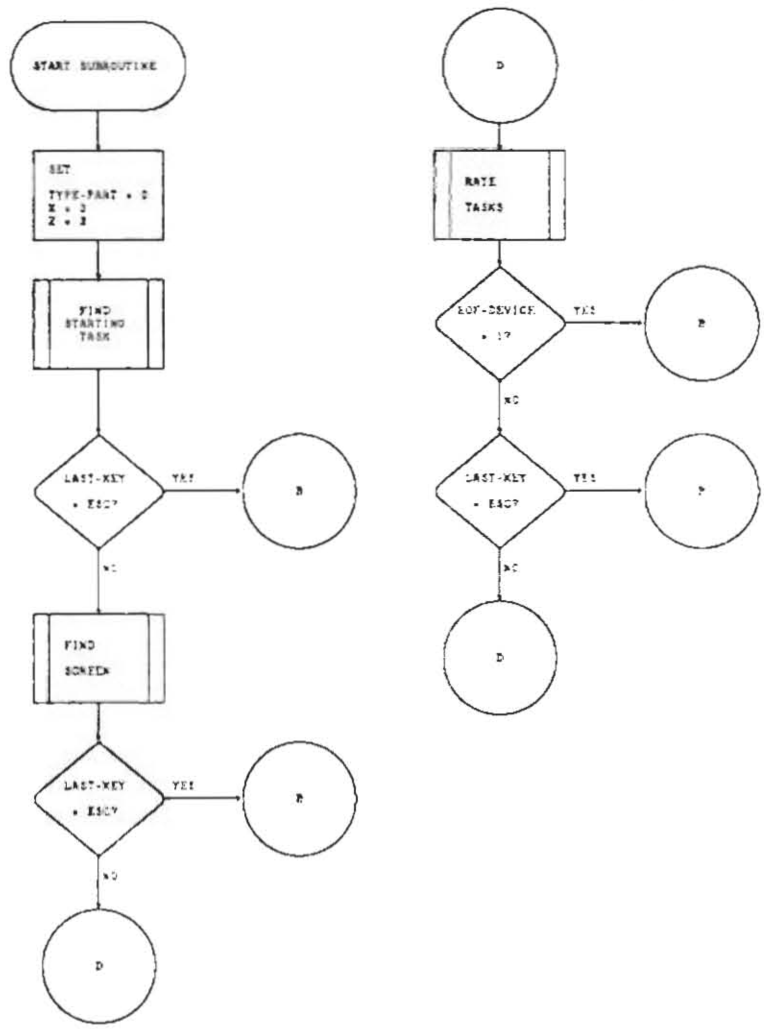
SUBROUTINE - ASTAR3 (page 1/2)



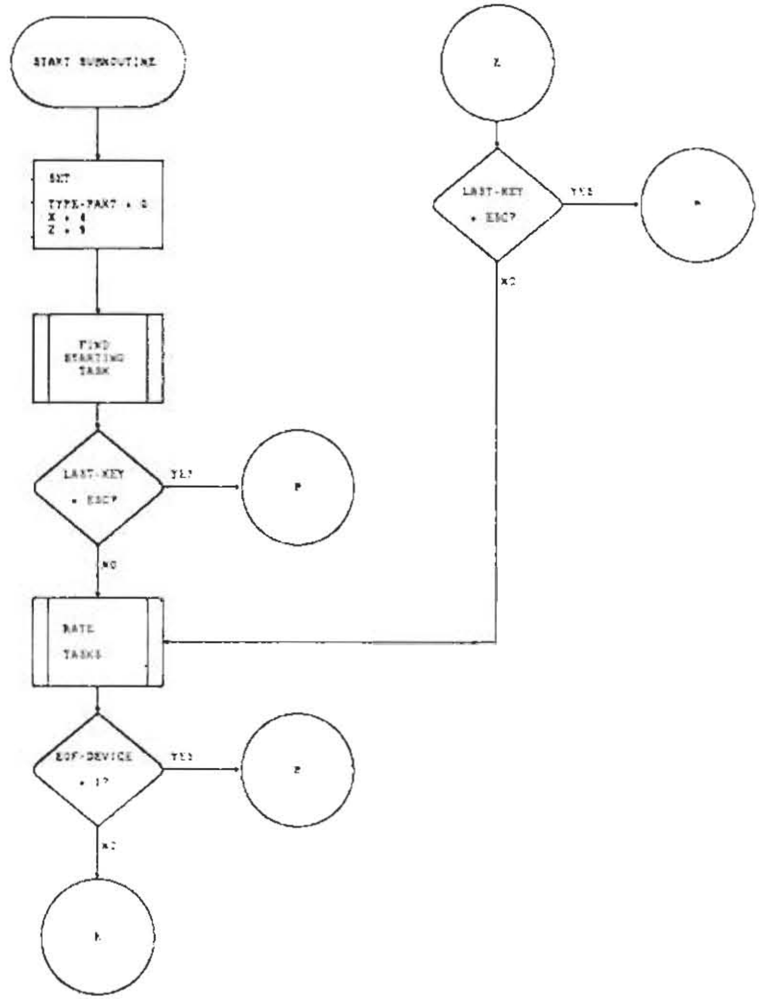
SUBROUTINE - ASTAR3 (page 2/2)



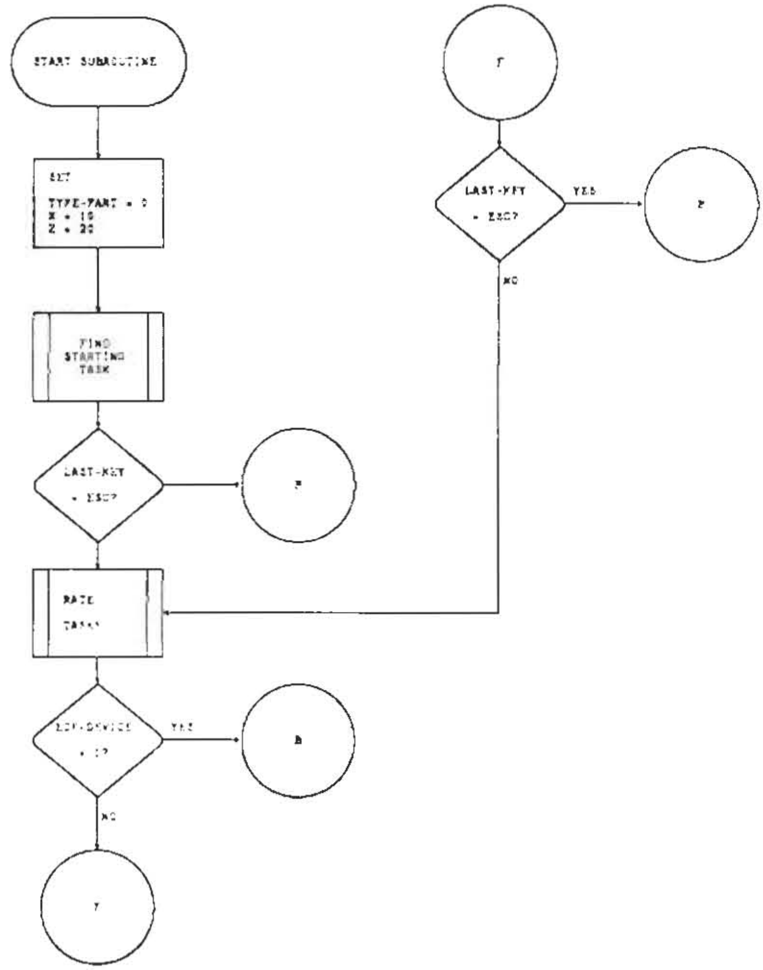
SUBROUTINE PERFORMANCE DEFICIT ANALYSIS (page 1/1)



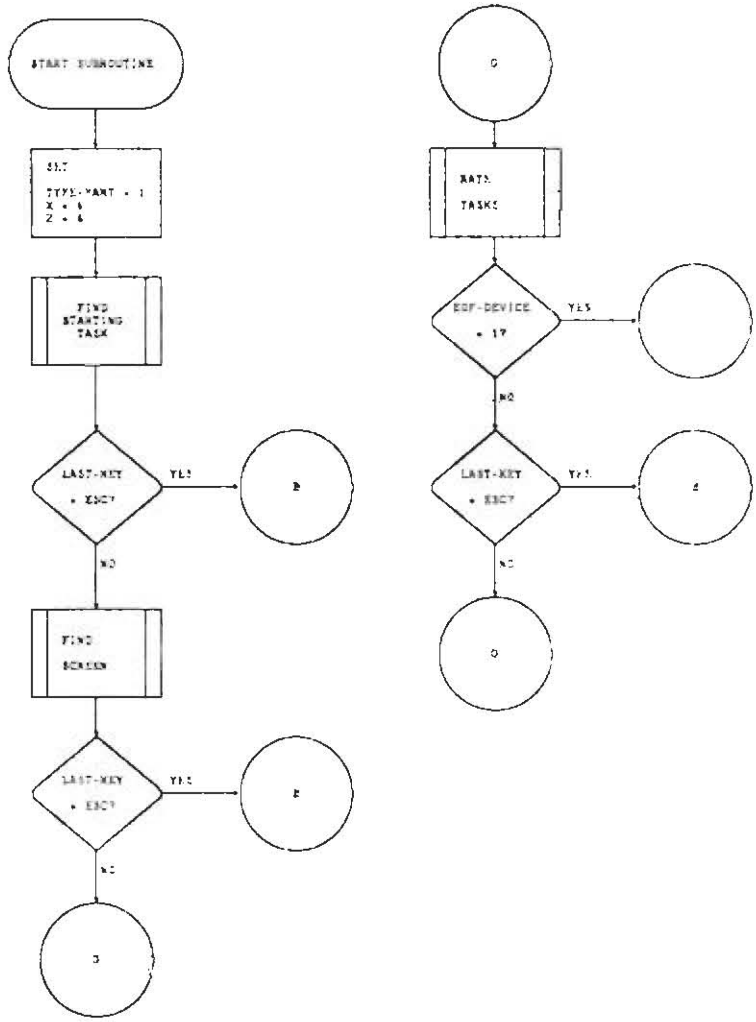
SUBROUTINE LEARNING DIFFICULTY ANALYSIS (page 1/1)



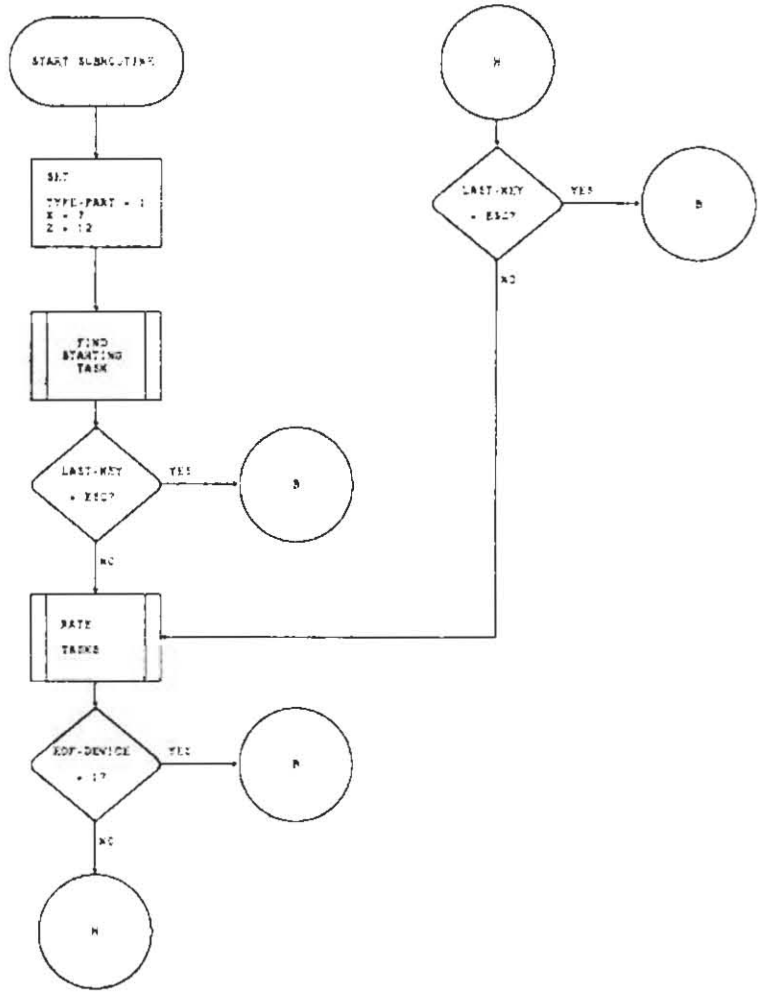
SUBROUTINE TRAINING ACQUISITION ANALYSIS (page 1/1)



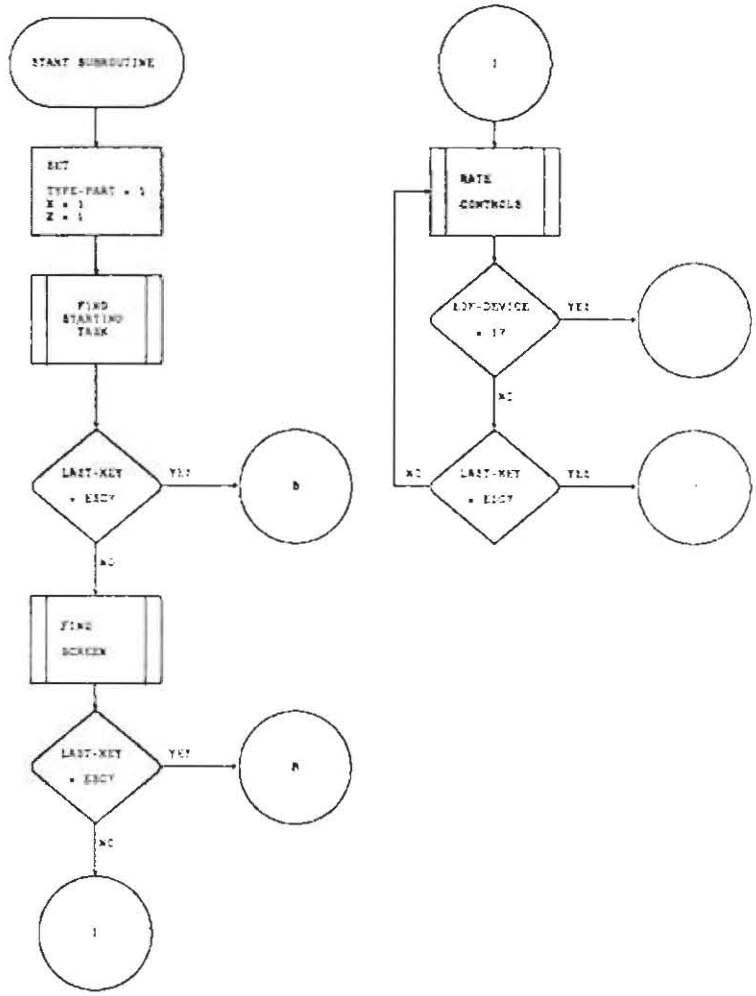
SUBROUTINE RESIDUAL DEFICIT ANALYSIS (page 1/1)



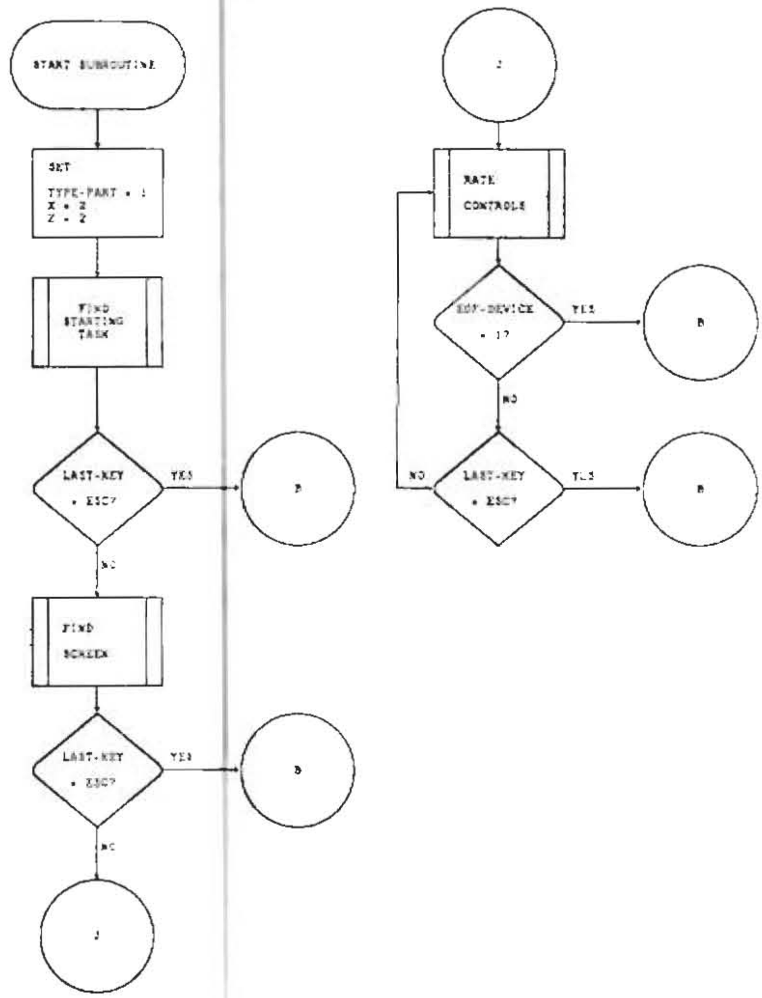
SUBROUTINE RESIDUAL DIFFICULTY ANALYSIS (page 1/1)



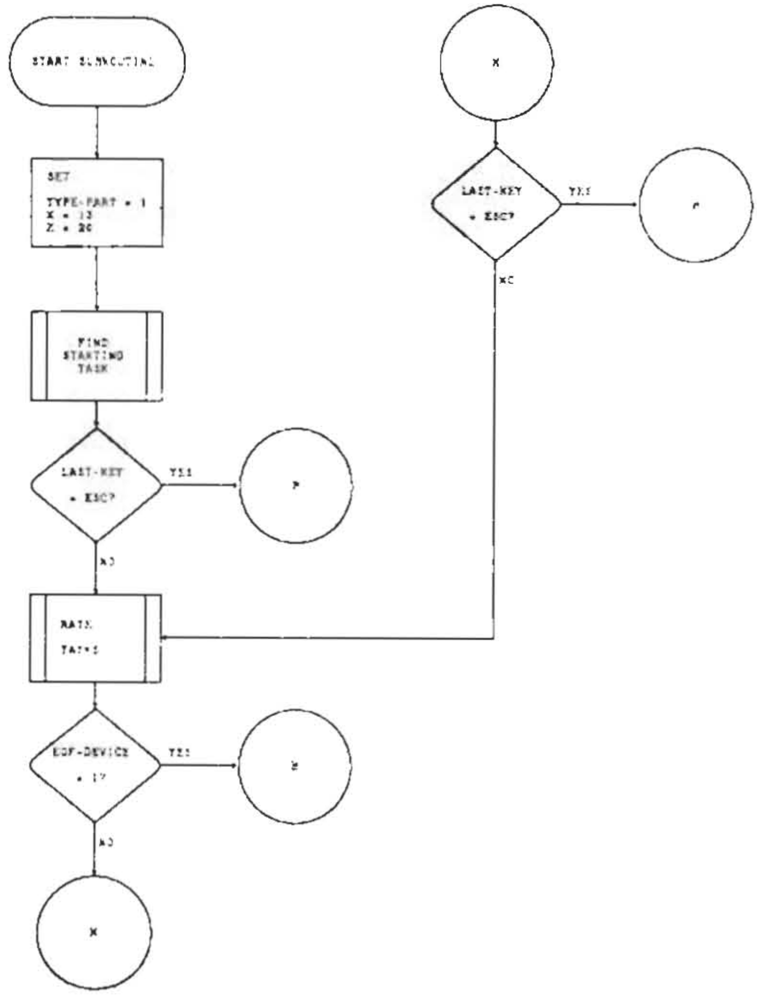
SUBROUTINE PHYSICAL SIMILARITY ANALYSIS (page 1/1)



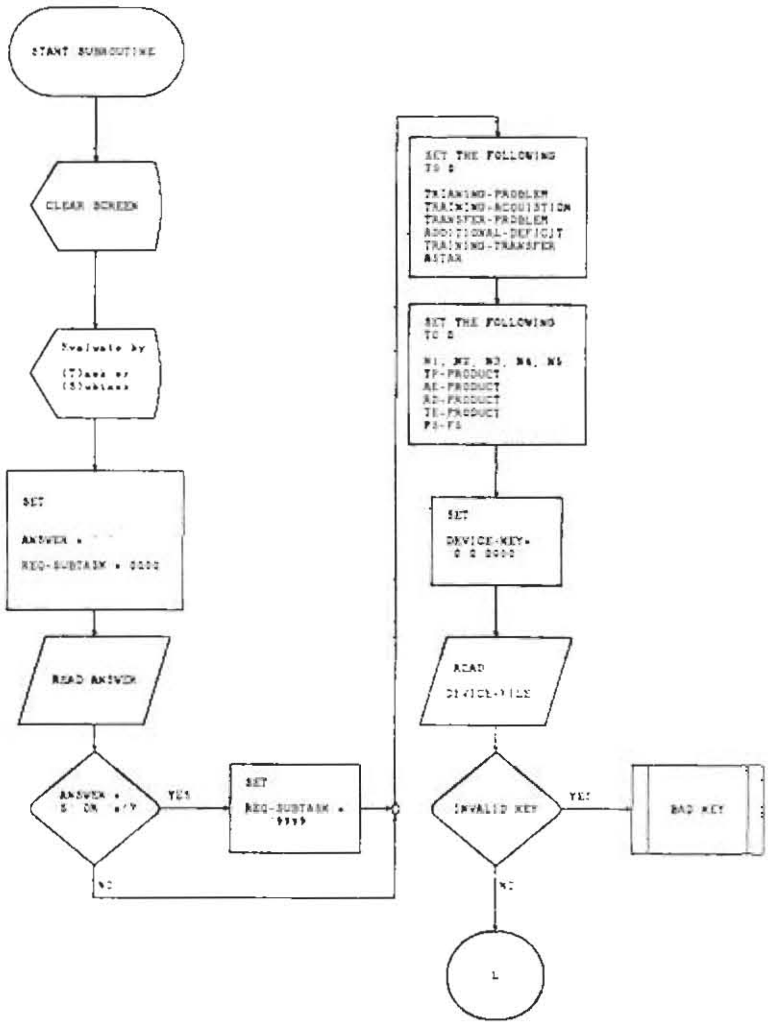
SUBROUTINE FUNCTIONAL SIMILARITY ANALYSIS (page 1/1)



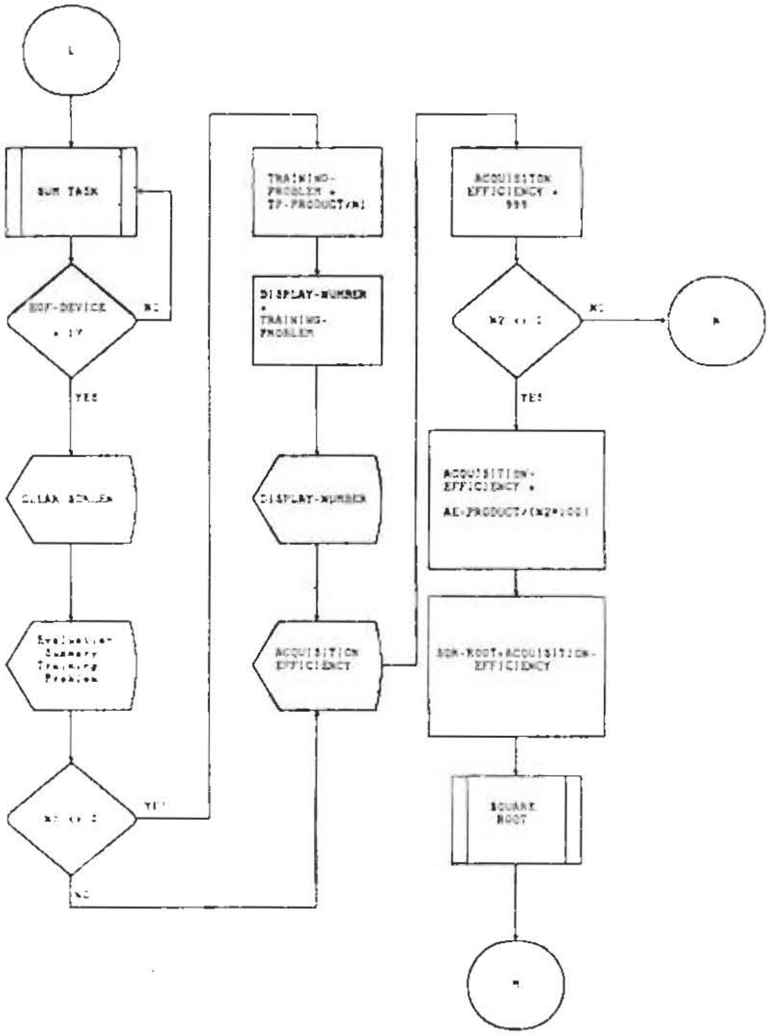
SUBROUTINE TRAINING TRANSFER ANALYSIS (page 1/1)



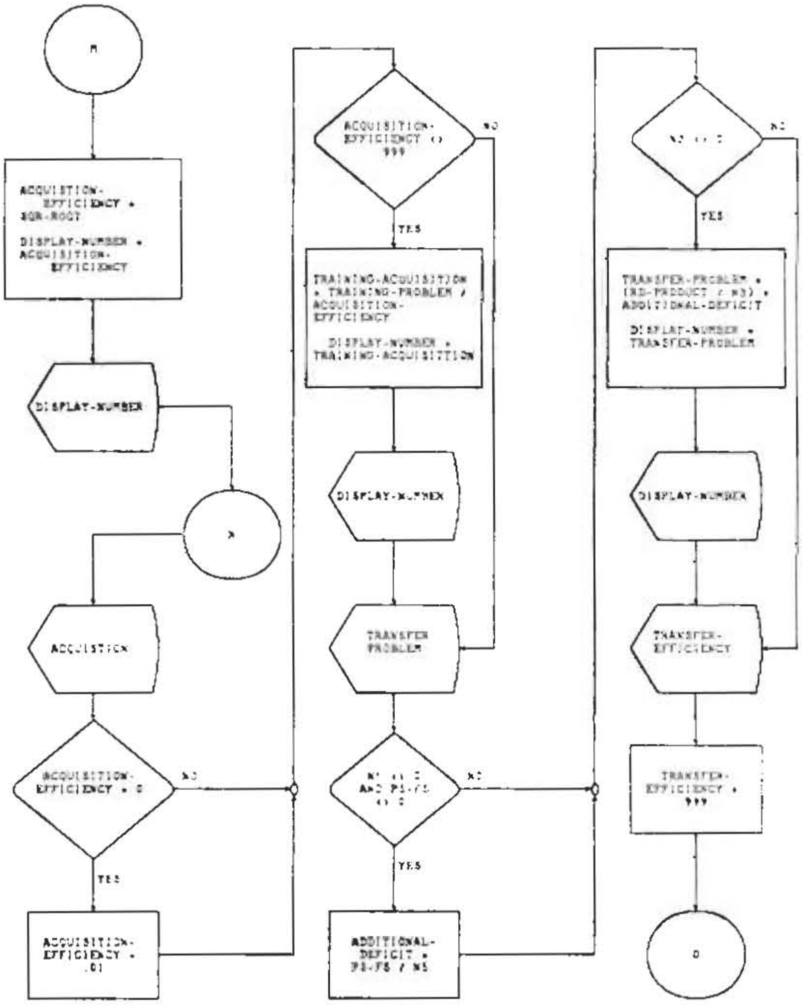
SUBROUTINE EVALUATION SUMMARY (page 1/4)



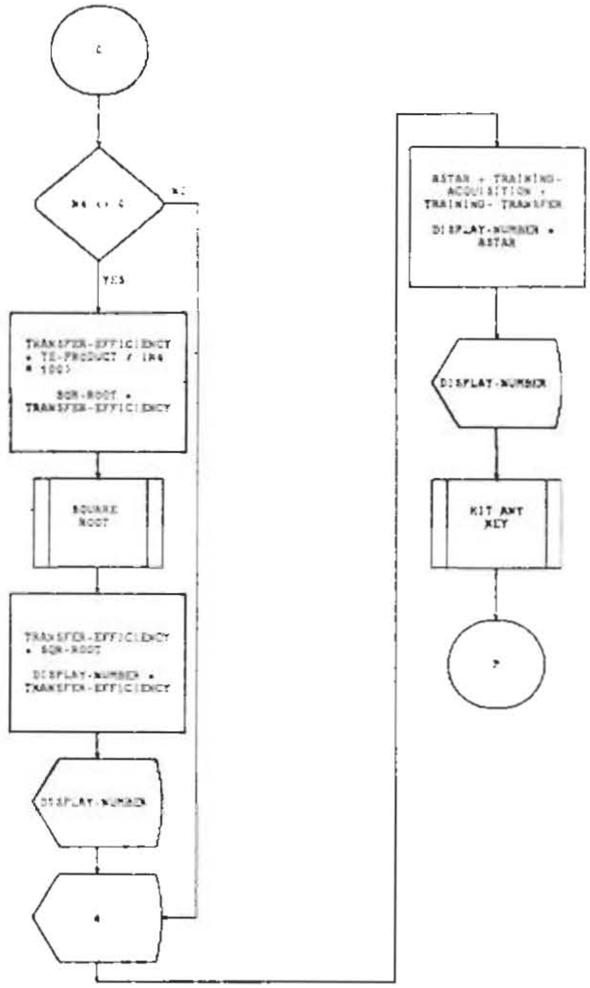
SUBROUTINE EVALUATION SUMMARY (page 2/4)



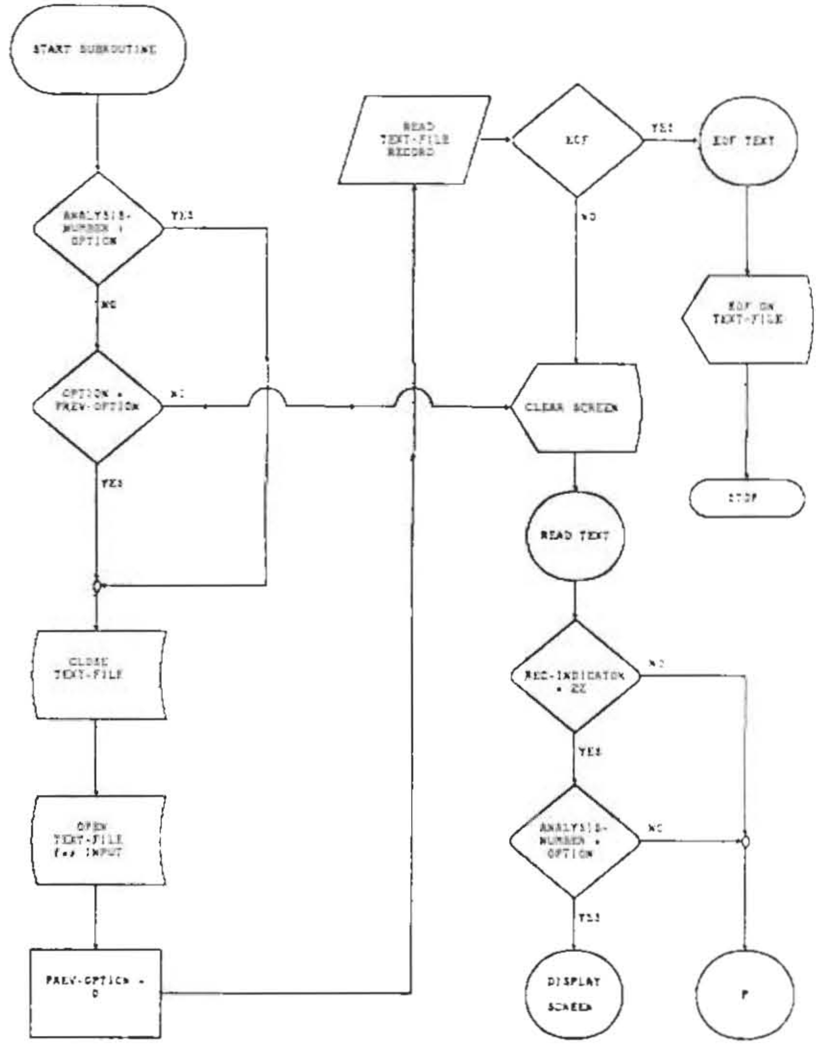
SUBROUTINE EVALUATION SUMMARY (page 3/4)



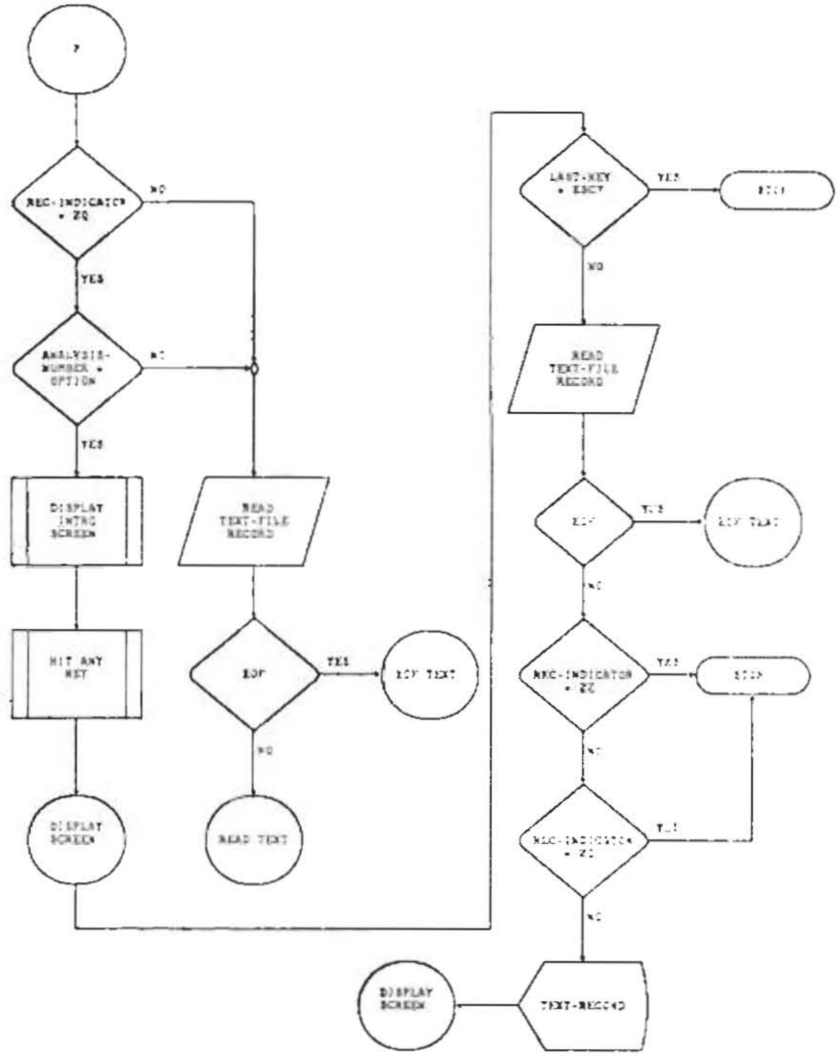
SUBROUTINE EVALUATION SUMMARY (page 4/4)



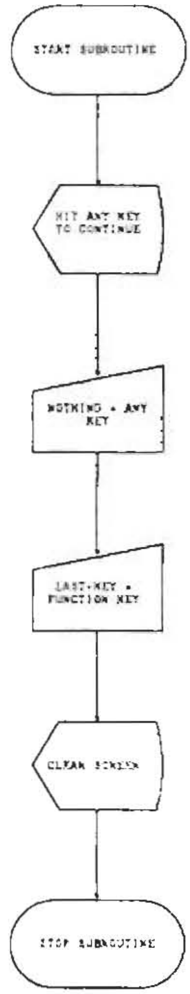
SUBROUTINE FIND SCREEN (page 1/2)



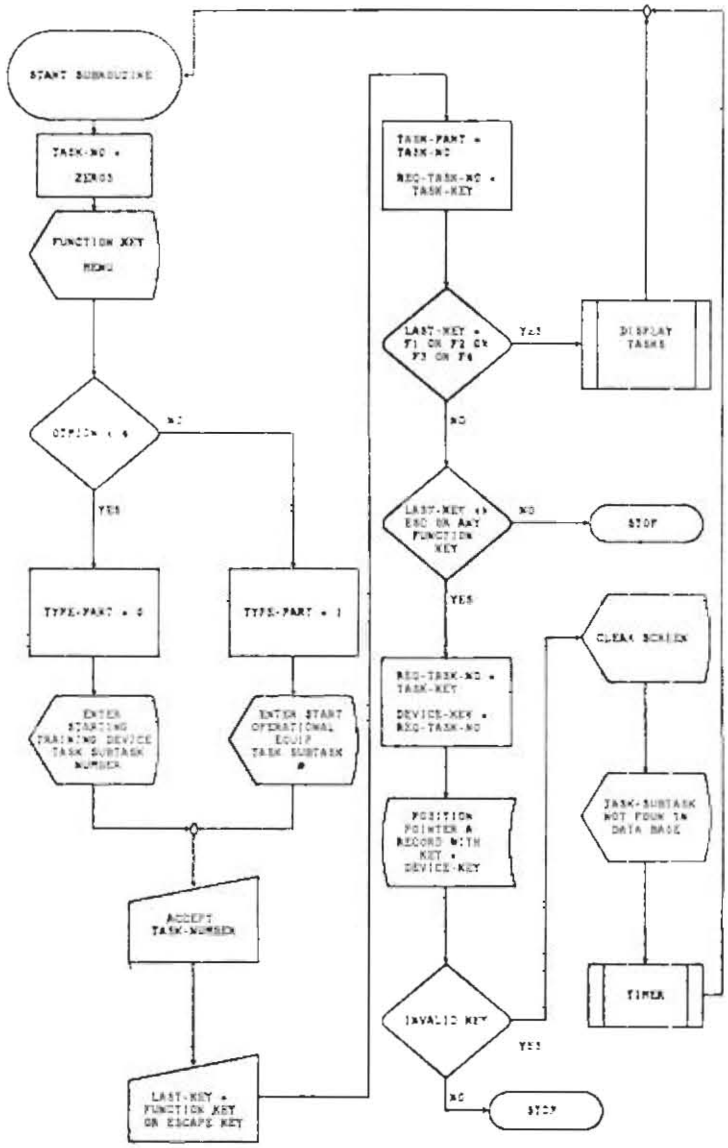
SUBROUTINE FIND SCREEN (page 2/2)



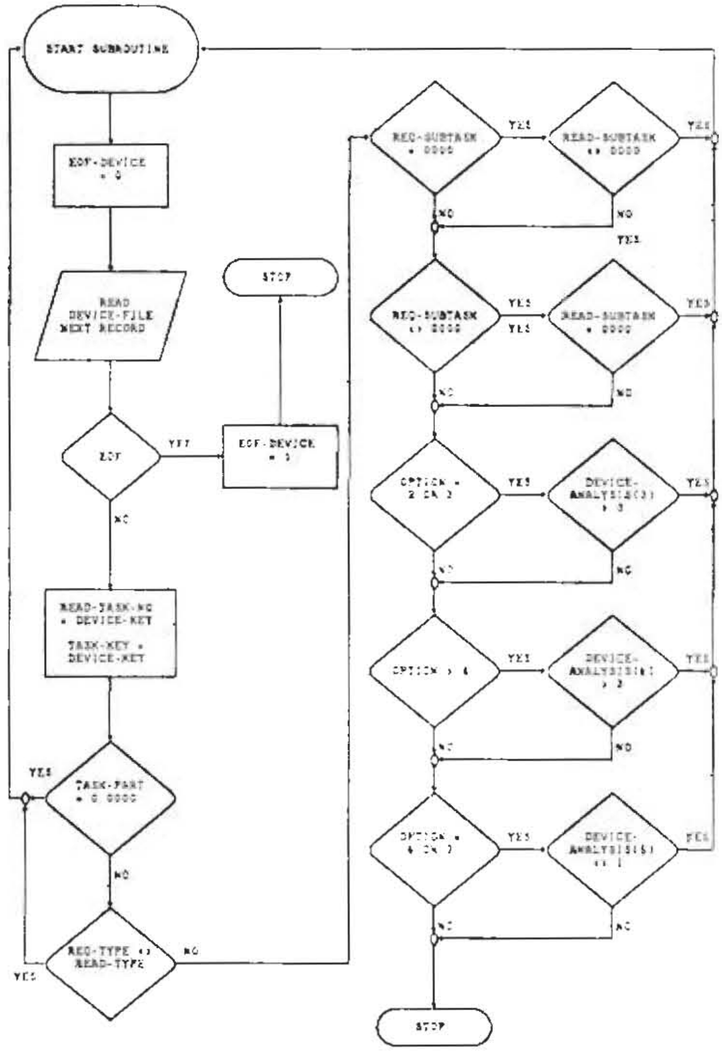
SUBROUTINE HIT ANY KEY (page 1/1)



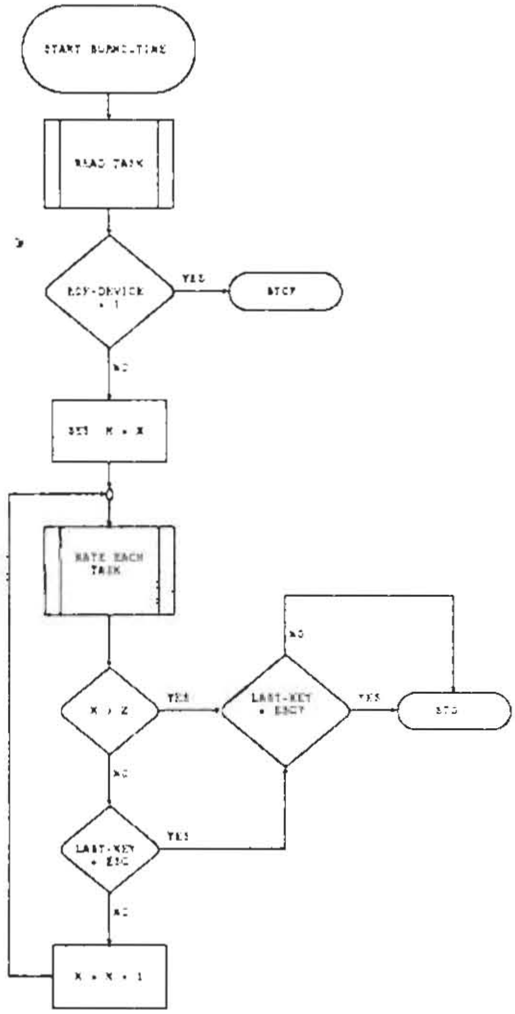
SUBROUTINE FIND STARTING TASK (page 1/1)



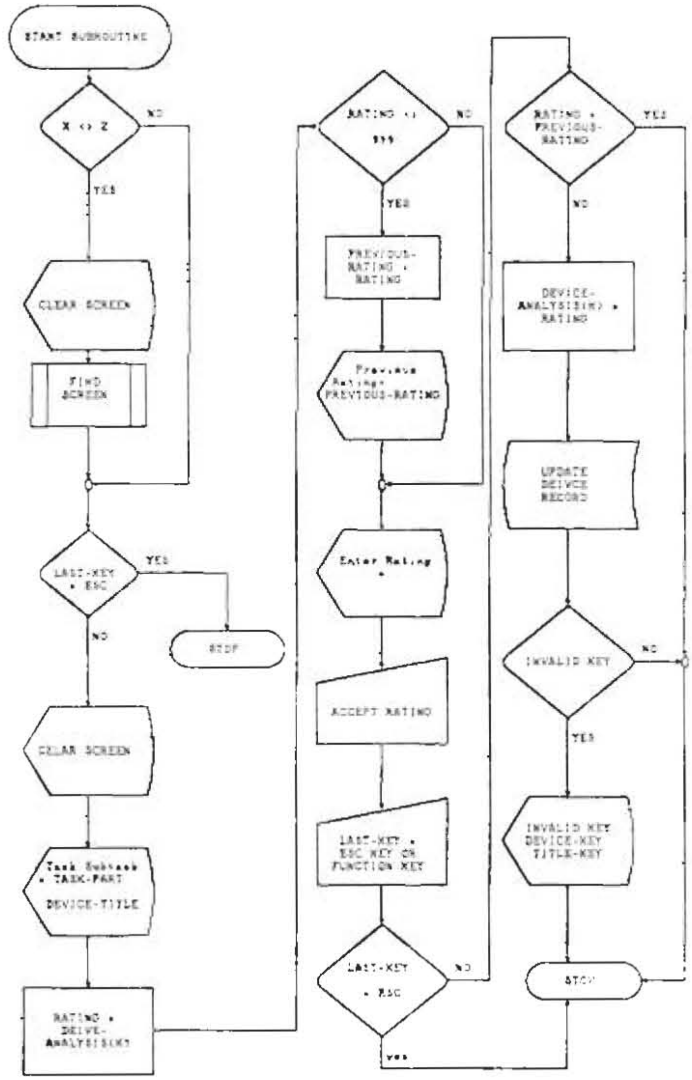
SUBROUTINE READ TASK (page 1/1)



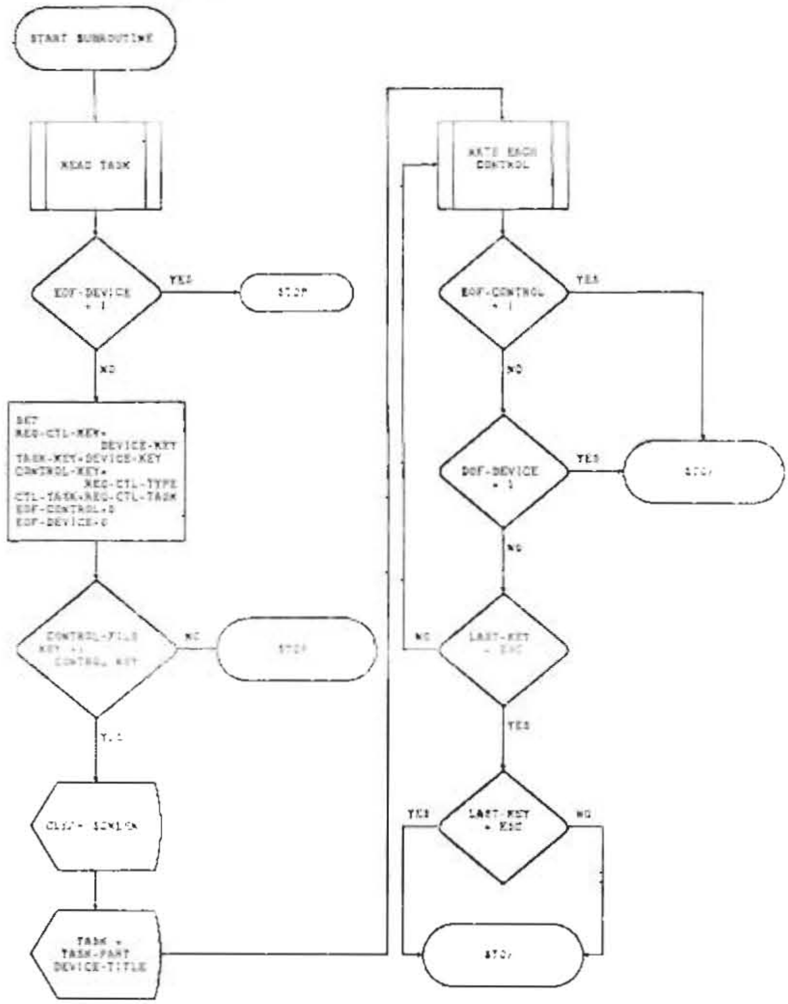
SUBROUTINE RATE TASKS (page 1/1)



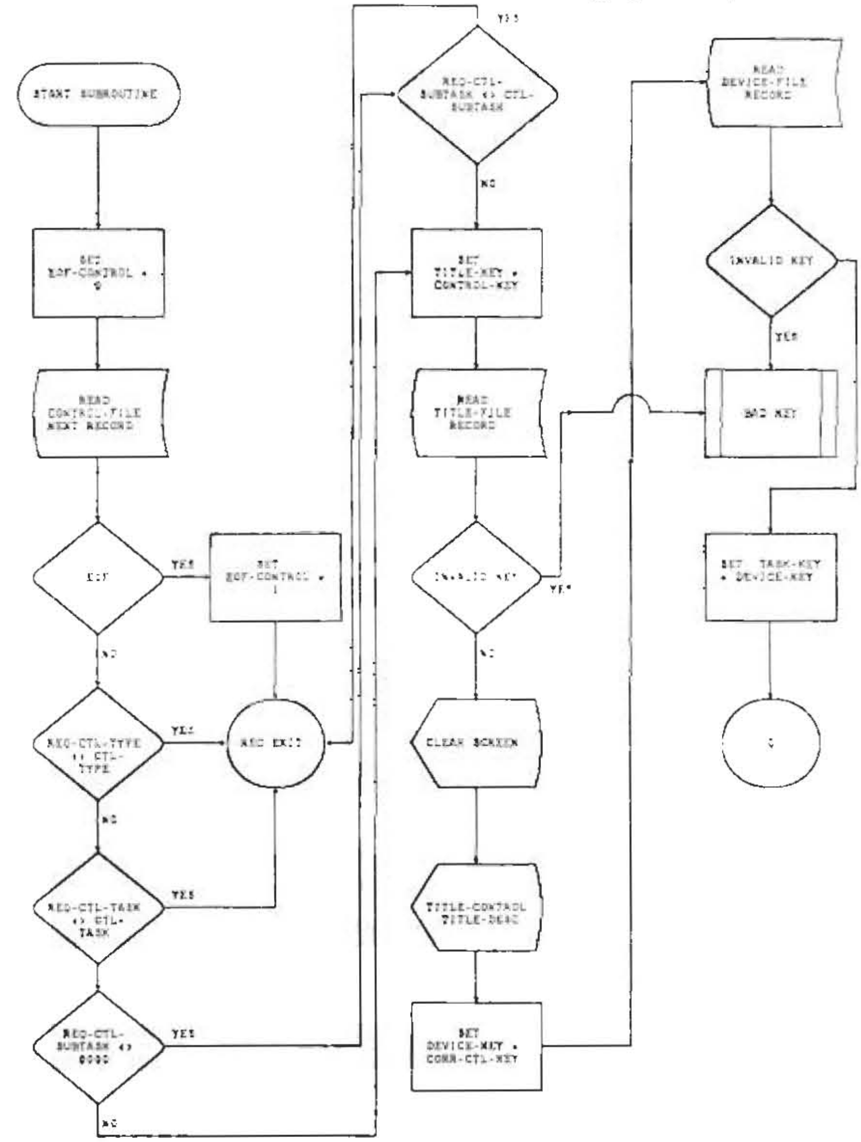
SUBROUTINE RATE EACH TASK (page 1/1)



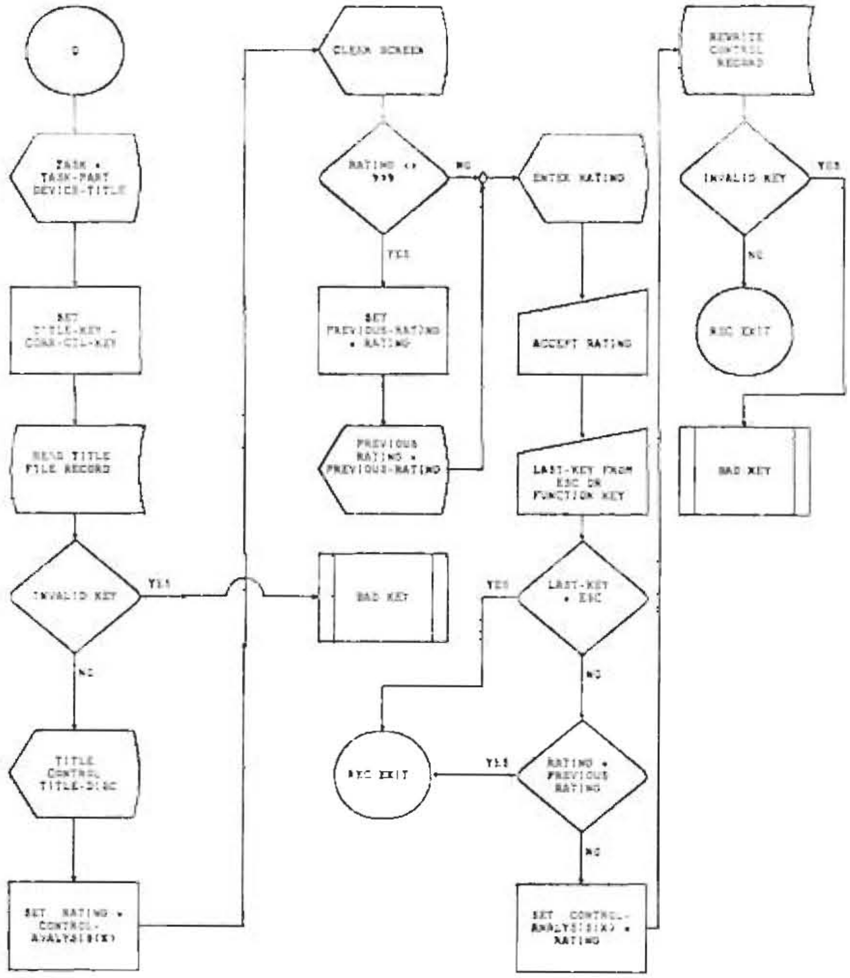
SUBROUTINE RATE CONTROLS (page 1/1)



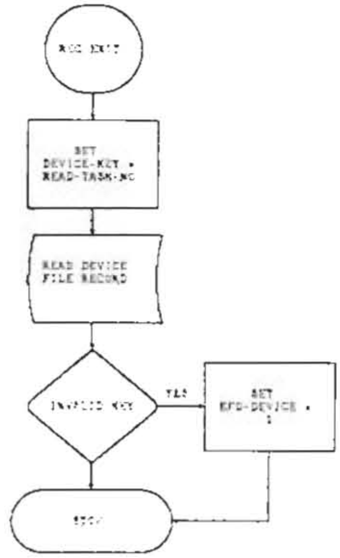
SUBROUTINE RATE EACH CONTROL (page 1/3)



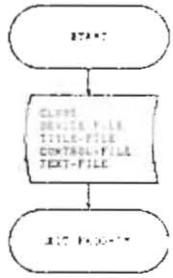
SUBROUTINE RATE EACH CONTROL (page 2/3)



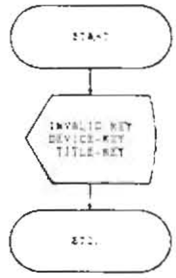
SUBROUTINE RATE EACH CONTROL (page 3/3)



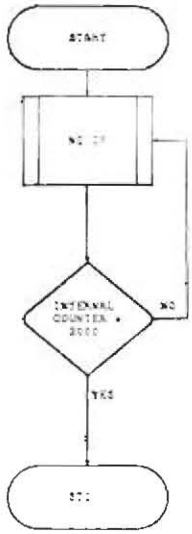
SUBROUTINE STOP RUN (page 1/1)

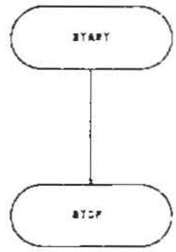


SUBROUTINE BAD KEY (page 1/1)

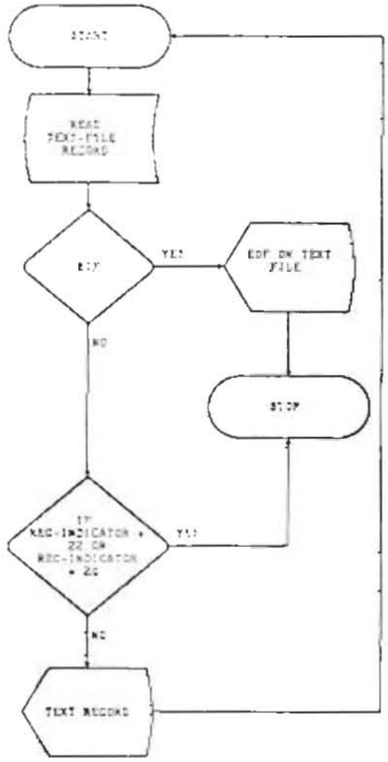


SUBROUTINE TIMER (page 1/1)

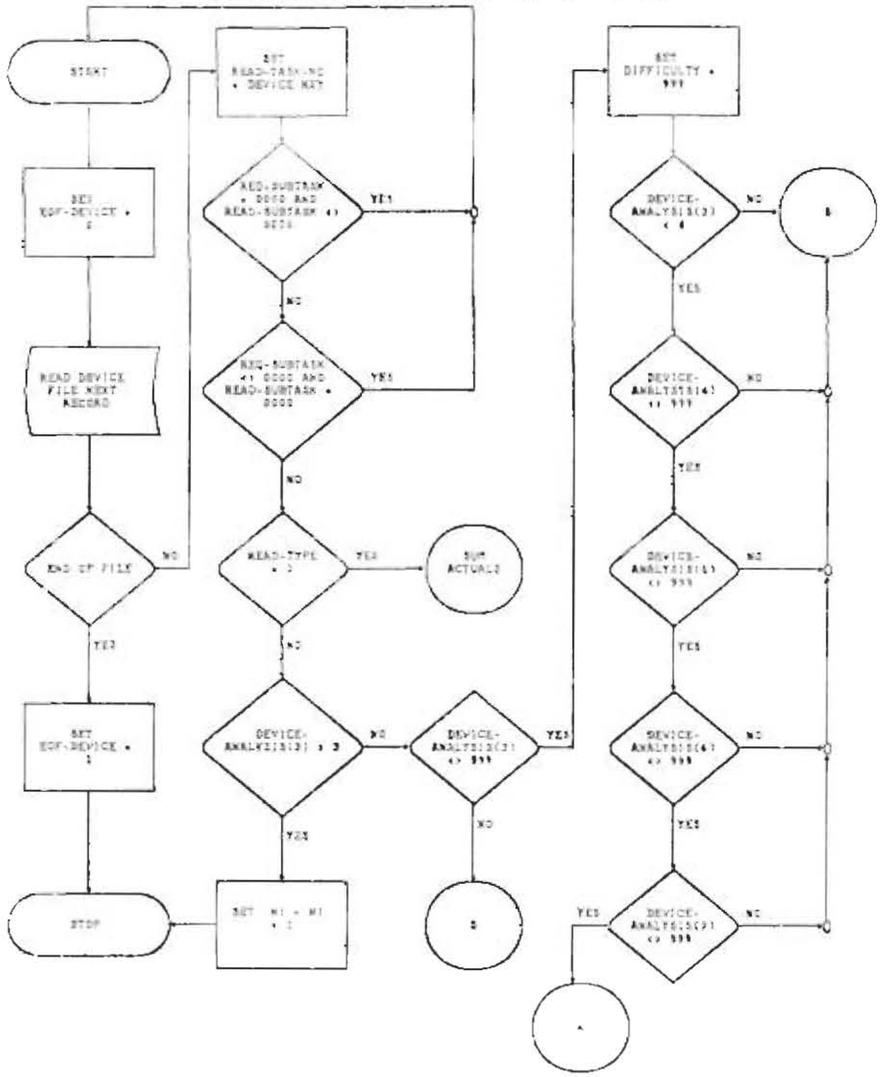




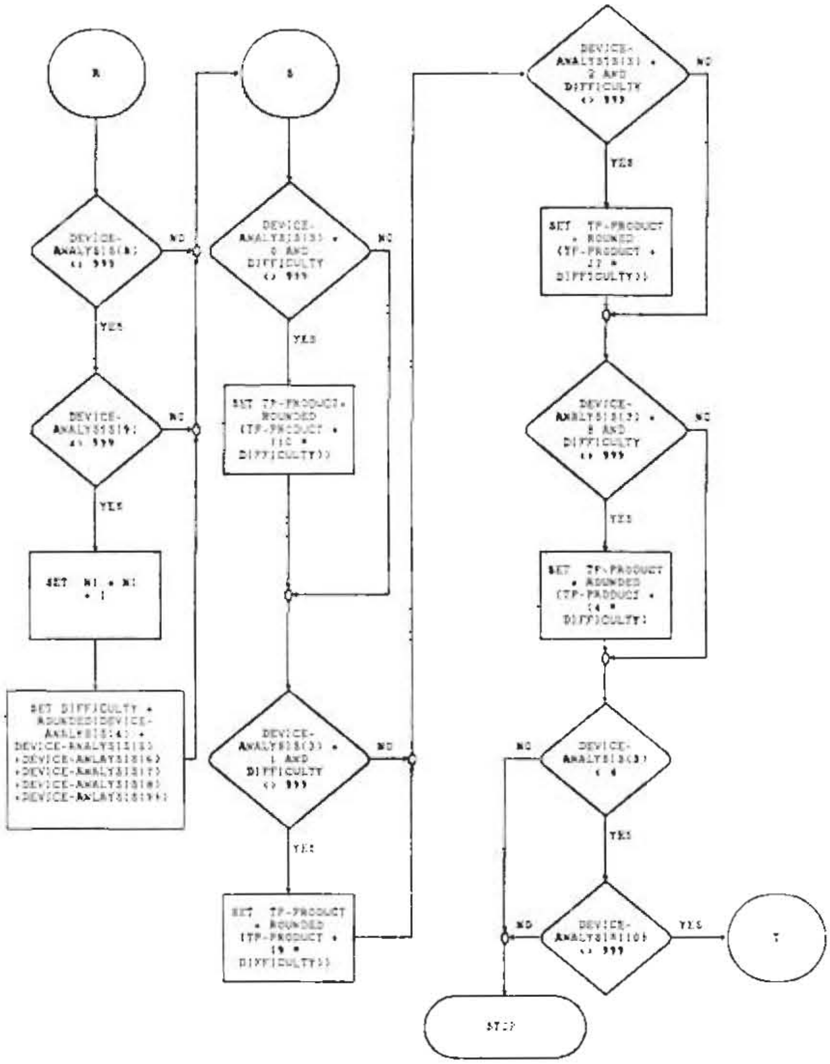
SUBROUTINE DISPLAY INTRO SCREEN (page 1/1)



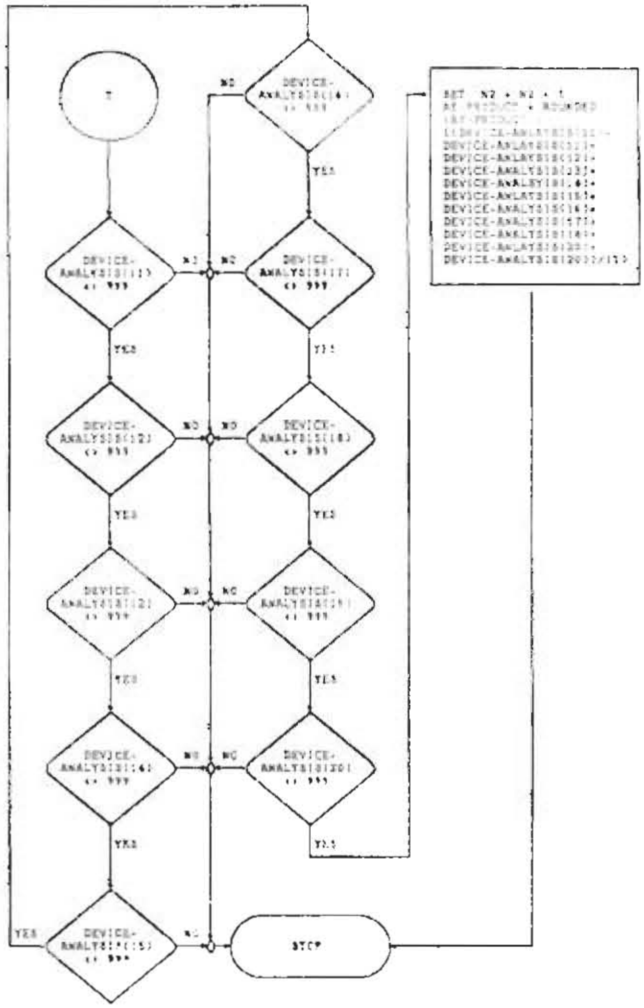
SUBROUTINE SUM TASK (page 1/5)

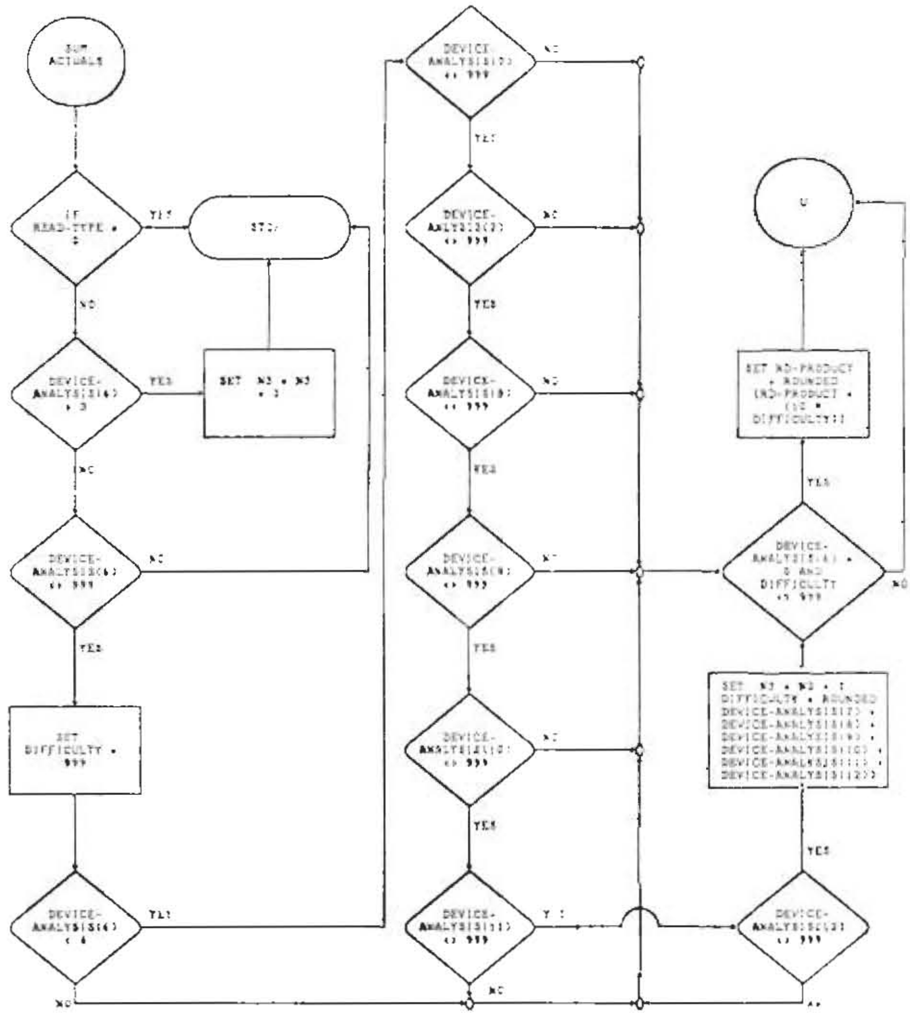


SUBROUTINE SUM TASK (page 2/5)

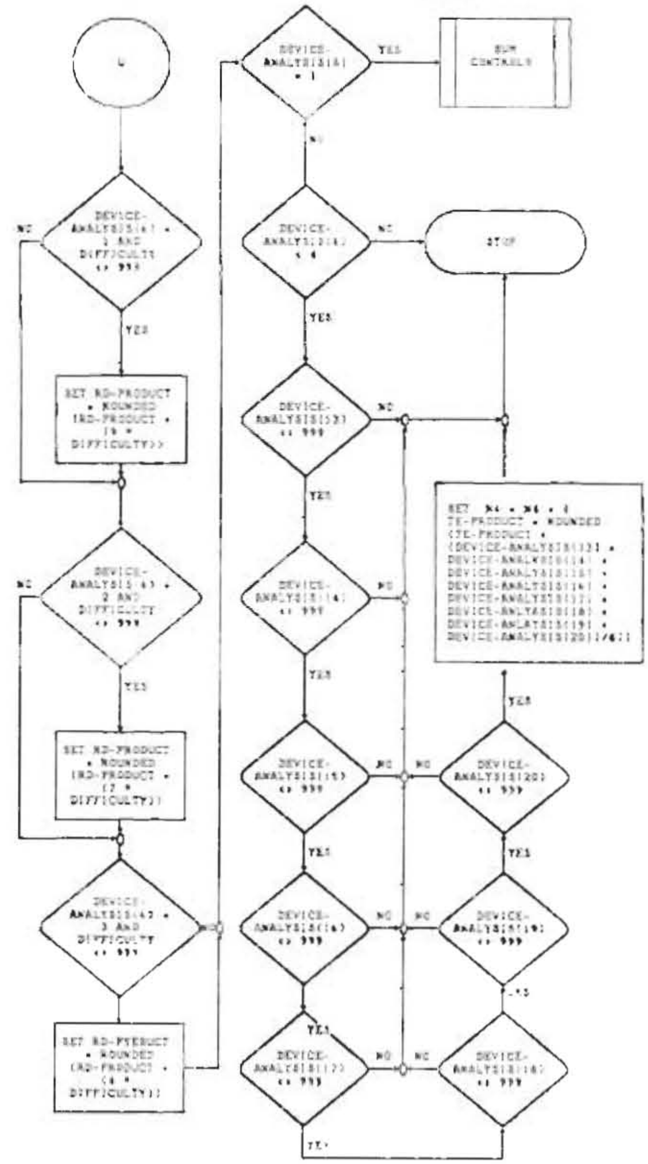


SUBROUTINE SUM TASK (page 3/5)

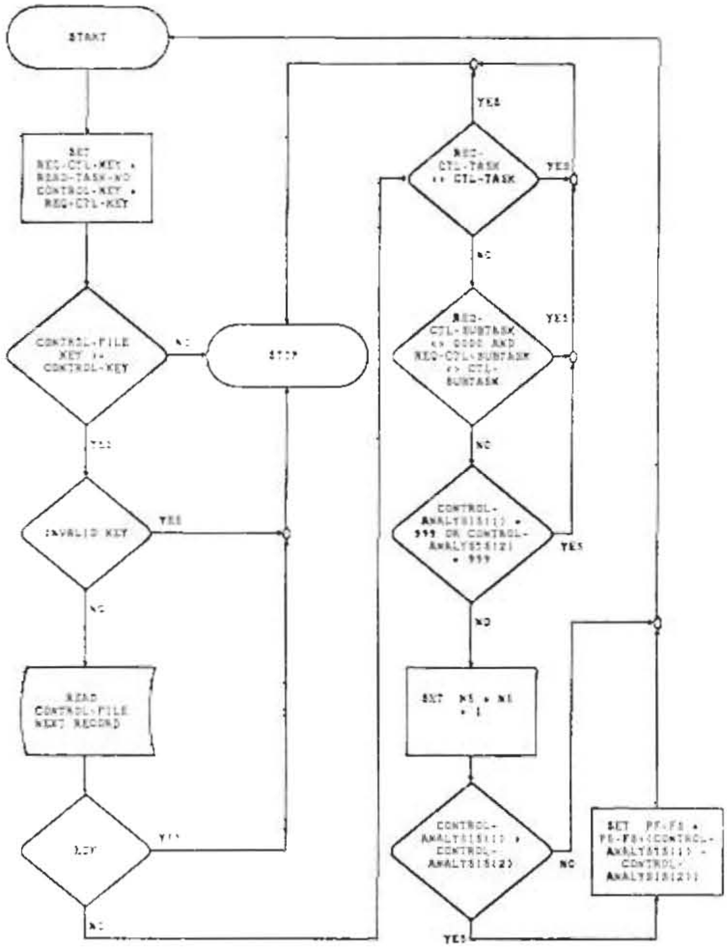



SUM ACTUALS
YES
NO
DEVICE-
SET DIFFICULTY
U
SET ND-PRODUCT
DIFFICULTY

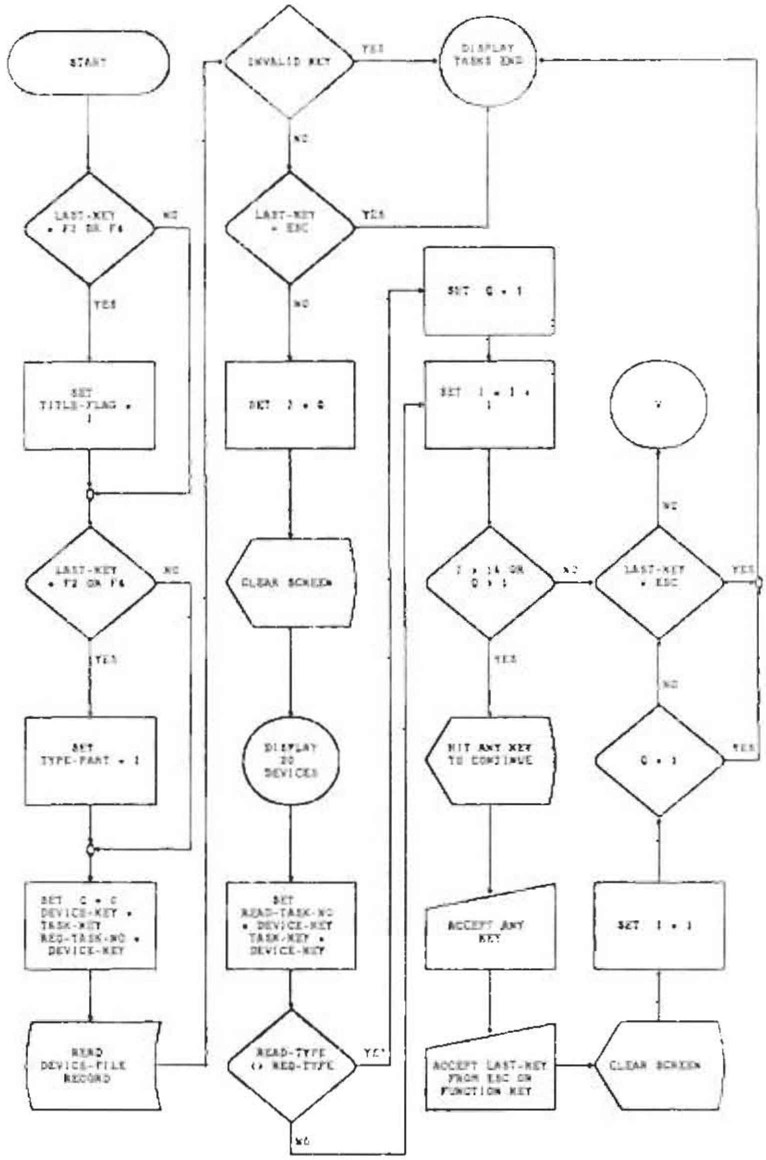
SUBROUTINE SUM TASK (page 5/5)



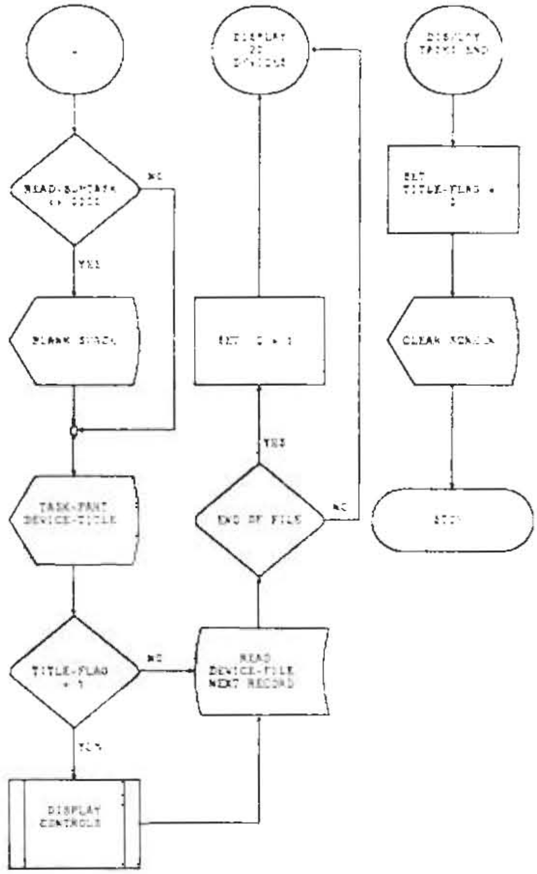
SUBROUTINE SUM CONTROLS (page 1/1)



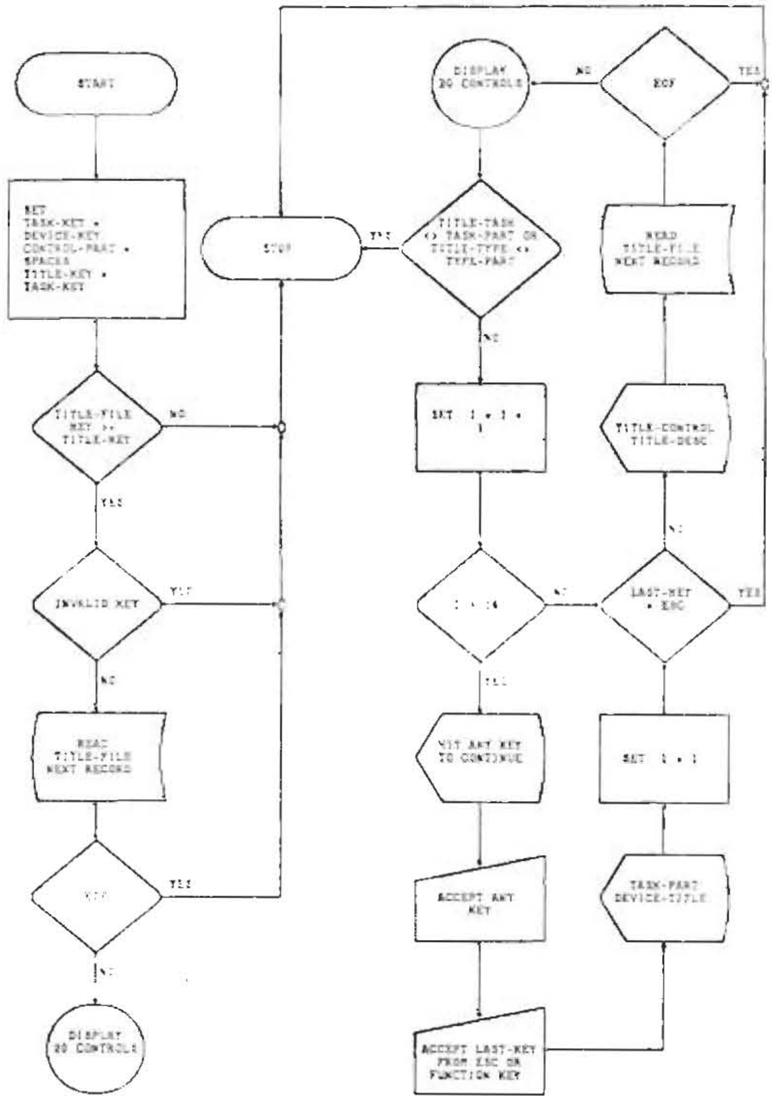
SUBROUTINE DISPLAY TASKS (page 1/2)



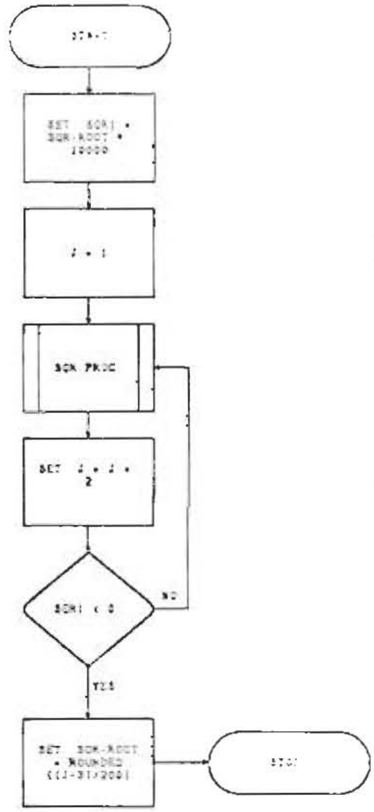
SUBROUTINE DISPLAY TASKS (page 2/2)



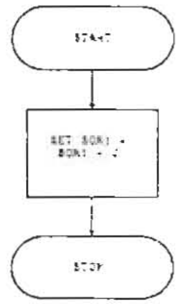
SUBROUTINE DISPLAY CONTROLS (page 1/1)



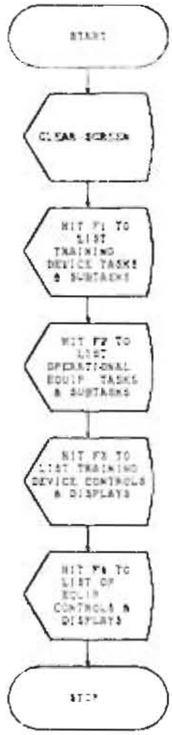
SUBROUTINE SQUARE ROOT (page 1/1)



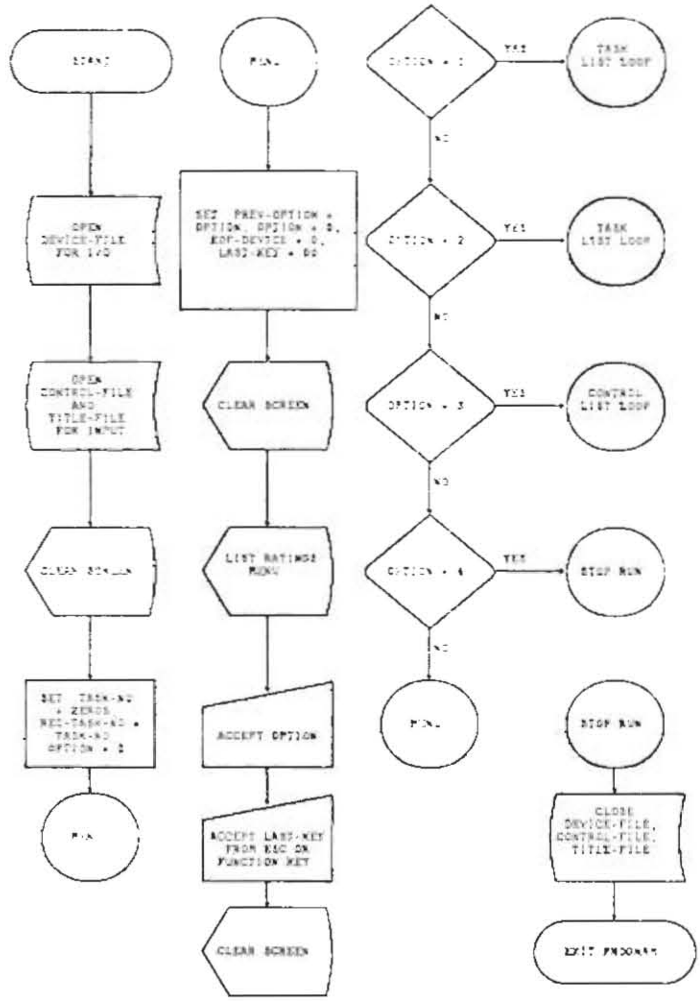
SUBROUTINE SQR PROC

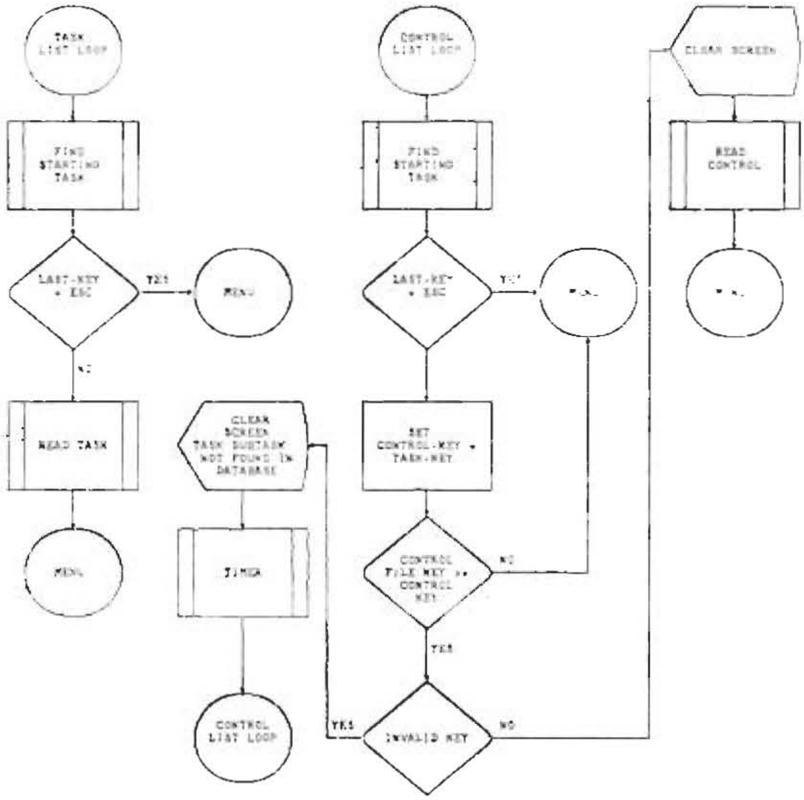


SUBROUTINE DISPLAY FUNCTION KEYS (page 1/1)

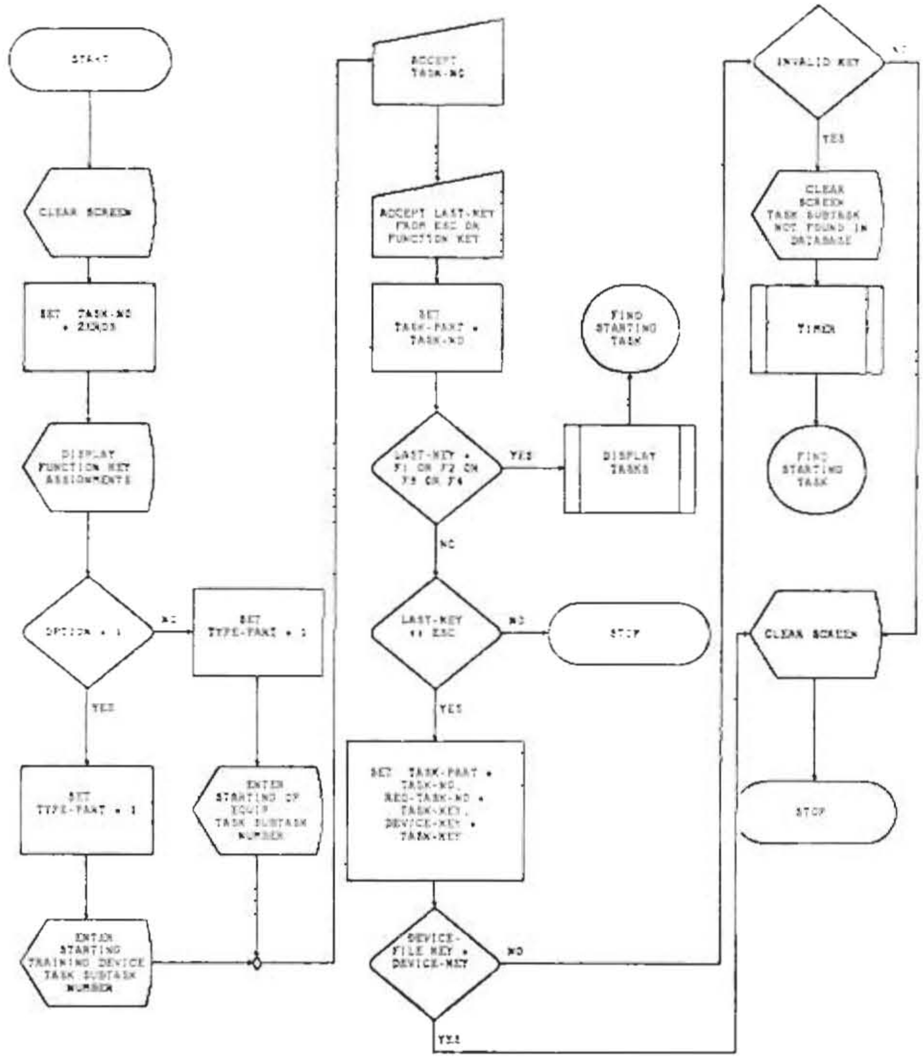


SUBROUTINE LIST (page 1/2)

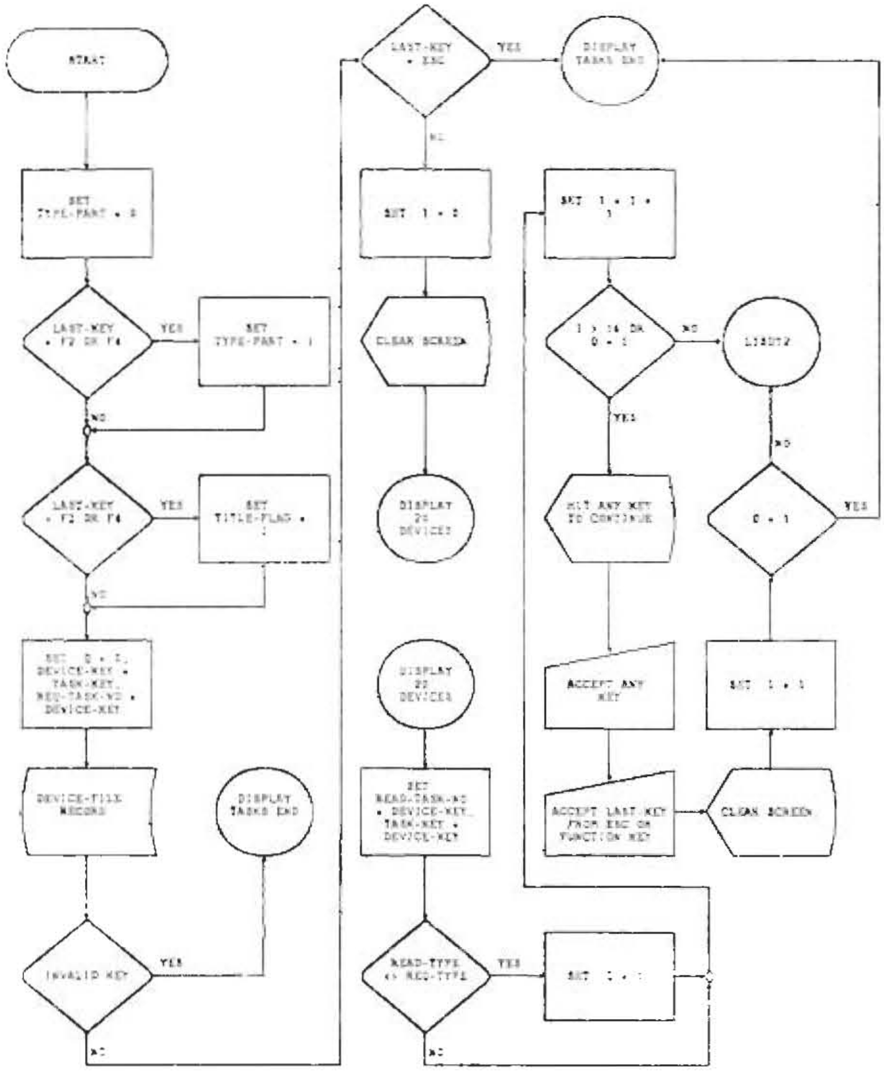



TASK LIST LOOP
FIND STARTING TASK
LAST-KEY = ESC
YES
MENU
NO
READ TASK
MENU
CONTROL LIST LOOP
FIND STARTING TASK
LAST-KEY = ESC
SET CONTROL-KEY = TASK-KEY
CONTROL FILE KEY >= CONTROL KEY
NO
YES
INVALID KEY
YES
NO
CLEAR SCREEN TASK SUBTASK NOT FOUND IN DATABASE
TIMER
CONTROL LIST LOOP
CLEAR SCREEN
READ CONTROL

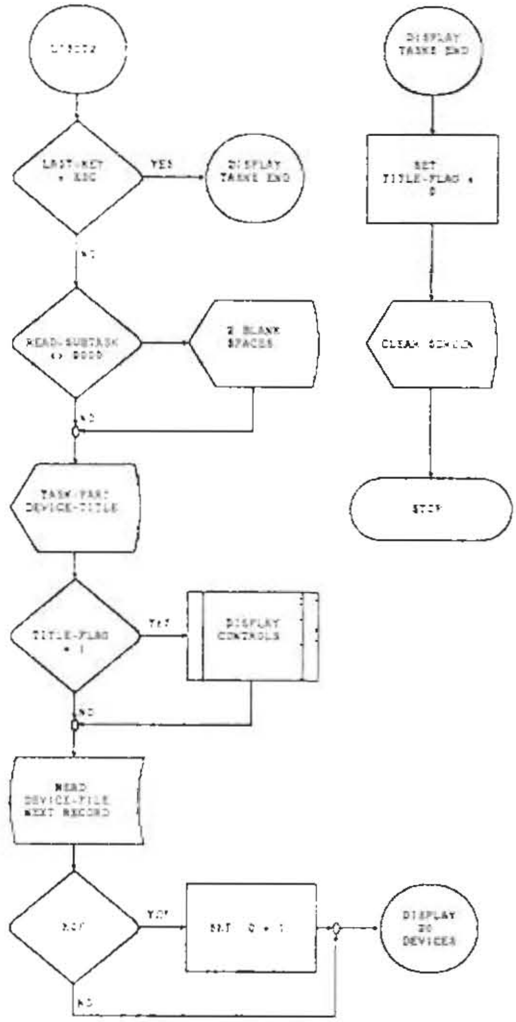
SUBROUTINE FIND STARTING TASK (LIST) (page 1/1)



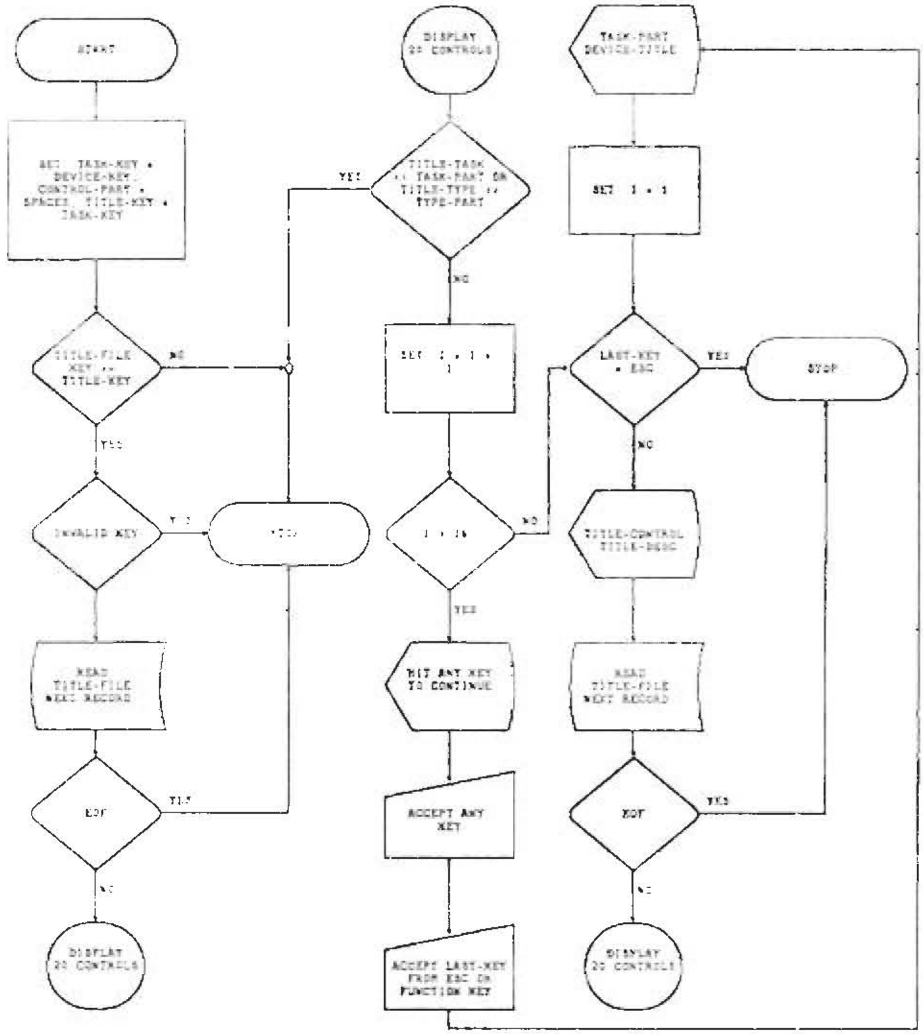
SUBROUTINE DISPLAY TASKS (LIST) (page 1/?)



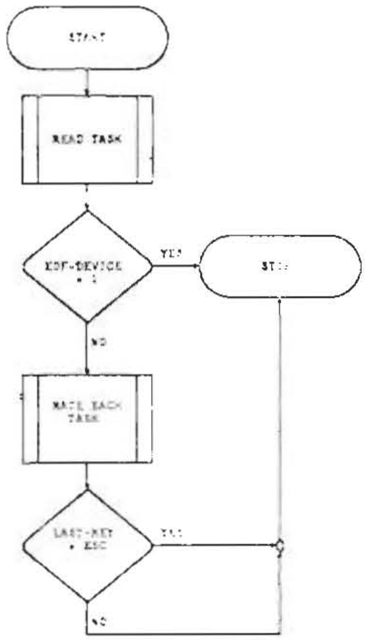
SUBROUTINE DISPLAY TASKS (LIST) (page 2/2)



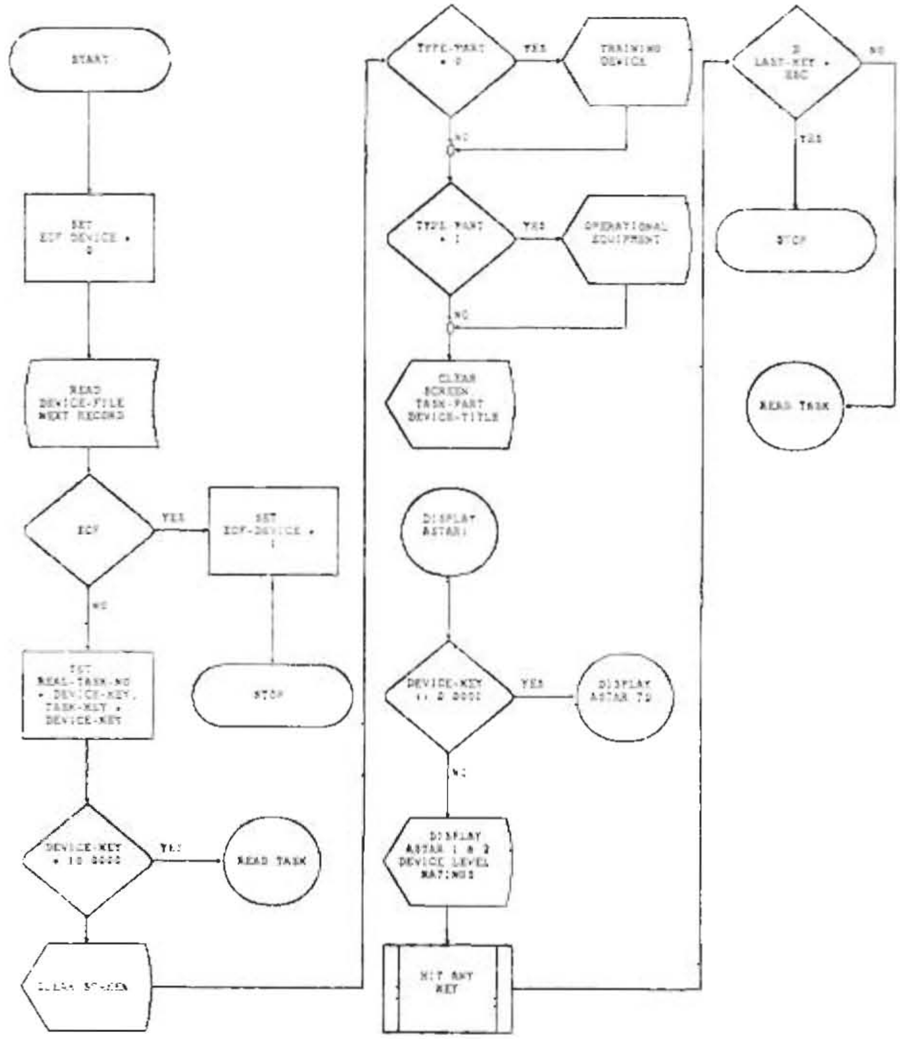
SUBROUTINE DISPLAY CONTROLS (LIST) (page 1/1)



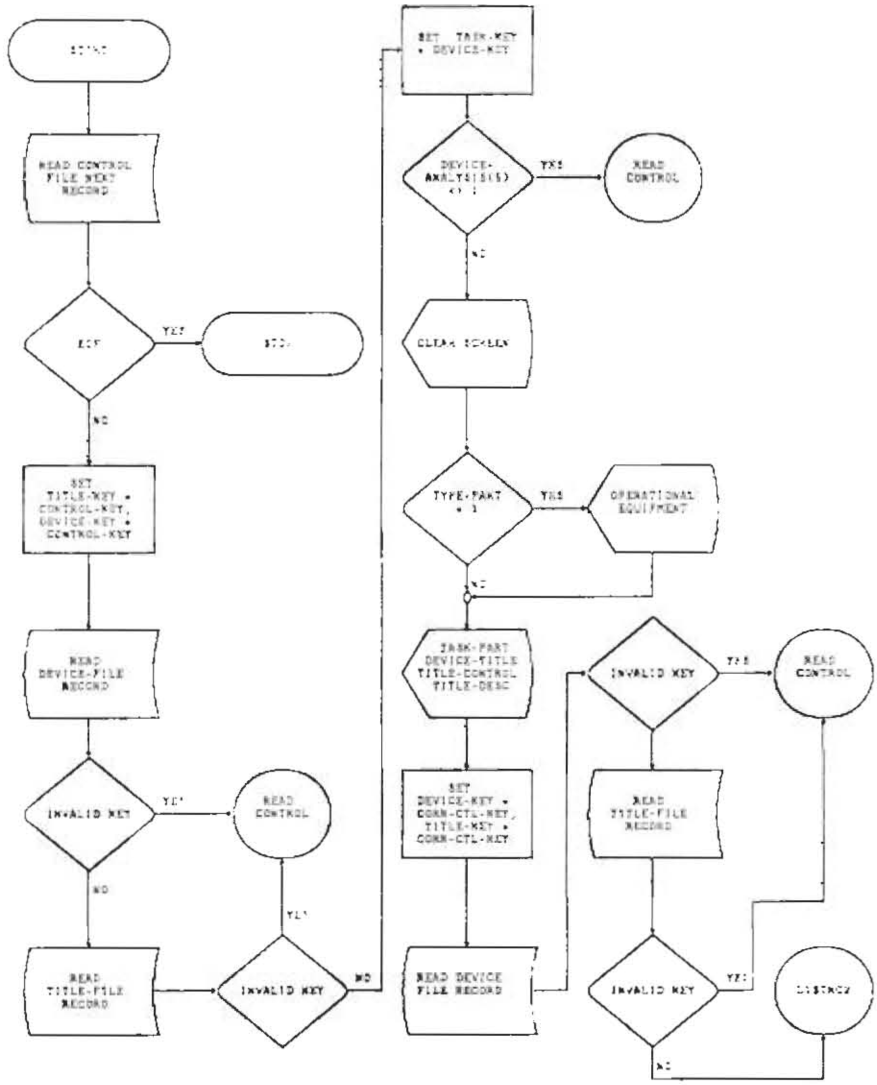
SUBROUTINE RATE TASKS (MAINT) (page 1/1)



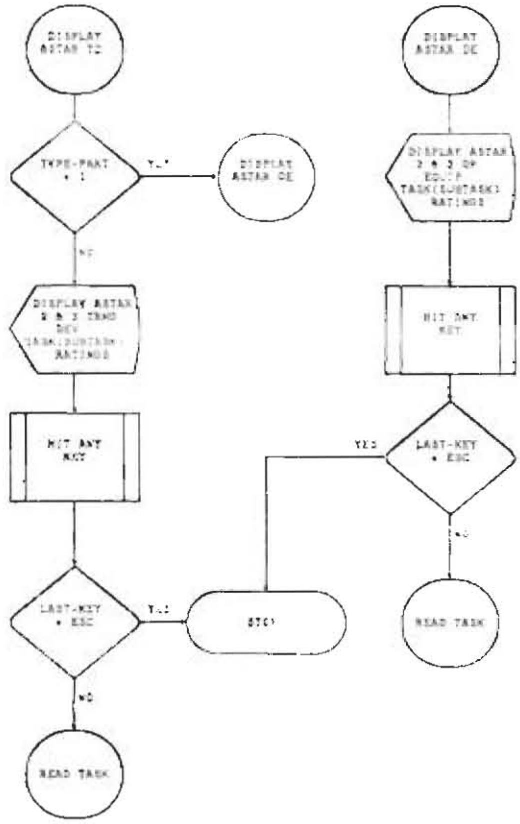
SUBROUTINE READ TASK (LIST) (page 1/2)



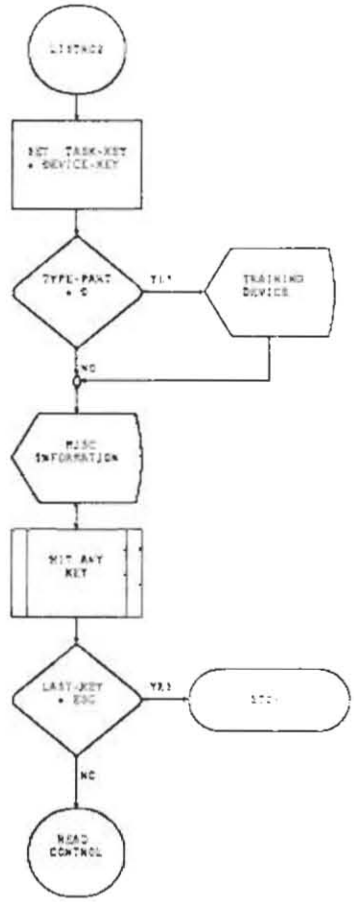
SUBROUTINE READ CONTROL (LIST) (page 1/2)



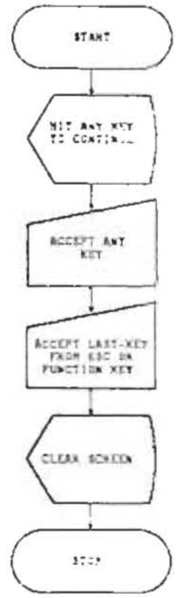
SUBROUTINE READ TASK (LIST) (page 2/2)



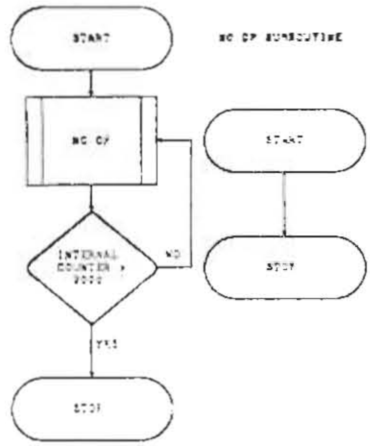
SUBROUTINE READ CONTROL (LIST) (page 2/2)



SUBROUTINE HIT ANY KEY (LIST) (page 1/1)



SUBROUTINE TIMER & NO OP (LIST) (page 1/1)



MAINT Variable Dictionary

Field Name	Type & Length	Contents
EOF-DEVICE	numeric 1	0
C-D-KEY	alphanumeric 10	
CTL-STATUS-WORD	alphanumeric 2	
DEVICE-STATUS-WORD	alphanumeric 2	
I	numeric 4	
LAST-KEY	alphanumeric 2	
NEW-DESC	alphanumeric 54	
NOTHING	alphanumeric 1	
OPTION	alphanumeric 1	
PREVIOUS-RATING	numeric 009	
RATING	numeric 3	
READ-TASK-NO		
READ-TYPE	numeric 1	
READ-TASK1	numeric 4	
FILLER	alphanumeric 1	
READ-SUBTASK	alphanumeric 4	
REQ-TASK-NO		
REQ-TYPE	numeric 1	
REQ-TASK	numeric 4	
FILLER	alphanumeric 1	
REQ-SUBTASK	alphanumeric 4	
TASK-KEY		
TYPE-PART	alphanumeric 1	
TASK-TARK	alphanumeric 9	
PERIOD-PART	alphanumeric 1	
CONTROL-PART	alphanumeric 9	
TASK-NO	numeric 0009.9999	
TITLE-FLAG	numeric 4	0
TITLE-STATUS-WORD	alphanumeric 2	
Z	numeric 2	

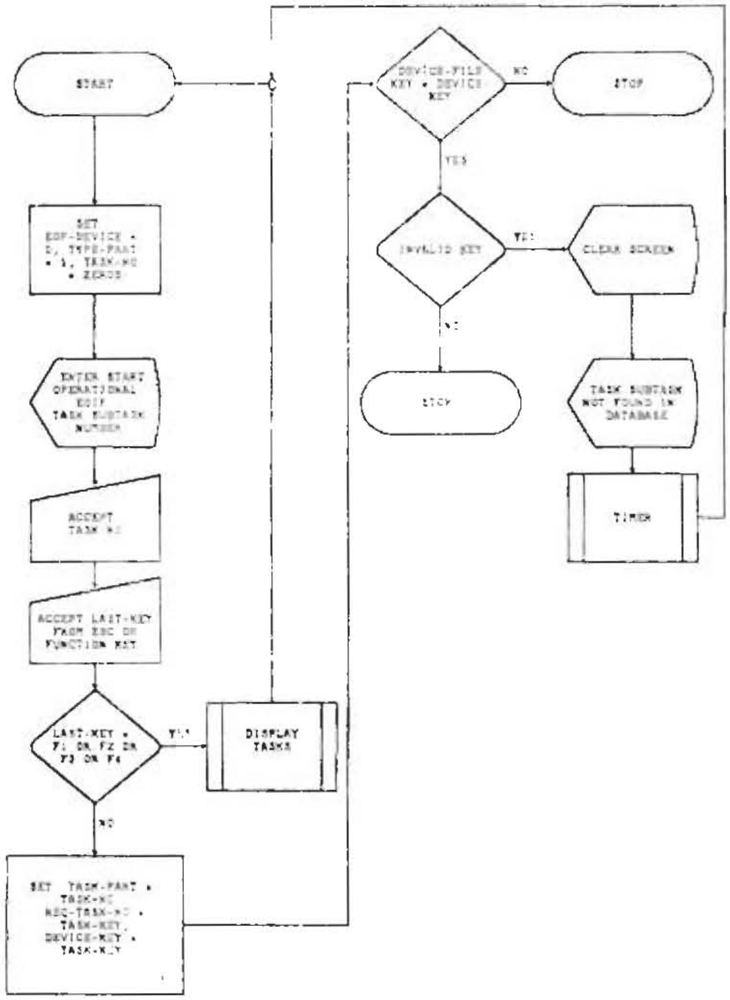
MAINT file descriptions:

```
1.   B:DEVICE (DEVICE-FILE)
     DEVICE-KEY            alphanumeric 10
     DEVICE-ANALYSIS(1)    integer 3
     DEVICE-ANALYSIS(2)    integer 3
             .                 .
             .                 .
     DEVICE-ANALYSIS(20)   integer 3
     DEVICE-TITLE          alphanumeric 60

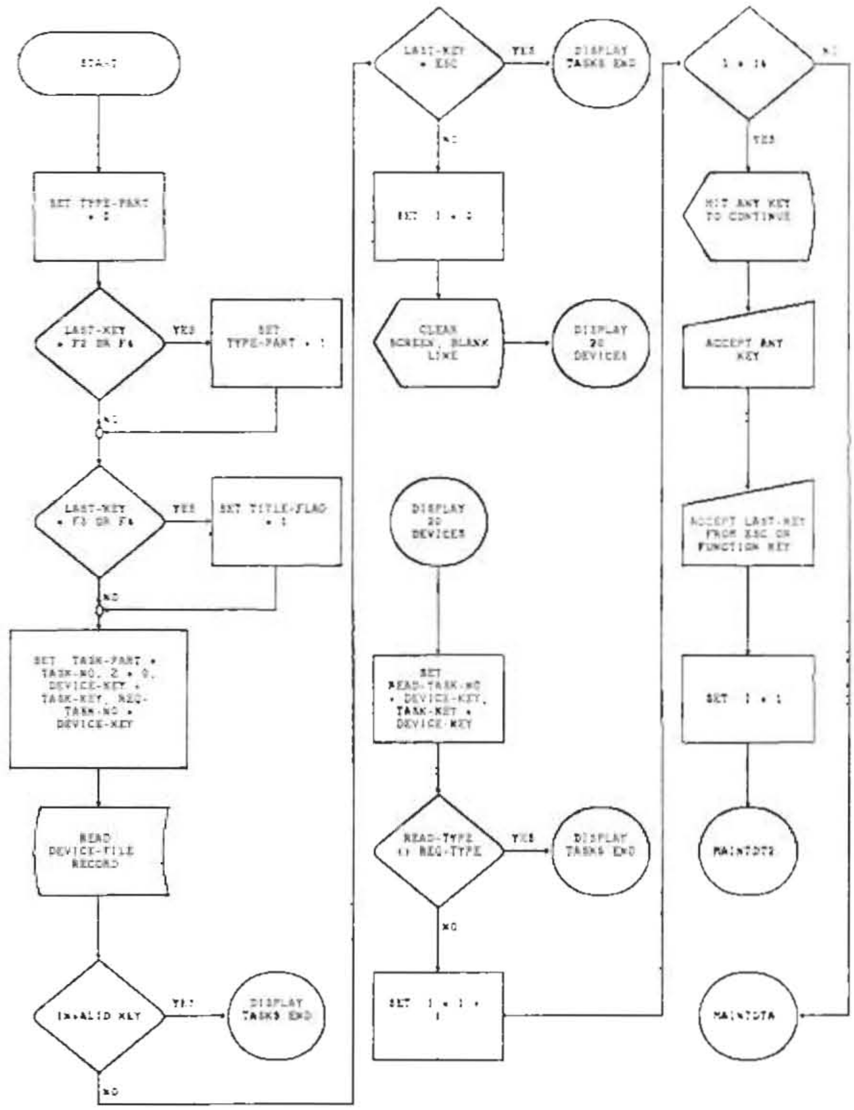
2.   B:TITLE (TITLE-FILE)
     TITLE-KEY
          TITLE-TYPE       integer 1
          TITLE-TASK       alphanumeric 9
          TITLE-PERIOD     alphanumeric 1
          TITLE-CONTROL    alphanumeric 9
     TITLE-DESC            alphanumeric 60

3.   B:CONTROL (CONTROL-FILE)
     CONTROL KEY           alphanumeric 20
     CONTROL-ANALYSIS(1)   integer 3
     CONTROL-ANALYSIS(2)   integer 3
     CORR-CTL-KEY          alphanumeric 20
```

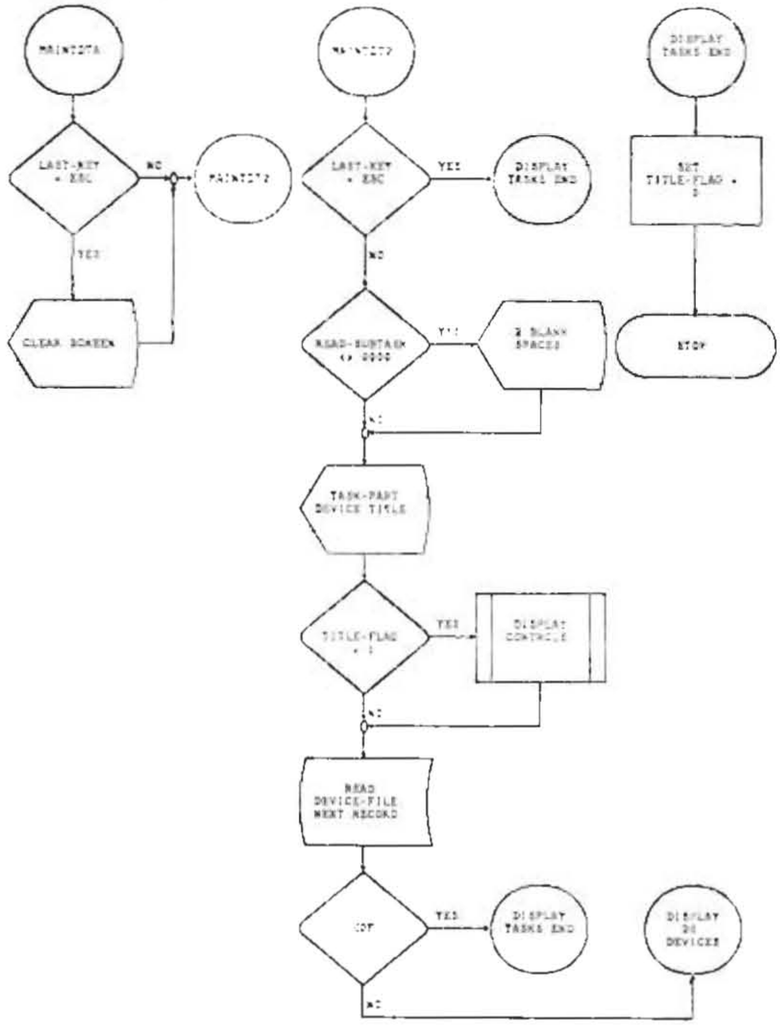
SUBROUTINE FIND STARTING TASK (MAINT) (page 1/1)



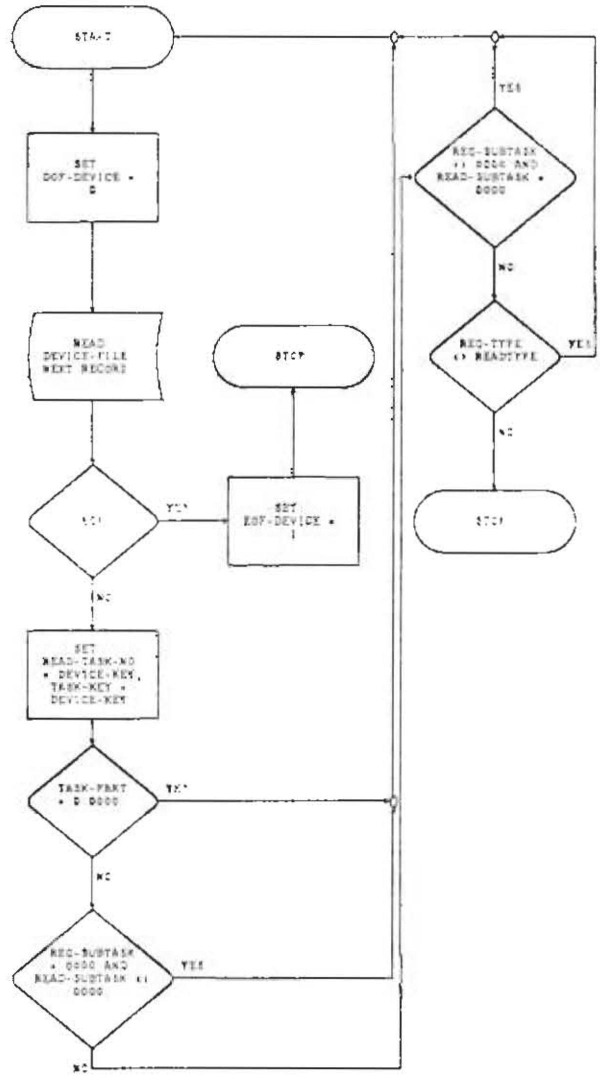
SUBROUTINE DISPLAY TASKS (MAINT) (page 1/2)



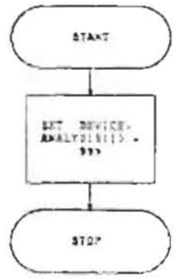
SUBROUTINE DISPLAY TASKS (MAINT) (page 2/2)



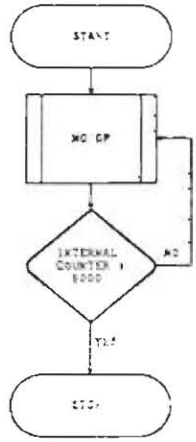
SUBROUTINE READ TASK (MAINT) (page 1/1)



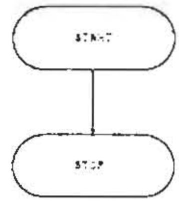
SUBROUTINE MOVE NINES (MAINT) (page 1/1)



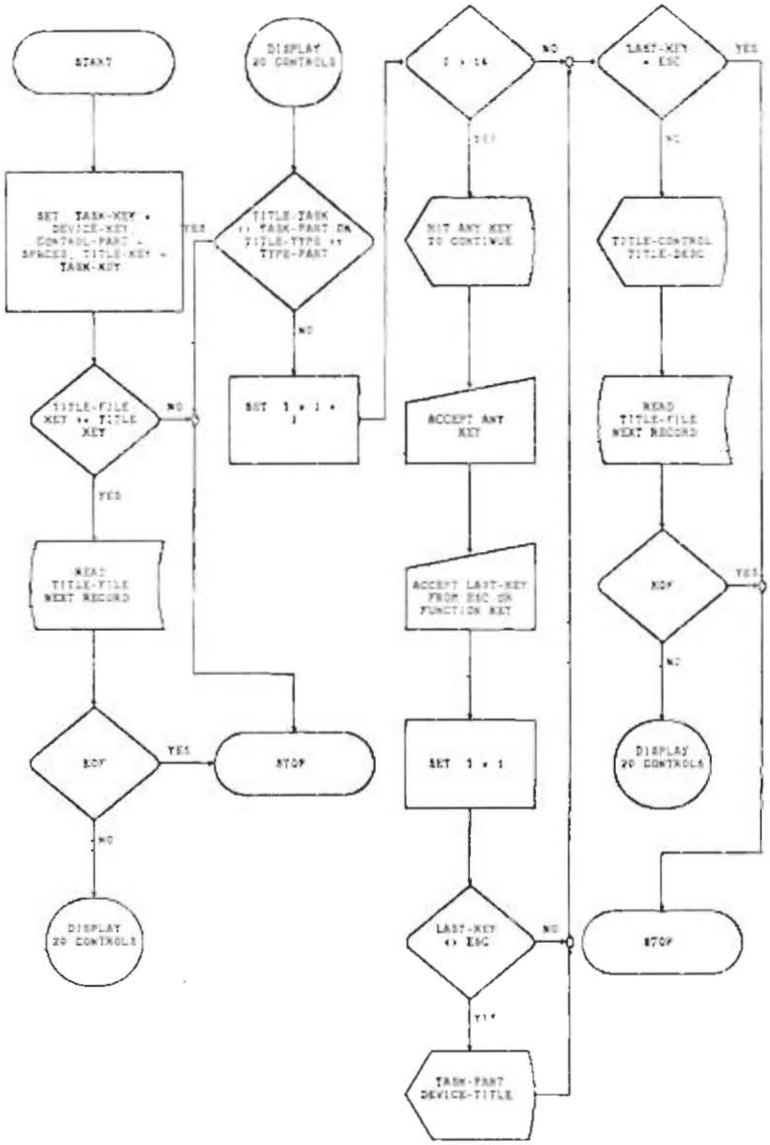
SUBROUTINE TIMER (MAINT) (page 1/1)



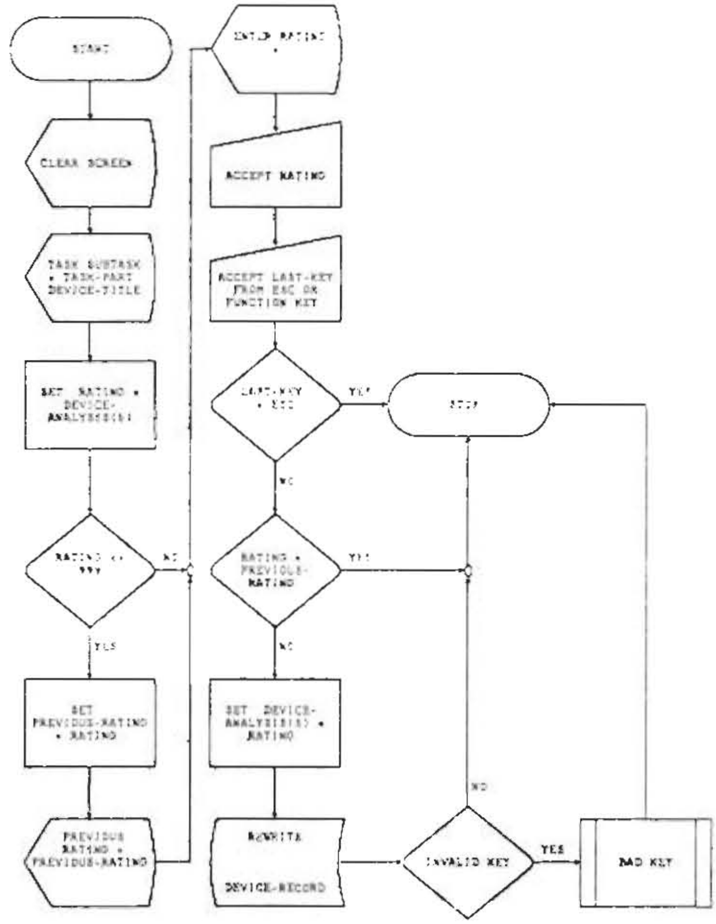
SUBROUTINE NO OP (MAINT)



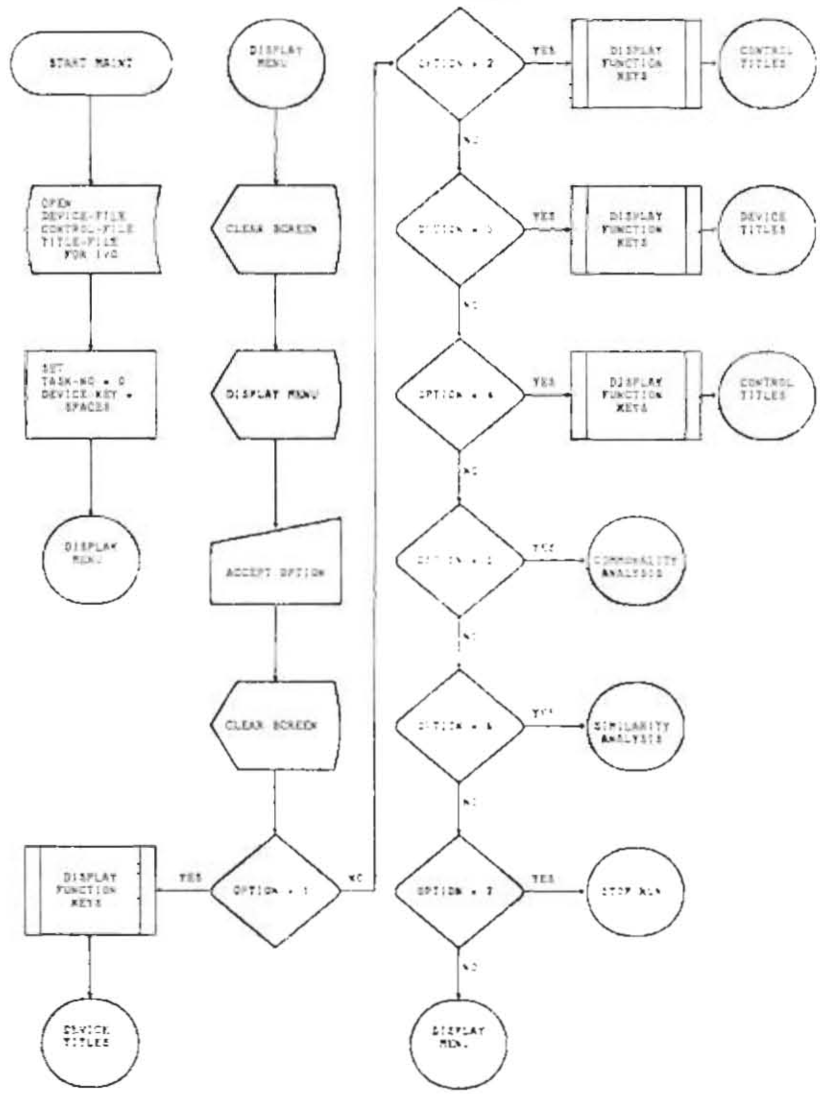
SUBROUTINE DISPLAY CONTROLS (MAINT) (page 1/1)

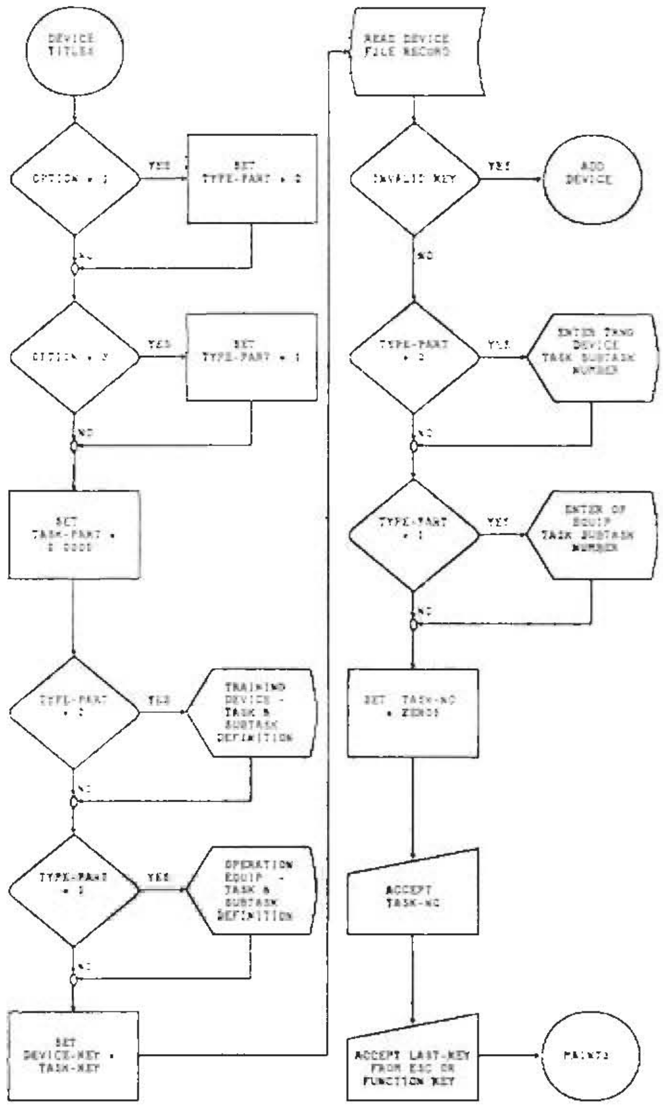


SUBROUTINE RATE EACH TASK (MAINT) (page 1/1)

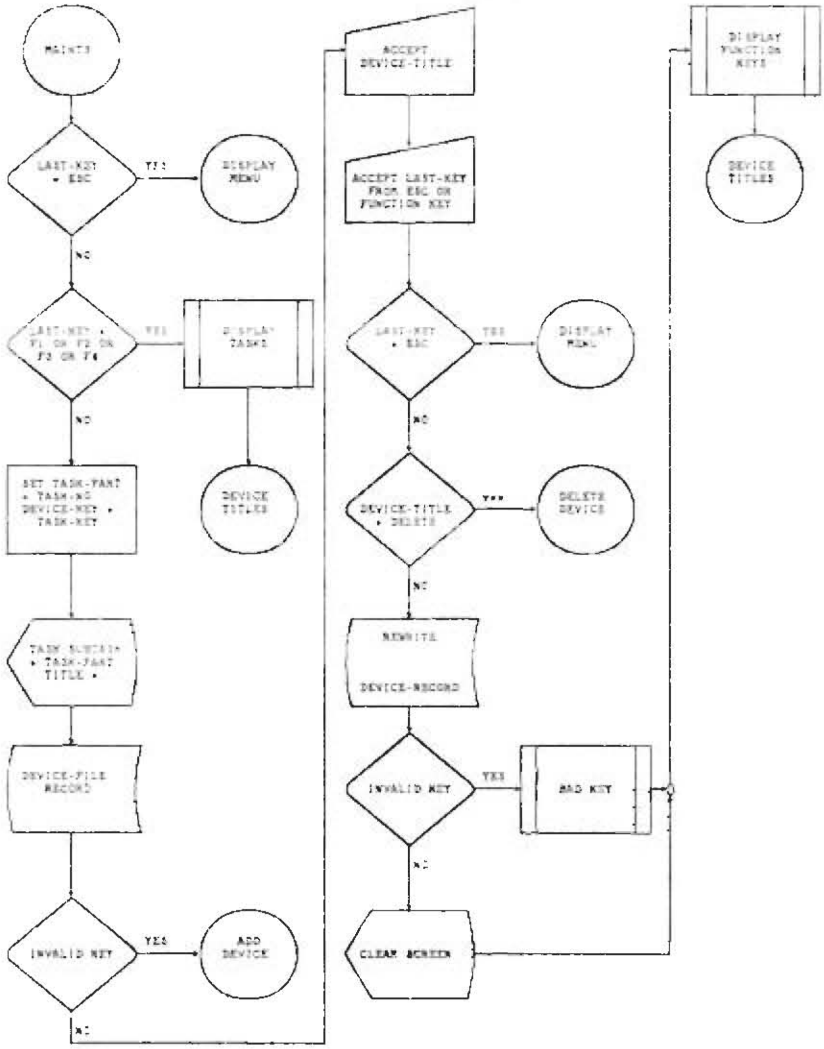


SUBROUTINE MAINT (page 1/14)

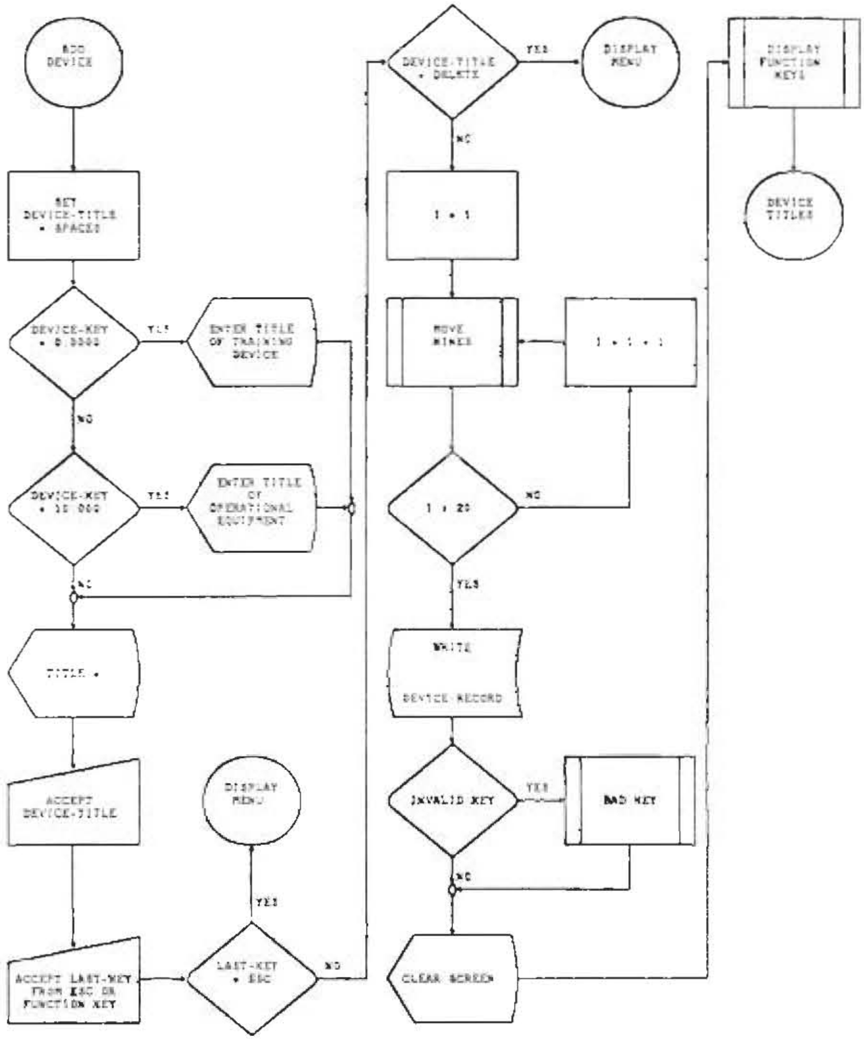



DEVICE
YES
NO
SET
READ DEVICE FILE RECORD
INVALID KEY
ADD DEVICE
TRAINING DEVICE - TASK & SUBTASK DEFINITION
OPERATION EQUIP - TASK & SUBTASK DEFINITION
SET DEVICE-KEY = TASK-KEY
SET TASK-NO = ZEROS
ACCEPT TASK-NO
ACCEPT LAST-KEY FROM ESC OR FUNCTION KEY

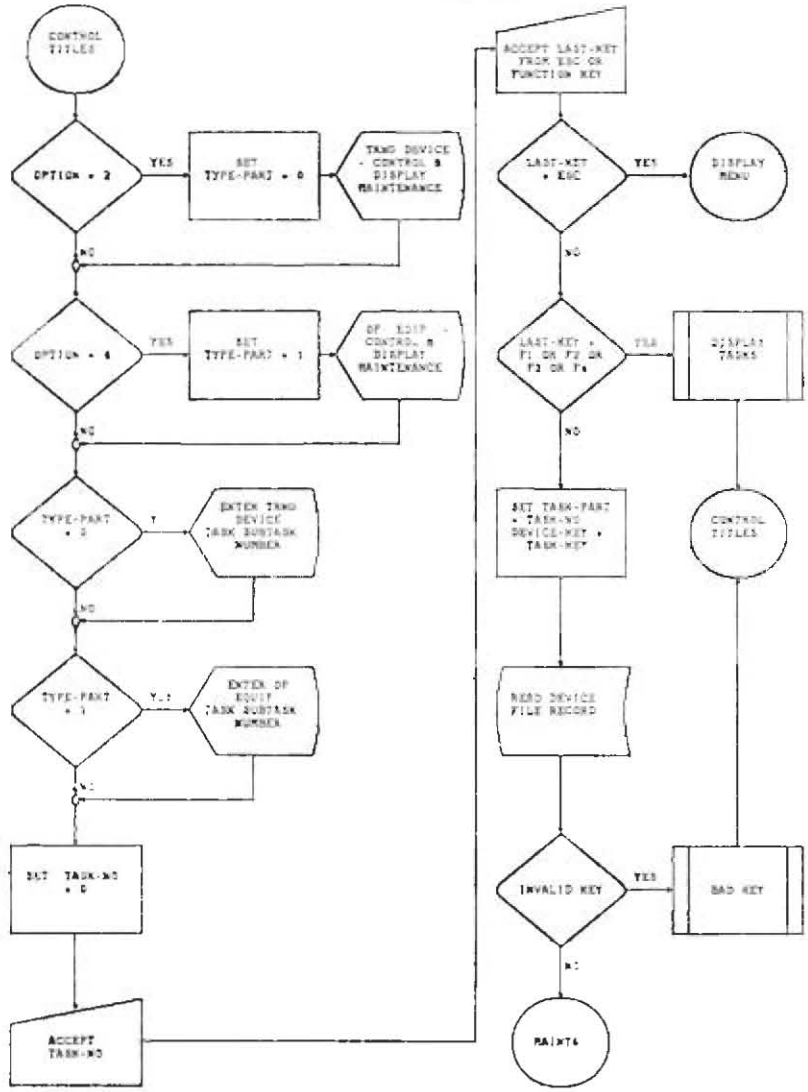
SUBROUTINE MAINT (page 3/14)



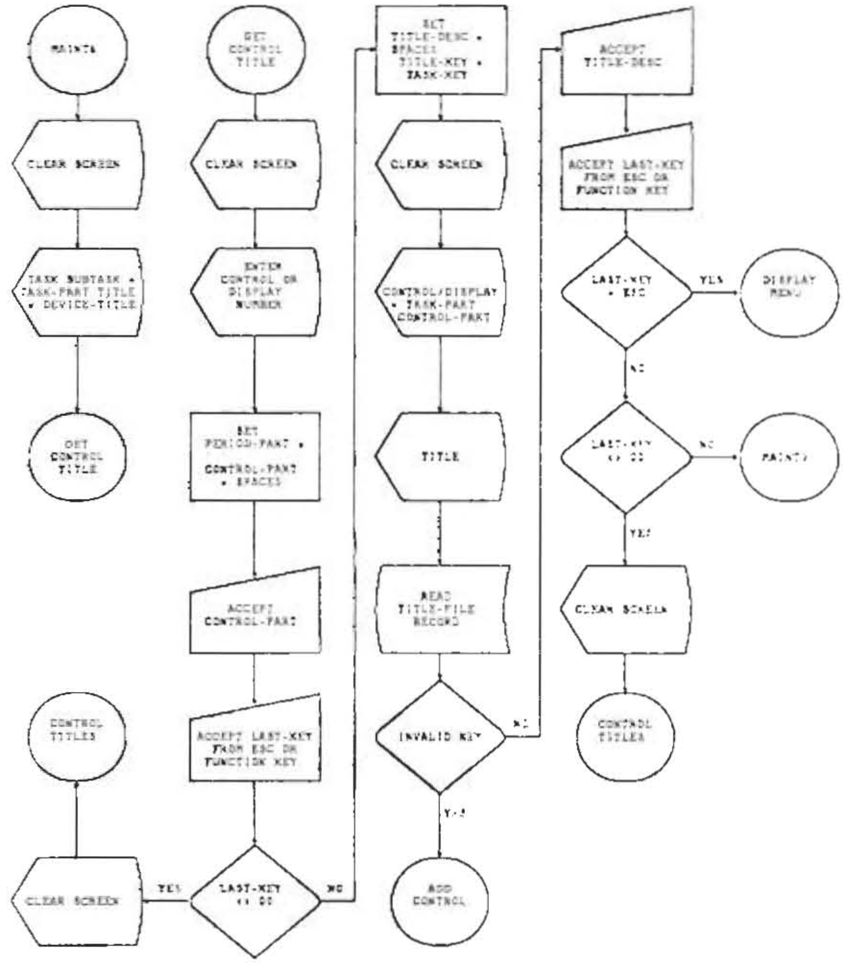
SUBROUTINE MAINT (page 4/14)



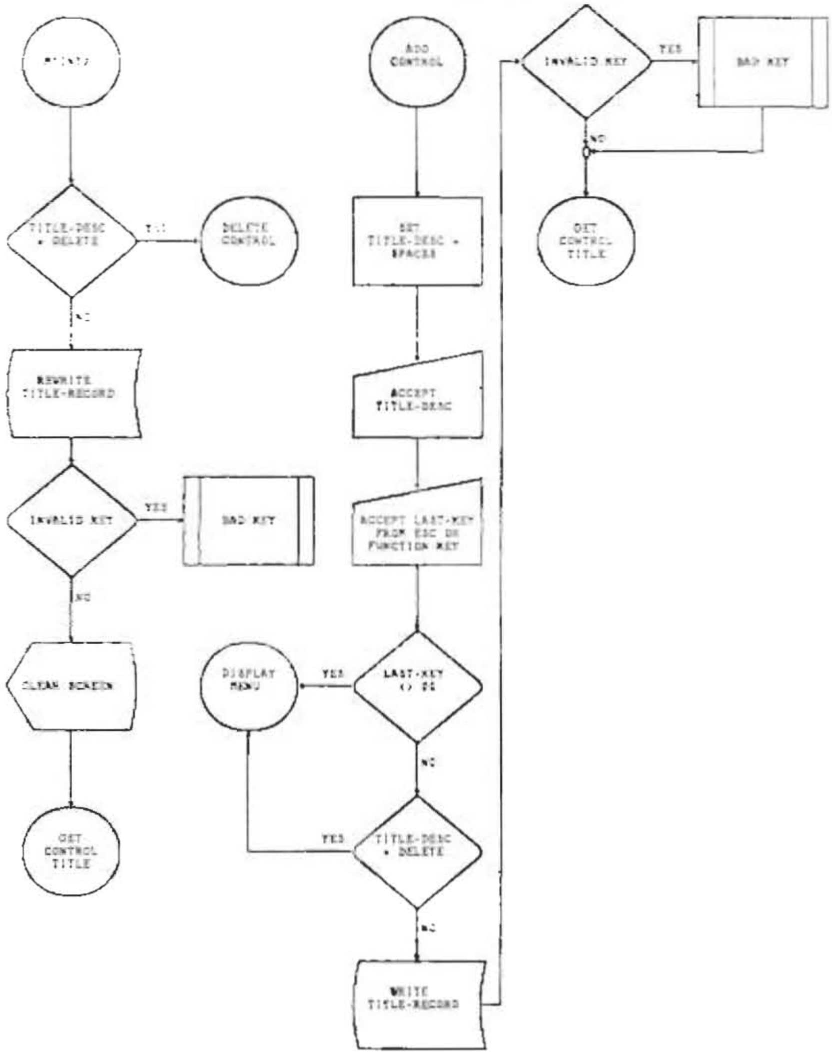
SUBROUTINE MAINT (page 5/14)



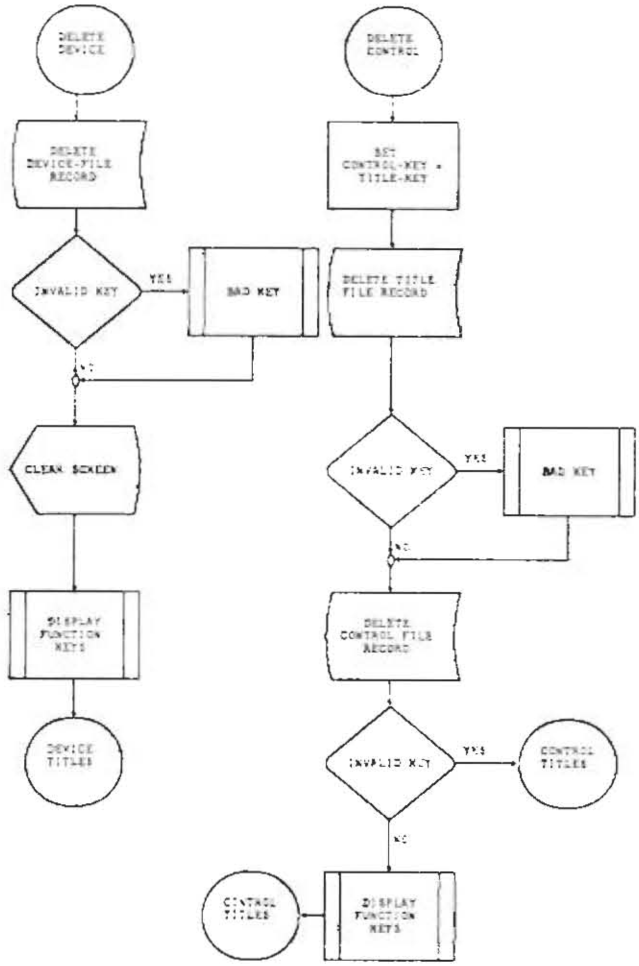
SUBROUTINE MAINT (page 6/14)



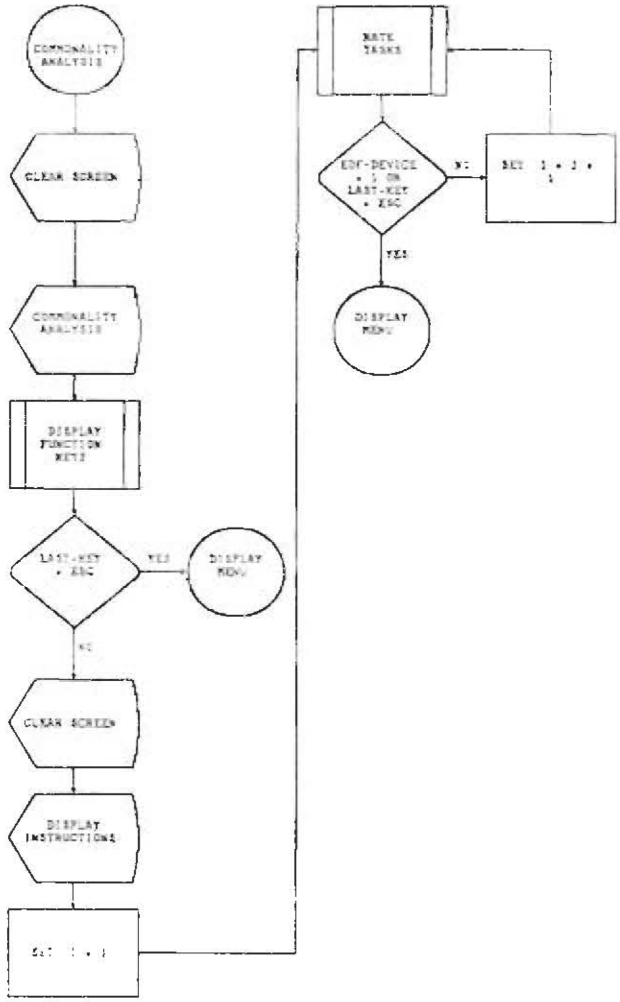
SUBROUTINE MAINT (page 7/14)



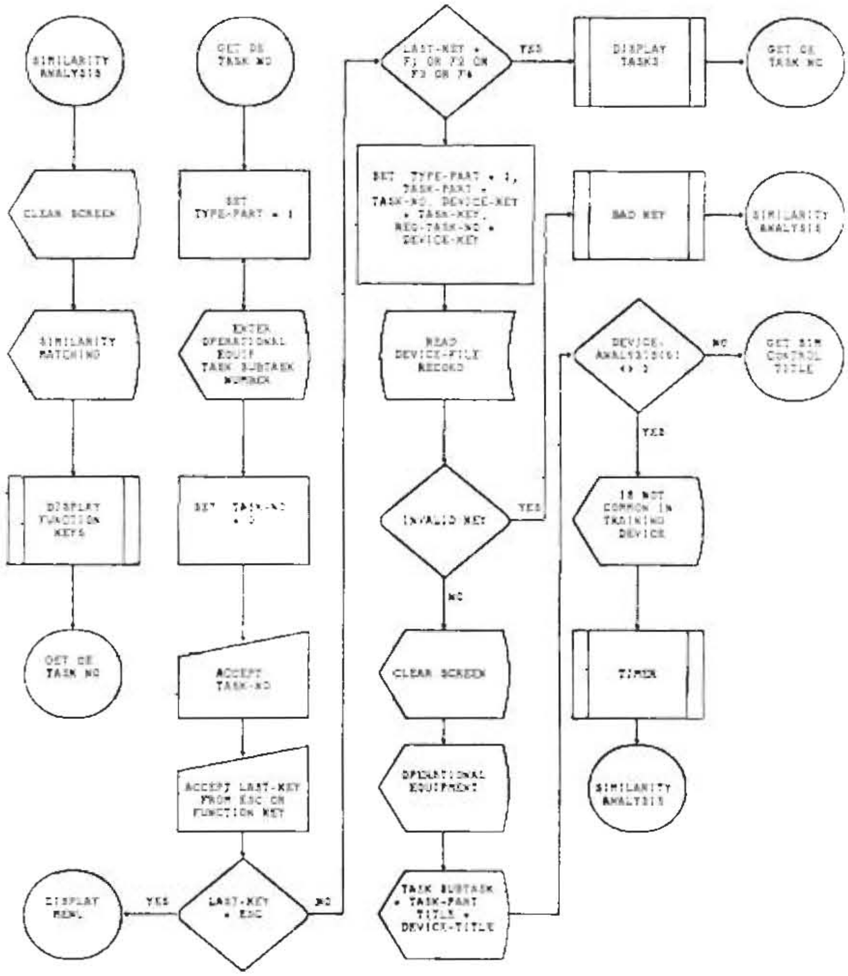
SUBROUTINE MAINT (page 8/14)



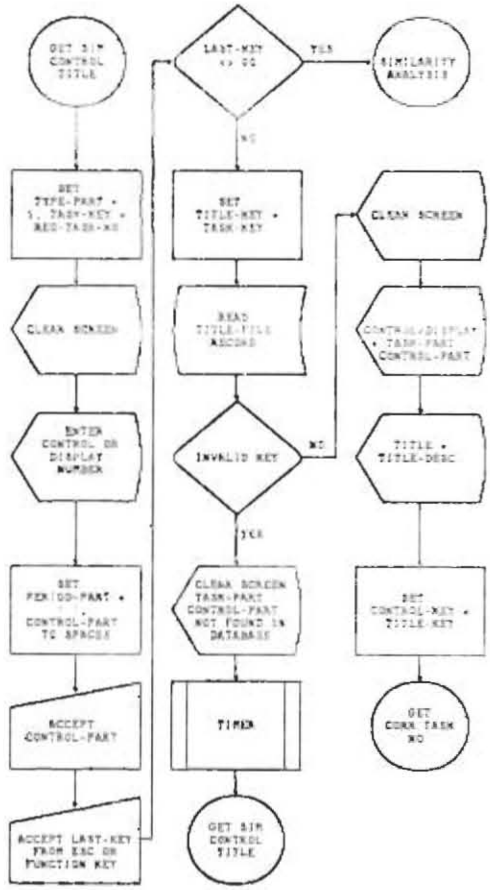
SUBROUTINE MAINT (page 9/14)



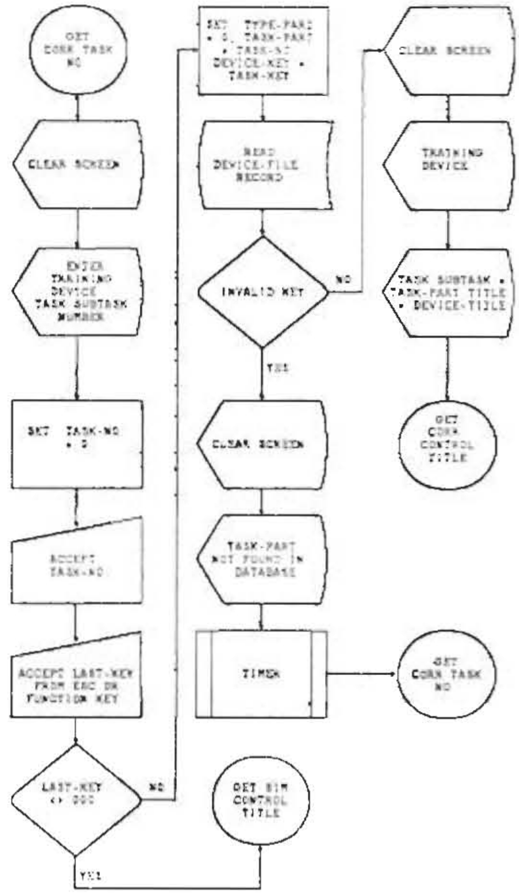
SUBROUTINE MAINT (page 10/14)



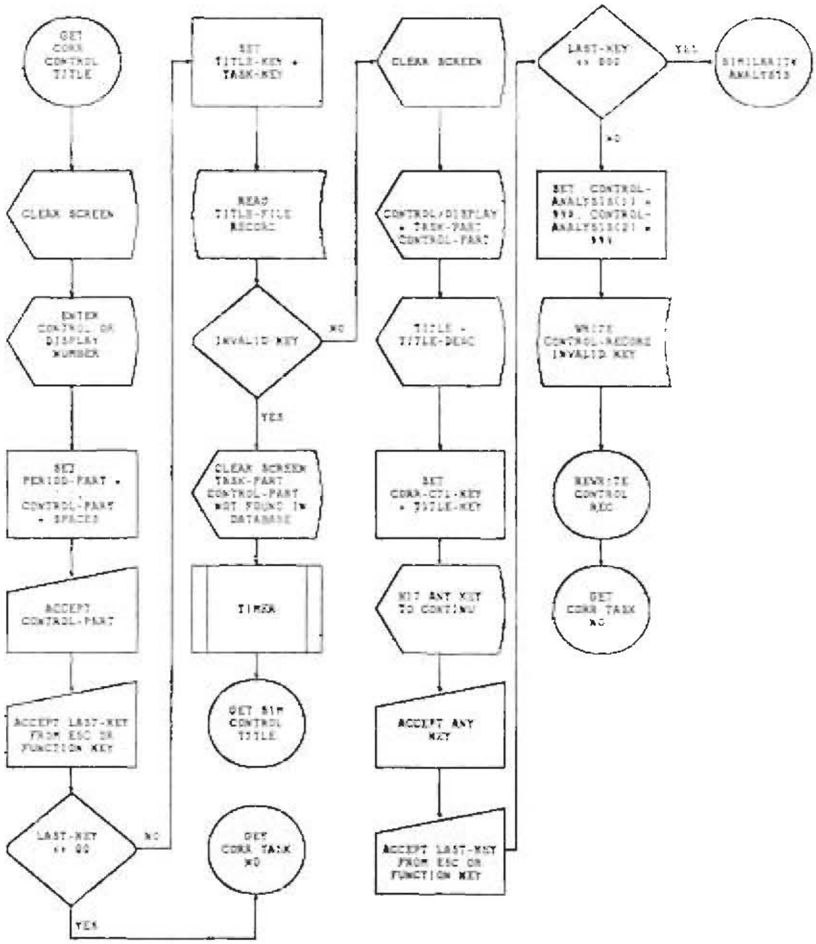
SUBROUTINE MAINT (page [illegible])



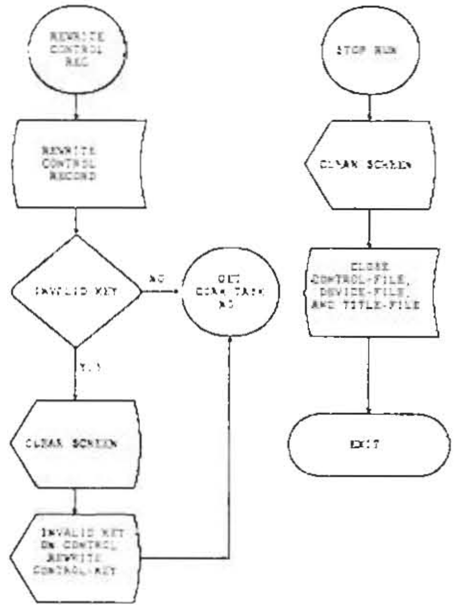
SUBROUTINE MAINT (page 12/14)



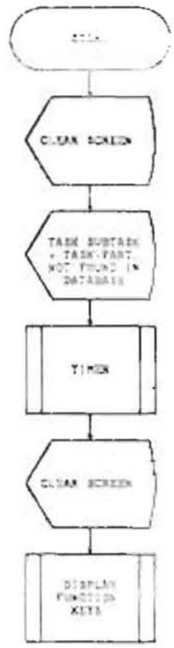
SUBROUTINE MAINT (page 13/14)



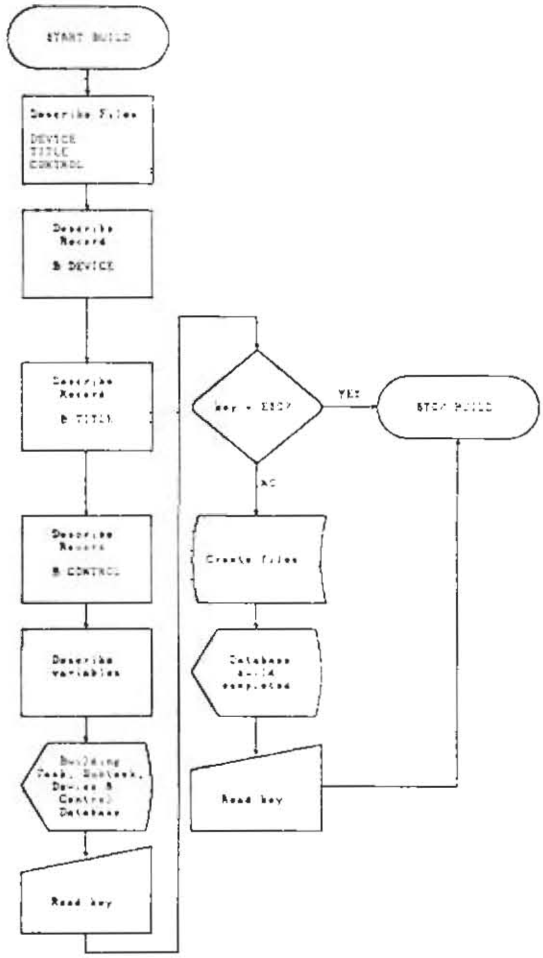
SUBROUTINE MAINT (page 14/14)



SUBROUTINE BAD KEY (MAINT) (page 1/1)



BUILD MODULE



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ANNEX 5

ASTAR II SCREENS

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ASTAR II TUTORIAL

W E L C O M E   T O   A S T A R   I I !

ENTER NAME:

SELECT ONE OF THE FOLLOWING OPTIONS WITH CURSOR AND PRESS ENTER

NO.	LESSON	COMPLETED
1	INTRODUCTION TO ASTAR II	✓
2	HOW TO COLLECT DATA	
3	HOW TO CREATE AND MANAGE THE DATA BASE	
4	HOW TO CONDUCT ASTAR II ANALYSES	
5	HOW TO GENERATE ASTAR II RESULTS	
6	HOW TO INTERPRET ASTAR II RESULTS	
7	RUN ASTAR II EXERCISE	

F1=HELP   F8=MAIN MENU   F10=QUIT

ASTAR MAIN MENU
SETUP ASTAR 1 ASTAR 2 ASTAR 3 FILES

NAME OF SYSTEM __

F1=HELP F2=TUTOR
F6=DIR F9=DOS F10=QUIT

ASTAR MAIN MENU

SETUP

ASTAR 1
ASTAR 2
ASTAR 3

FILES

H E L P: ASTAR analyses can be performed at three different levels. Which level to use depends upon the amount of information you have about the training system, operational equipment, the tasks to be trained, and the trainees themselves. The more specific the information, the higher the level you can use in ASTAR. For examples of required information at each level, refer to the ASTAR II Tutorial.

F1=HELP F2=TUTOR
F6=DIR F9=DOS F10=QUIT

SETUP

SPECIFY PRINTER:

IBM	GRAPHICS	EPSON	FX
	COLOR		RX
	QUIETWRITER		LQ 800
HP	LASERJET	XEROX	4020
	QUIETJET		4045

SPECIFY MONITOR:

CGA COLOR
VGA COLOR
EGA COLOR
MONOCHROME

SPECIFY DEFAULTS:

STORAGE PATH
A: B: C: D:

MOUSE AVAILABLE
YES NO

F1=HELP F2=TUTOR F9=DOS F10=QUIT
F6=DIR

FILE OPERATIONS MAIN MENU	
1	CREATE FILE
2	IMPORT FILE
3	EXPORT FILE
4	MERGE DATA FILES
5	COPY DATA BASE
6	DELETE DATA BASE
7	MANAGE DATA BASE
8	DEVELOP REPORT

F1=HELP
F6=DIR   F7=SAVE   F8=MAIN MENU   F9=DOS   F10=QUIT

FILE OPERATIONS MAIN MENU

1 CREATE FILE
2 IMPORT FILE
3 EXPORT FILE
4 MERGE DATA FILES
5 COPY DATA BASE
6 DELETE DATA BASE
7 MANAGE DATA BASE
8 DEVELOP REPORT

H E L P: The CREATE FILE option allows you to set up, or modify the data base structure for a system and activate an audit trail log of commands used during that ASTAR session.

You will need to specify a file name and number of training system(s) and the name of the operational system.

F1=HELP
F6=DIR F7=SAVE F8=MAIN MENU F9=DOS F10=QUIT

CREATE FILE

ENTER FILE NAME: _

LABEL AUDIT TRAIL LOG:

NAME OPERATIONAL SYSTEM:

NUMBER OF TRAINING SYSTEMS:

NAME TRAINING SYSTEMS:
1

ANY MODIFICATIONS NEEDED? YES NO

F1=HELP
F6=DIR F7=SAVE F8=MAIN MENU F9=DOS F10=QUIT

IMPORT FILE

NAME SOURCE LOCATION AND FILE NAME: _

NAME DESTINATION LOCATION AND FILE NAME: _

F1=HELP
F6=DIR F7=SAVE F8=MAIN MENU F9=DOS F10=QUIT

IMPORT FILE

NAME SOURCE LOCATION AND FILE NAME: _

NAME DESTINATION LOCATION AND FILE NAME: _

C O N F I R M : YES NO
SOURCE =
DESTINATION =

ANY MODIFICATIONS NEEDED? YES NO

F1=HELP
F6=DIR F7=SAVE F8=MAIN MENU F9=DOS F10=QUIT

EXPORT FILE

NAME SOURCE LOCATION AND FILE NAME: _

NAME DESTINATION LOCATION AND FILE NAME: _

CONFIRM: YES NO
SOURCE =
DESTINATION =

ANY MODIFICATIONS NEEDED? YES NO

F1=HELP
F6=DIR F7=SAVE F8=MAIN MENU F9=DOS F10=QUIT

MERGE DATA FILES

NAME SOURCE LOCATION AND NAMES OF FILES TO BE MERGED:

NAME DESTINATION LOCATION AND NAME OF MERGED FILE:

F1=HELP
F6=DIR F7=SAVE F8=MAIN MENU F9=DOS F10=QUIT

COPY FILE

NAME SOURCE LOCATION AND FILE NAME: _

NAME DESTINATION LOCATION AND FILE NAME: _

F1=HELP
F6=DIR F7=SAVE F8=MAIN MENU F9=DOS F10=QUIT

DELETE FILE

NAME FILE LOCATION AND FILE NAME: _

WARNING!
ALL DATA WITHIN THE FILE WILL BE LOST !
ESC TO CANCEL   ENTER TO CONTINUE

F1=HELP
F6=DIR   F7=SAVE   F8=MAIN MENU   F9=DOS   F10=QUIT

MANAGE DATA BASE

1 ENTER DATA
2 SIMILARITY MATCHING
3 COMMONALITY ANALYSIS
4 SKILL ANALYSIS
5 KNOWLEDGE ANALYSIS
6 EDIT DATA

F1=HELP
F6=DIR F7=SAVE F8=MAIN MENU F9=DOS F10=QUIT

ENTER DATA	
1	TASK LIST
2	DISPLAY LIST
3	CONTROL LIST
4	SKILLS LIST
5	KNOWLEDGE LIST

F1=HELP
F6=DIR   F7=SAVE   F8=MAIN MENU   F9=DOS   F10=QUIT

TASK LIST

SEAWOLF IAL SYSTEM

ENTER TASK NUMBER [FORMAT X.X]
AND TASK NAME [MAX = 50 CHARACTERS]

1.0	Prepare IAL for manual hydraulic operation
2.0	Open breech door and inspect barrel

F1=HELP
F6=DIR F7=SAVE F8=MAIN MENU F9=DOS F10=QUIT

SIMILARITY MATCHING

Identify the training tasks/subtasks that are in the operational system

Task List for: SEAWOLF IAL

```
  1.0  Prepare IAL for manual hydraulic operation
       1.1  Establish comm. with Command and Control center
       1.2  Energize LCDP, position Power On switch to "On"

✓ 2.0  LCDP:  Ensure Vent and Drain Valve "Shut" Lights are On
       2.1  LCDP:  If not, override Hydraulic Valve Actuator

  3.0  Open Breech door and inspect barrel
       3.1  Prepare device for launch

✓ 4.0  Load device and shut Breech Door

  5.0  Position Load/Unloaded Switch to "Loaded"
```

Select appropriate tasks/subtasks and hit enter

```
F1=HELP
F6=DIR      F7=SAVE      F8=MAIN MENU      F9=DOS      F10=QUIT
```

EDIT DATA

1 TASK LIST
2 DISPLAY LIST
3 CONTROL LIST
4 SKILLS LIST
5 KNOWLEDGE LIST

F1=HELP	F2=INSERT	F3=MODIFY	F4=DELETE	
	F7=SAVE	F8=MAIN MENU	F9=DOS	F10=QUIT

EDIT TASK LIST

SEAWOLF IAL SYSTEM

USE F2 TO INSERT TASKS, F4 TO DELETE TASKS, AND F3 TO MAKE CORRECTIONS

1.0	Prepare IAL for manual hydraulic operation
2.0	Open breech door and inspect barrel

F1=HELP	F2=INSERT	F3=MODIFY	F4=DELETE	
	F7=SAVE	F8=MAIN MENU	F9=DOS	F10=QUIT

DEVELOP REPORT
1 DISPLAY RATINGS 2 DISPLAY FILES 3 DISPLAY ANALYSIS RESULTS 4 PRINT AUDIT TRAIL LOG

F1=HELP
F6=PRINT F7=SAVE F8=MAIN MENU F9=DOS F10=QUIT

ASTAR 1
1 PERFORMANCE DEFICIT 2 LEARNING DIFFICULTY 3 QUALITY OF TRAINING - ACQUISITION 4 RESIDUAL DEFICIT 5 RESIDUAL LEARNING DIFFICULTY 6 PHYSICAL SIMILARITY 7 FUNCTIONAL SIMILARITY 8 QUALITY OF TRAINING - TRANSFER

F1=HELP	F2=FIND	F3=QUERY	F4=REPEAT	F5=RESULTS
F6=TSK/STSK	F7=SAVE	F8=MAIN MENU	F9=DOS	F10=QUIT

ASTAR 1

PERFORMANCE DEFICIT

Examine the training objectives and consider what you know about the typical trainee's background, work experience, and prior training. What proportion of the skills and knowledge required by the training objectives will the typical trainee have to learn in order to reach criterion performance on the training device?

Enter this proportion using the following scale:

0 20 40 60 80 100

0 = None - the trainee does not have to learn anything.

100 = All - the trainee has to learn all of the skills and knowledge needed to meet the training objectives.

Use Tab or Enter to select system(s) to be rated:
1) SEAWOLF (2D)

2) SEAWOLF (3D)

3) SEAWOLF (PROTO)
More ▾

Enter Rating -999

F1=HELP	F2=FIND	F3=QUERY	F4=REPEAT	F5=RESULTS
F6=TSK/STSK	F7=SAVE	F8=MAIN MENU	F9=DOS	F10=QUIT

ASTAR 2

1 PERFORMANCE DEFICIT
2 LEARNING DIFFICULTY
3 QUALITY OF TRAINING - ACQUISITION
4 RESIDUAL DEFICIT
5 RESIDUAL LEARNING DIFFICULTY
6 PHYSICAL SIMILARITY
7 FUNCTIONAL SIMILARITY
8 QUALITY OF TRAINING - TRANSFER

F1=HELP	F2=FIND	F3=QUERY	F4=REPEAT	F5=RESULTS
F6=TSK/STSK	F7=SAVE	F8=MAIN MENU	F9=DOS	F10=QUIT

ASTAR 2

QUALITY OF TRAINING - TRANSFER

Consider what you know about the training device and operational situation, a typical instructor (if there is one), and how the device will be used.

What percentage of the tasks that must be learned in the training device are similar to the tasks that are performed in the operational situation?

Rate the percentage using the following scale:

0 20 40 60 80 100

0 = None - none of the training tasks are similar to the operational tasks.

100 = All - all of the training tasks are identical to the operational tasks.

Task.Subtask =
Enter Rating -999

Use Tab or Enter to select system(s) to be rated:
1) SEAWOLF (2D)

2) SEAWOLF (3D)

3) SEAWOLF (PROTO)
More ▾

F1=HELP	F2=FIND	F3=QUERY	F4=REPEAT	F5=RESULTS
F6=TSK/STSK	F7=SAVE	F8=MAIN MENU	F9=DOS	F10=QUIT

ASTAR 3

1 PERFORMANCE DEFICIT
2 LEARNING DIFFICULTY
3 QUALITY OF TRAINING - ACQUISITION
4 RESIDUAL DEFICIT
5 RESIDUAL LEARNING DIFFICULTY
6 PHYSICAL SIMILARITY
7 FUNCTIONAL SIMILARITY
8 QUALITY OF TRAINING - TRANSFER

F1=HELP	F2=FIND	F3=QUERY	F4=REPEAT	F5=RESULTS
F6=TSK/STSK	F7=SAVE	F8=MAIN MENU	F9=DOS	F10=QUIT

ASTAR 3

LEARNING DIFFICULTY

Consider the skills and knowledge needed to meet the training objectives for this subtask that the trainee must learn (the Performance Deficit that you identified). Answer the following.

Will the trainee use job aids or memory aids to perform this subtask in the training device?

Definition - Job and memory aids assist in doing a subtask correctly. Some examples are:
- Documents (Tech manuals, etc.),
- Instructions printed on the equipment, and
- Memory joggers (S-A-L-U-T-E).

Enter on of these ratings:
0 = Job or memory aids ARE used.
1 = Job or memory aids ARE NOT used.

Task.Subtask =
Enter Rating -999

Use Tab or Enter to select system(s) to be rated:
1) SEAWOLF (2D)

2) SEAWOLF (3D)

3) SEAWOLF (PROTO)
More ▾

F1=HELP	F2=FIND	F3=QUERY	F4=REPEAT	F5=RESULTS
F6=TSK/STSK	F7=SAVE	F8=MAIN MENU	F9=DOS	F10=QUIT

ASTAR 3

RESIDUAL LEARNING DIFFICULTY

How many steps are required to do this subtask?

Definition - A step is a seperate physical activity with well defined, observable beginning and end points. A subtask may have one step (identify enemy vehicles) or many steps (those involved in disassembling a rifle).

Enter one of these ratings:

QUERY
1) VIEW OTHER RATINGS WITHIN ASTAR 3
2) VIEW OTHER RATINGS FROM ASTAR 1
3) VIEW OTHER RATINGS FROM ASTAR 2
SELECT OPTION WITH CURSOR BAR

F7=SAVE F8=MAIN MENU F9=DOS F10=QUIT

ANALYSIS RESULTS REQUEST PAGE

RATINGS SCORES

AVERAGES INDIVIDUAL

TASK SUBTASK

OUTPUT

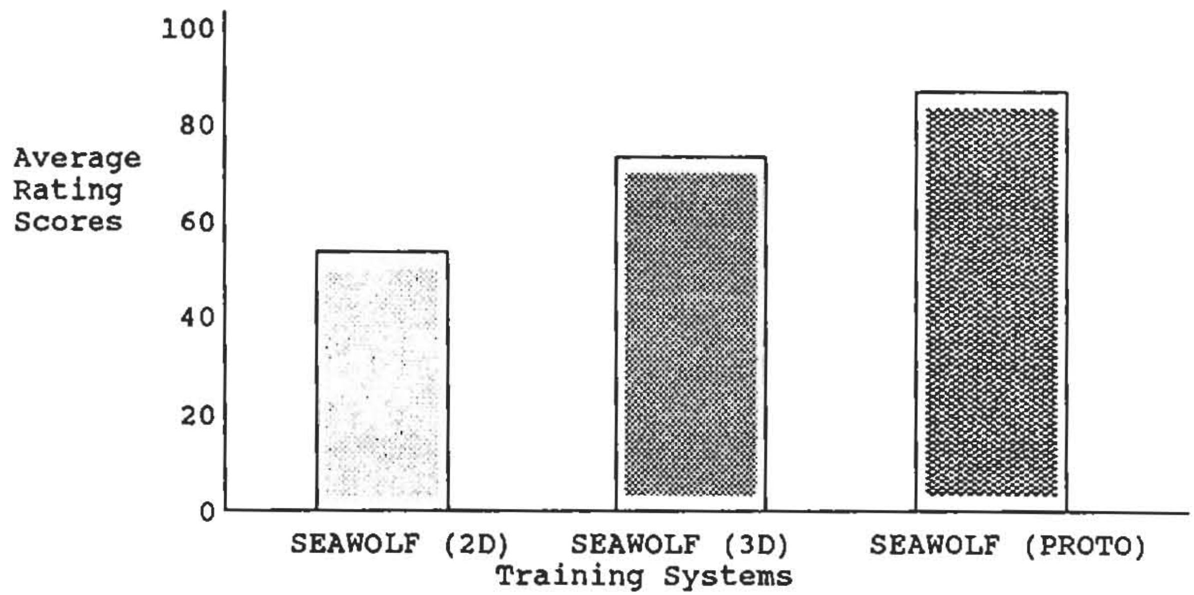
GRAPHIC TABULAR

SELECT WHICH TRAINING SYSTEM(S)	SELECT WHICH CATEGORY
1) SEAWOLF (2D)	1) PERFORMANCE DEFICIT
✓ 2) SEAWOLF (3D)	✓ 2) LEARNING DIFFICULTY
3) SEAWOLF (PROTO)	3) QUALITY OF TRAINING-ACQUISITION
	4) RESIDUAL DEFICIT
	5) RESIDUAL LEARNING DIFFICULTY
	6) PHYSICAL SIMILARITY
	7) FUNCTIONAL SIMILARITY
	8) QUALITY OF TRAINING - TRANSFER

F1=HELP F3=QUERY F4=ANALYSIS

F6=PRINT F8=MAIN MENU F9=DOS F10=QUIT

ANALYSIS RESULTS GRAPHIC OUTPUT
FUNCTIONAL SIMILARITY



F1=HELP F3=QUERY F4=ANALYSIS
F6=PRINT F8=MAIN MENU F9=DOS F10=QUIT

ANALYSIS RESULTS TABULAR OUTPUT

		SEAWOLF 3D	
Performance Deficit	90		
Learning Difficulty	70		
Training Problem		63.00	
Quality of Training - Acquisition	100		
Acquisition		1.00	
Acquisition Efficiency			63.00
Residual Deficit	20		
Residual Learning Difficulty	60		
Physical Similarity	30		
Functional Similarity	80		
Transfer Problem		12.00	
Quality of Training - Transfer	67		
Transfer Efficiency		.81	
Transfer			14.81
sum			77.81

F1=HELP F3=QUERY F4=ANALYSIS
F6=PRINT F8=MAIN MENU F9=DOS F10=QUIT

ANNEX 6

SAMPLE ASTAR II OUTPUTS

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ASTAR II Level 1
Evaluation Summary
DEVICE NAME

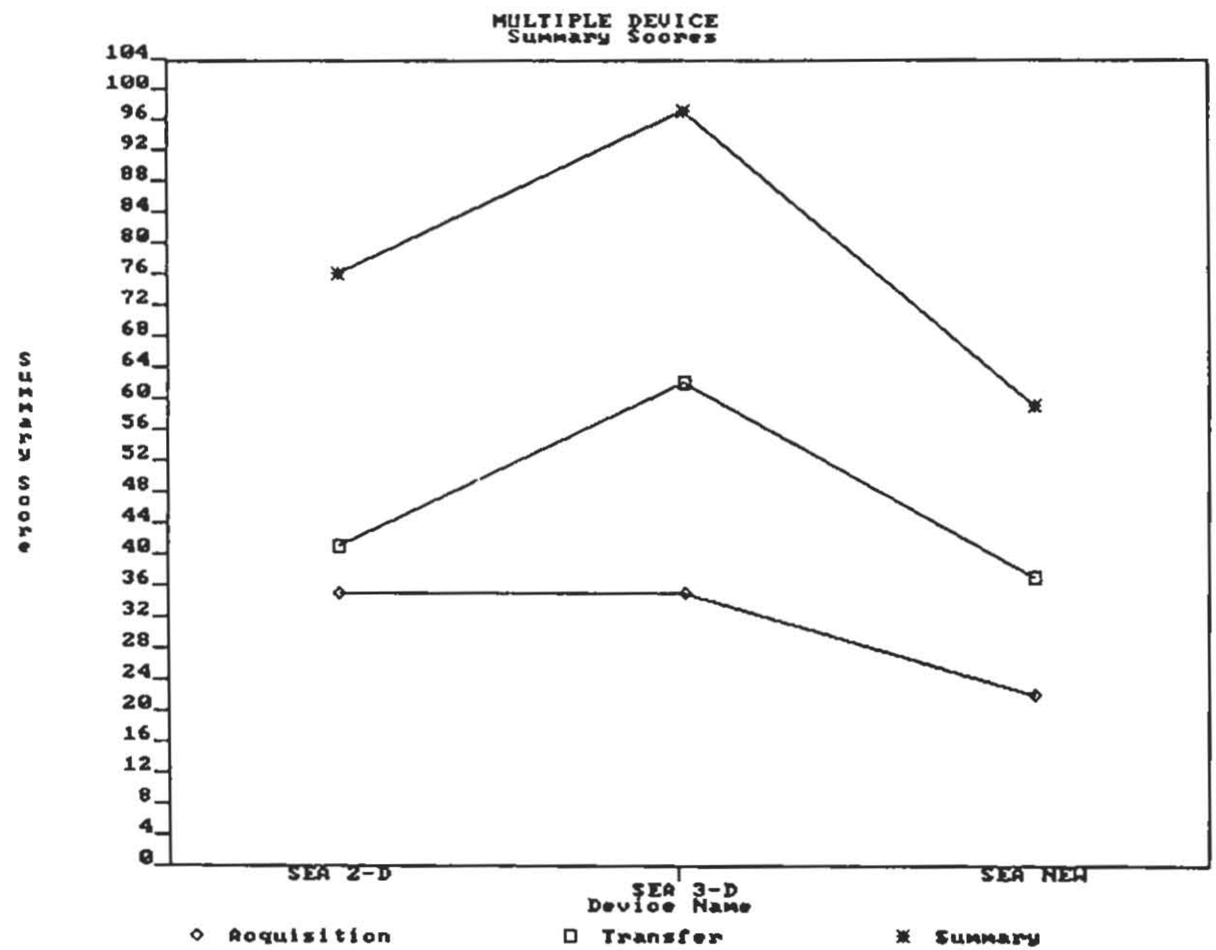
Performance Deficit	55		
Learning Dificulty	65		
Training Problem		35.75	
Quality of Trn-Acq	83		
Acquisition Efficiency		.91	
Acquisition			39.29
Residual Deficit	35		
Residual Learn Diff	65		
Physical Similarity	89		
Functional Similarity	92		
Transfer Problem		22.75	
Quality of Trn-Trans	70		
Transfer Efficiency		.83	
Transfer			27.41
Summary			66.70

F1=HELP F3=QUERY F4=ANALYSIS
F6=PRINT F8=MAIN MENU F9=DOS F10=QUIT

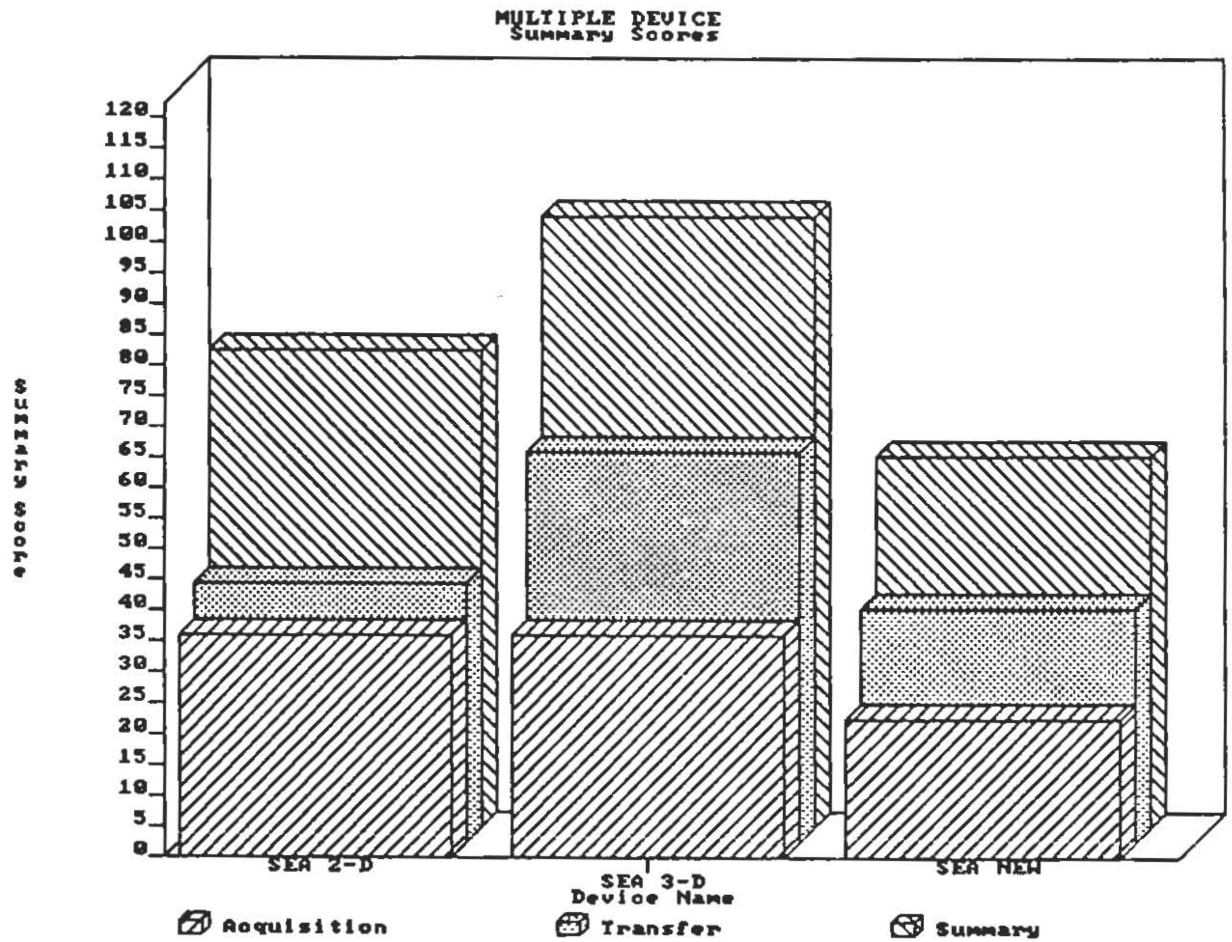
ASTAR II Level 1
Evaluation Summary

	Device Name 1			Device Name 2		
Performance Deficit	55			45		
Learning Dificulty	65			53		
Training Problem		35.75			47.23	
Quality of Trn-Acq	83			75		
Acquisition Efficiency		.91			.68	
Acquisition			39.29			45.65
Residual Deficit	35			45		
Residual Learn Diff	65			52		
Physical Similarity	89			85		
Functional Similarity	92			88		
Transfer Problem		22.75			31.25	
Quality of Trn-Trans	70			85		
Transfer Efficiency		.83			.75	
Transfer			27.41			36.25
Summary			66.70			81.90

F1=HELP F3=QUERY F4=ANALYSIS
F6=PRINT F8=MAIN MENU F9=DOS F10=QUIT



F1=HELP F3=QUERY F4=ANALYSIS
F6=PRINT F8=MAIN MENU F9=DOS F10=QUIT



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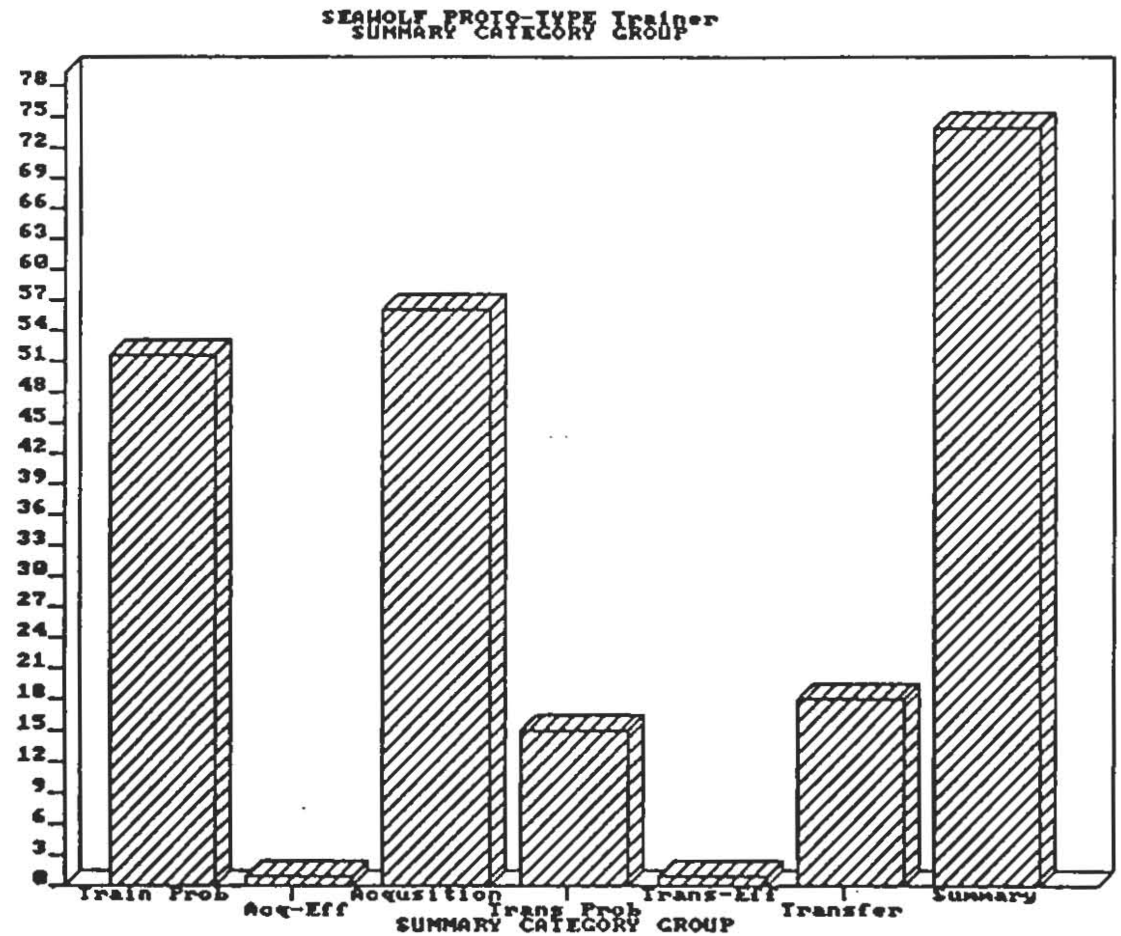
F6=PRINT

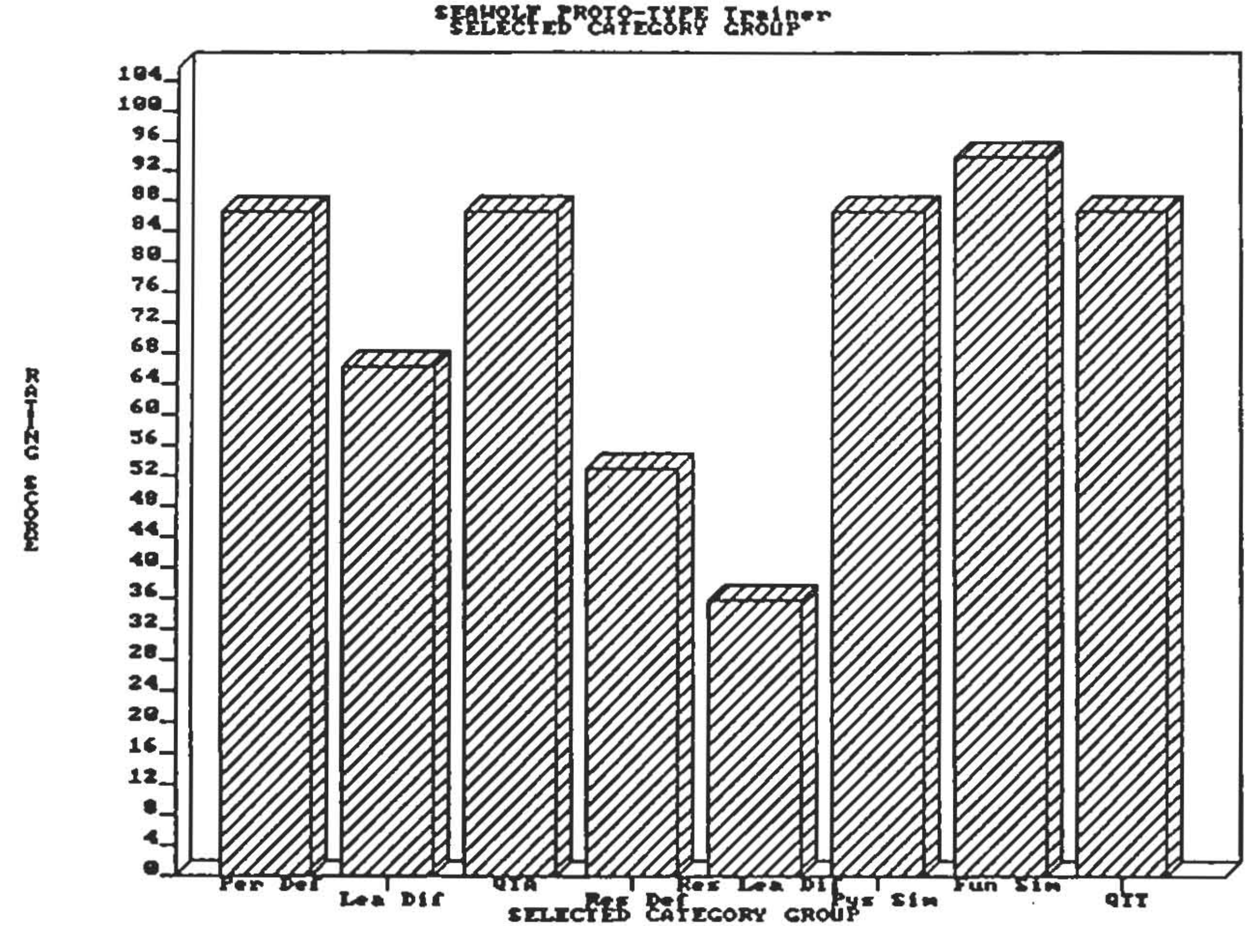
F3=QUERY
F8=MAIN MENU

F4=ANALYSIS
F9=DOS

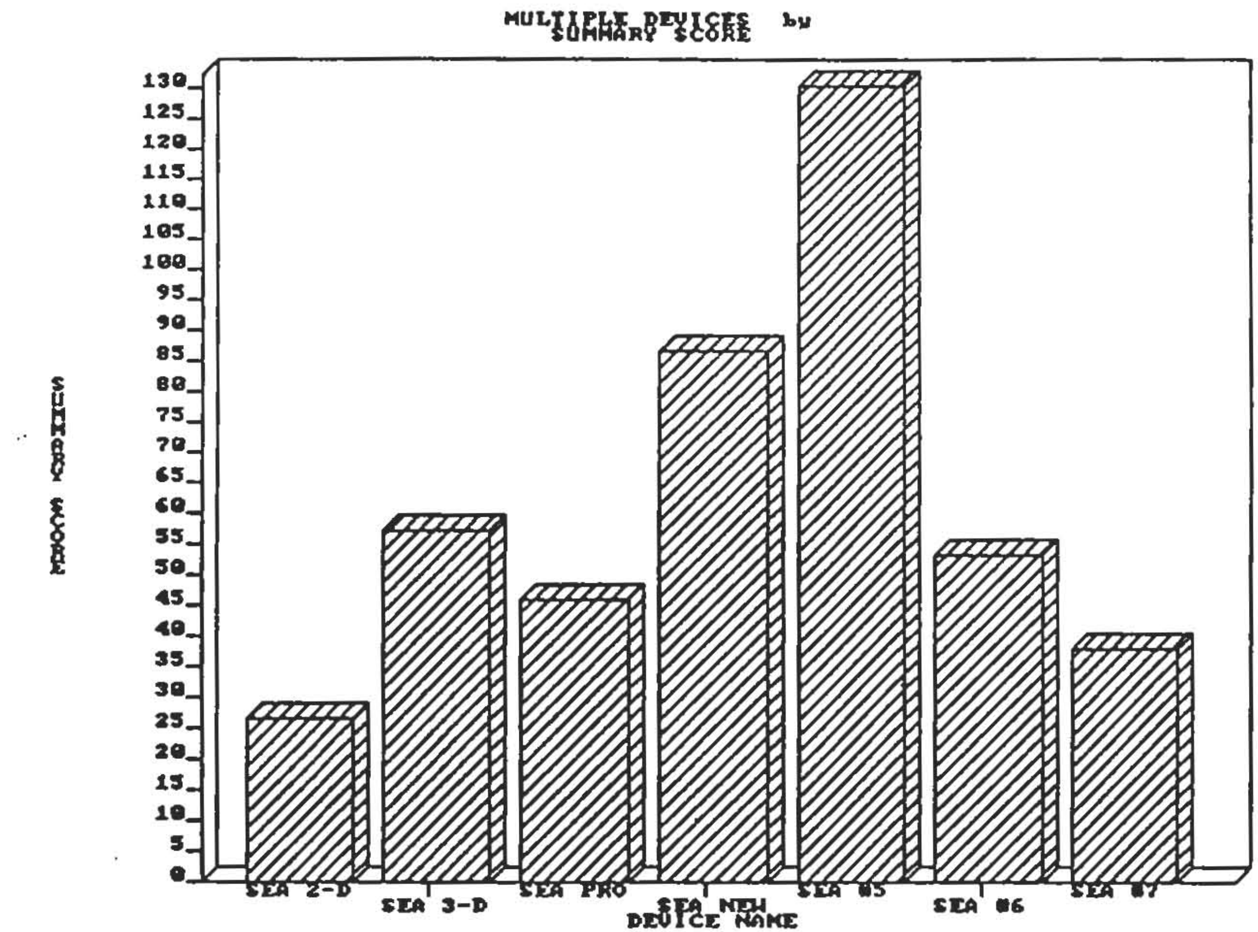
F10=QUIT



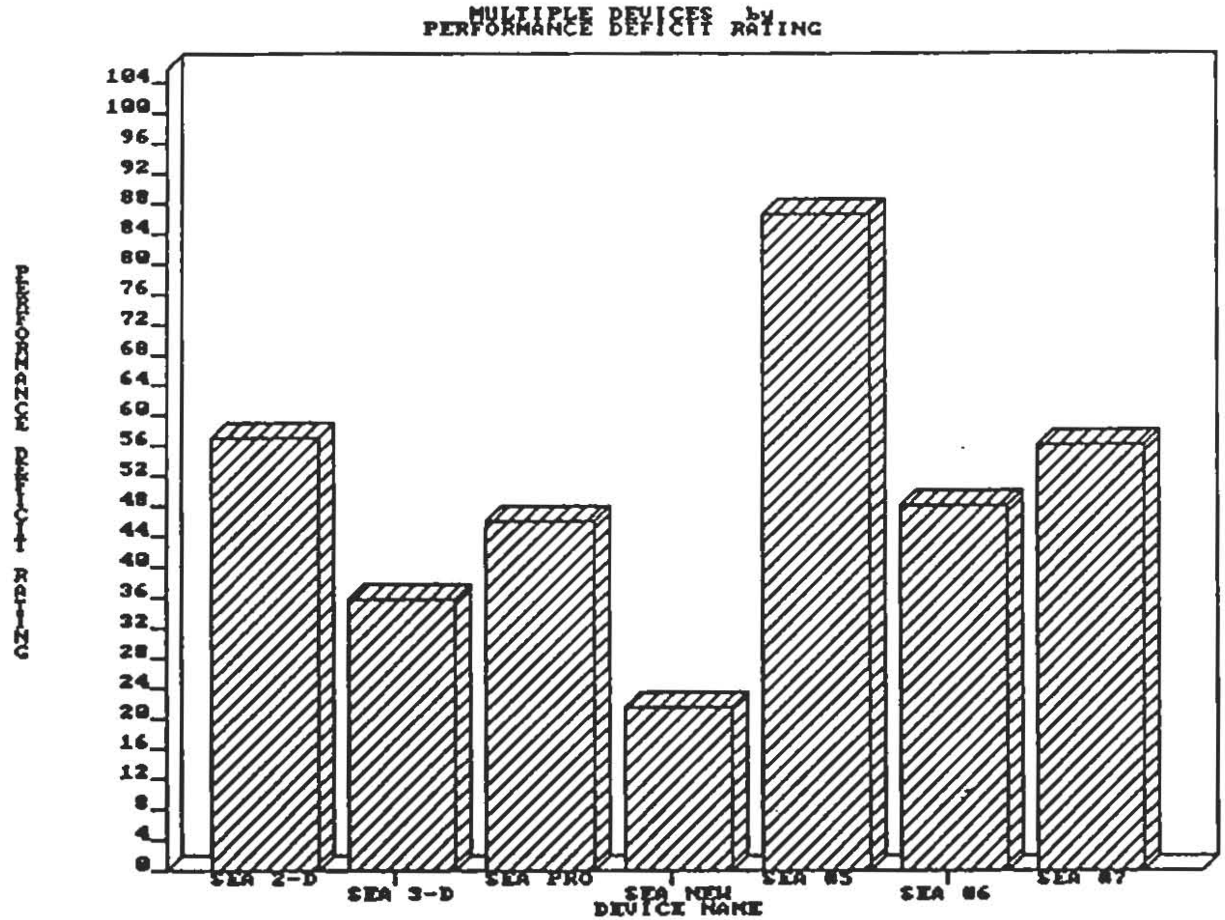
F1=HELP F3=QUERY F4=ANALYSIS
F6=PRINT F8=MAIN MENU F9=DOS F10=QUIT



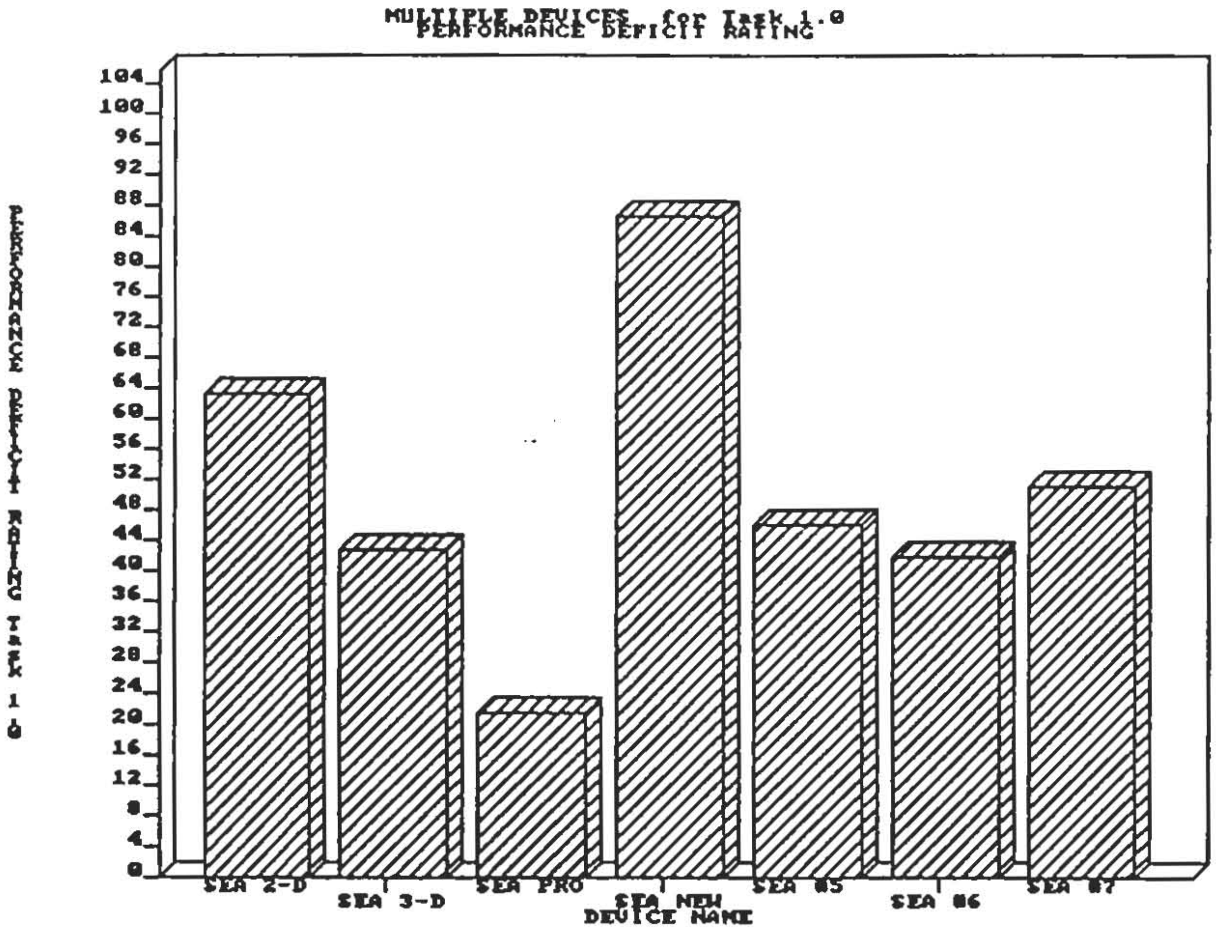
F1=HELP F3=QUERY F4=ANALYSIS
F6=PRINT F8=MAIN MENU F9=DOS F10=QUIT



F1=HELP F3=QUERY F4=ANALYSIS
F6=PRINT F8=MAIN MENU F9=DOS F10=QUIT



F1=HELP F3=QUERY F4=ANALYSIS
F6=PRINT F8=MAIN MENU F9=DOS F10=QUIT

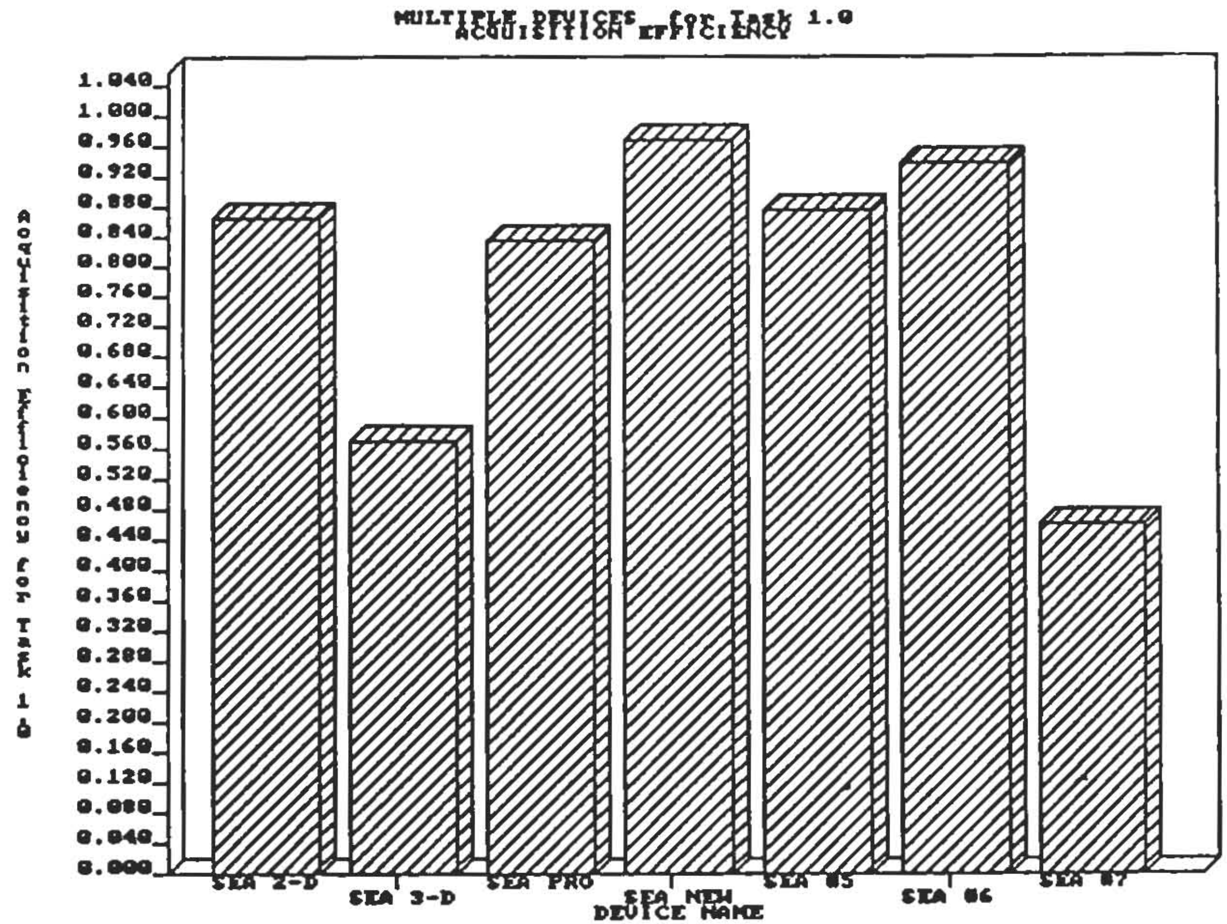


F1=HELP
F6=PRINT

F3=QUERY
F8=MAIN MENU

F4=ANALYSIS
F9=DOS

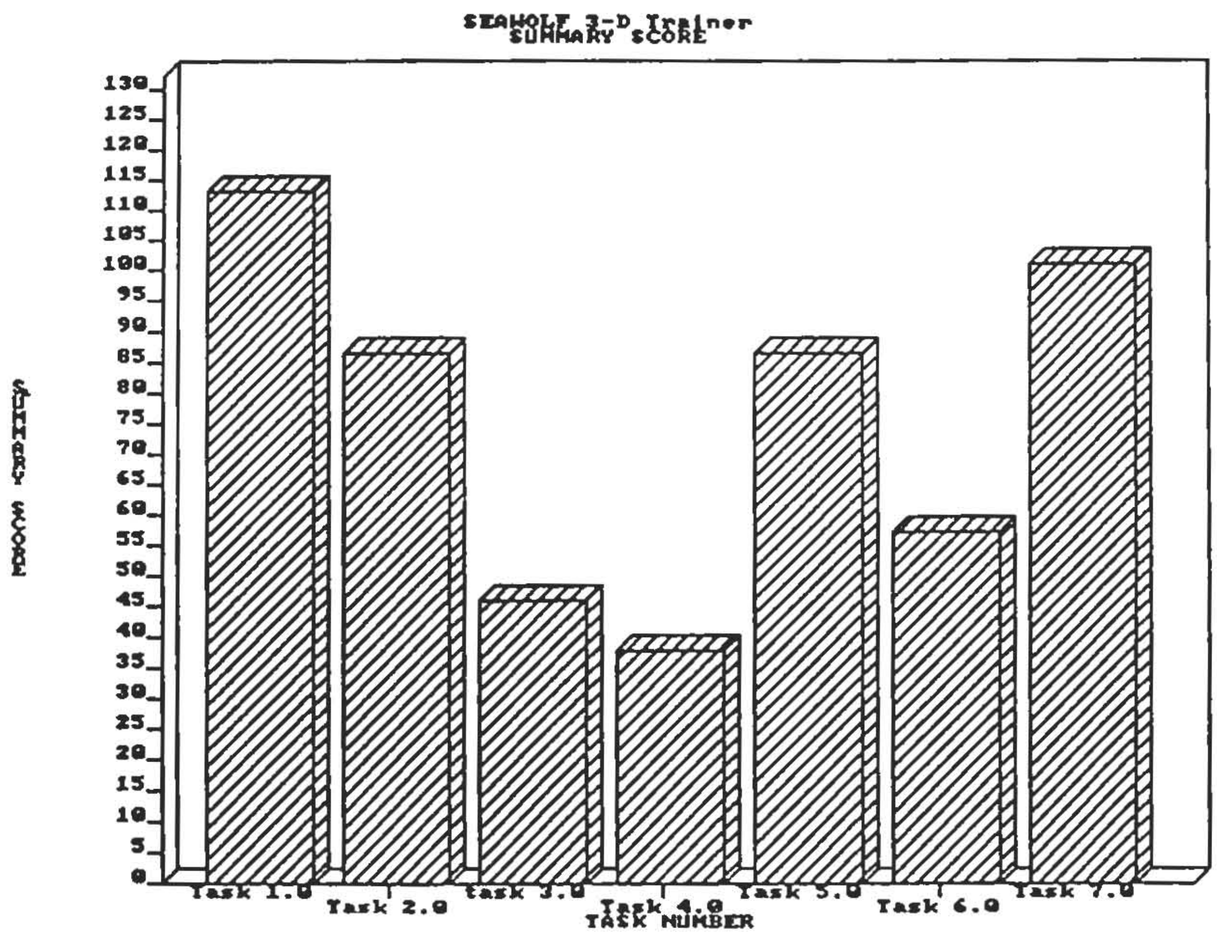
F10=QUIT



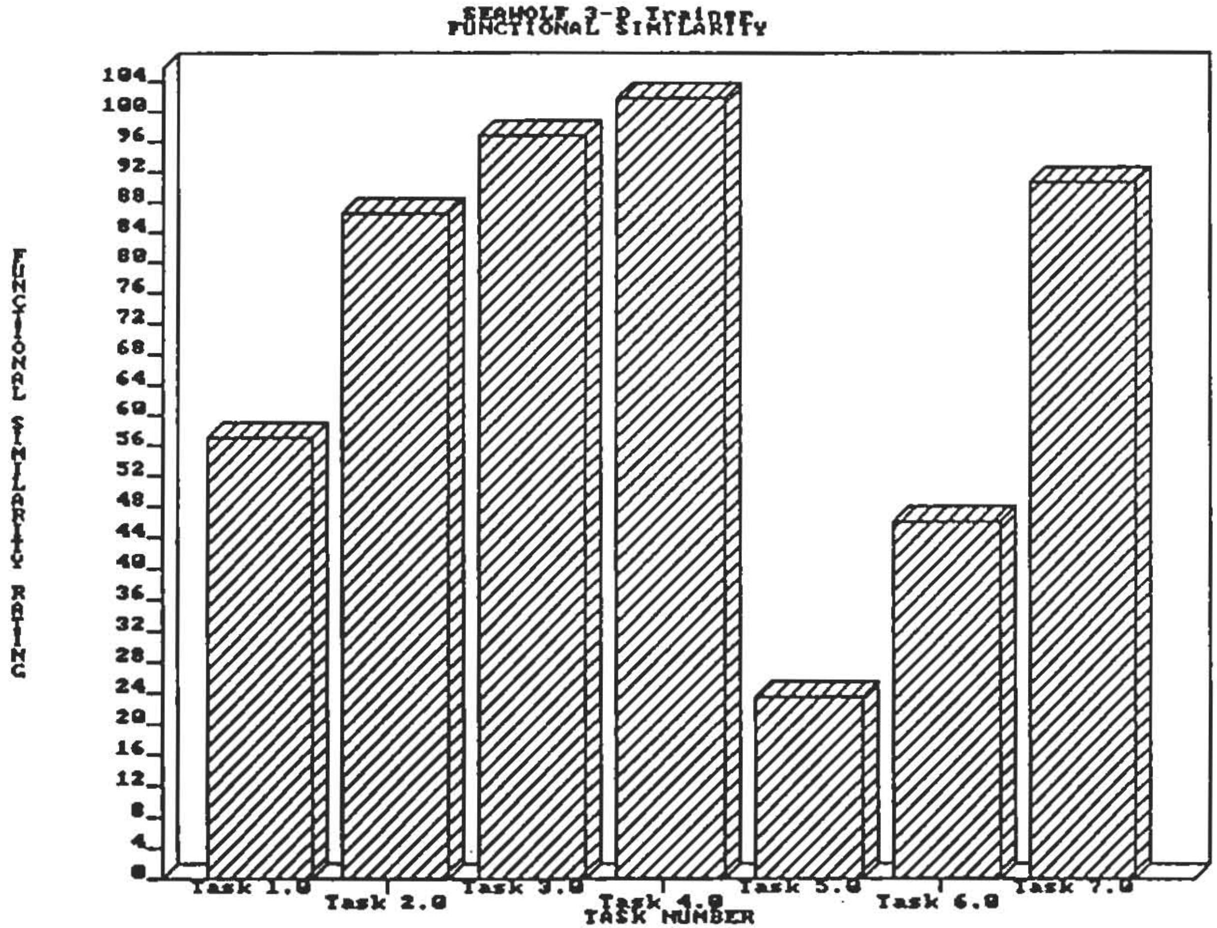
F1=HELP F3=QUERY F4=ANALYSIS
F6=PRINT F8=MAIN MENU F9=DOS F10=QUIT

```
                         ASTAR II LEVEL 3
               RAW RATINGS Task 1.0 DEVICE NAME
Performance Deficit     =  XX      Residual Deficit            =  XX
Learning Difficulty                Residual Learn Diff
     Job Aids Used      =  XX           Job Aids Used          =  XX
     Number of Steps    =  XX           Number of Steps        =  XX
     Done in Sequence   =  XX           Done in Sequence       =  XX
     Built-In Logic     =  XX           Built-In Logic         =  XX
     Mental Demands     =  XX           Mental Demands         =  XX
     Motor Demands      =  XX           Motor Demands          =  XX
Quality of Trn-Acq                 Physical Similarity         =  XX
     Current Standing   =  XX      Functional Similarity       =  XX
     Progressive Examp  =  XX      Quality of Trn-Trans
     Feedback Provided  =  XX           Similar Trn Tasks      =  XX
     Enough Practice    =  XX           Similar Features       =  XX
     Faded Help         =  XX           Clear Objectives       =  XX
     Material Organized =  XX           Reduce Training        =  XX
     Memory Aids        =  XX           Task Similarity        =  XX
     Error Tolerance    =  XX           Enough Practice        =  XX
     Many Examples      =  XX           Overlearning           =  XX
     Different Levels   =  XX           Different Levels       =  XX
     Funct of Perform   =  XX

     F1=HELP                       F3=QUERY       F4=ANALYSIS
     F6=PRINT                      F8=MAIN MENU   F9=DOS          F10=QUIT
```



F1=HELP F3=QUERY F4=ANALYSIS
F6=PRINT F8=MAIN MENU F9=DOS F10=QUIT

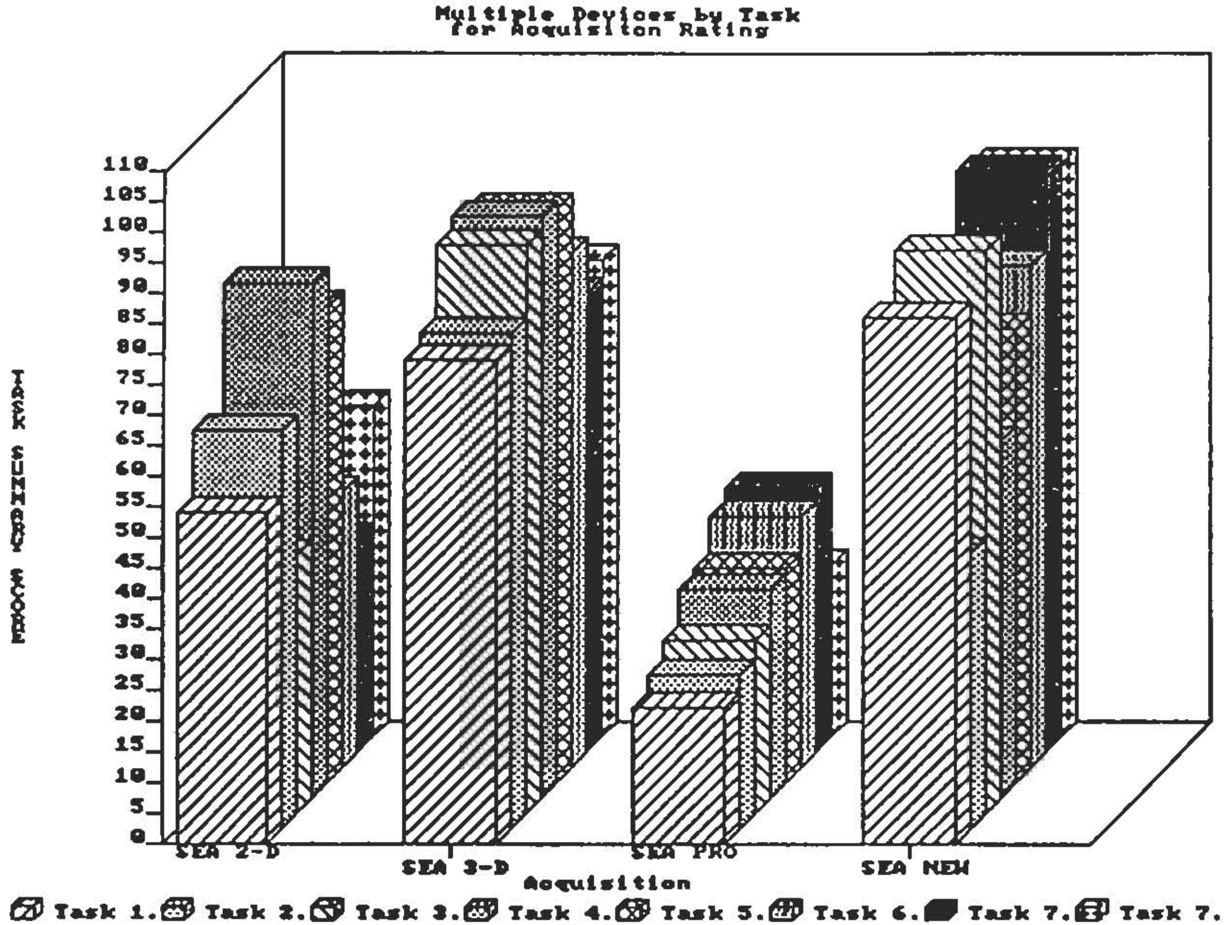


F1=HELP
F6=PRINT

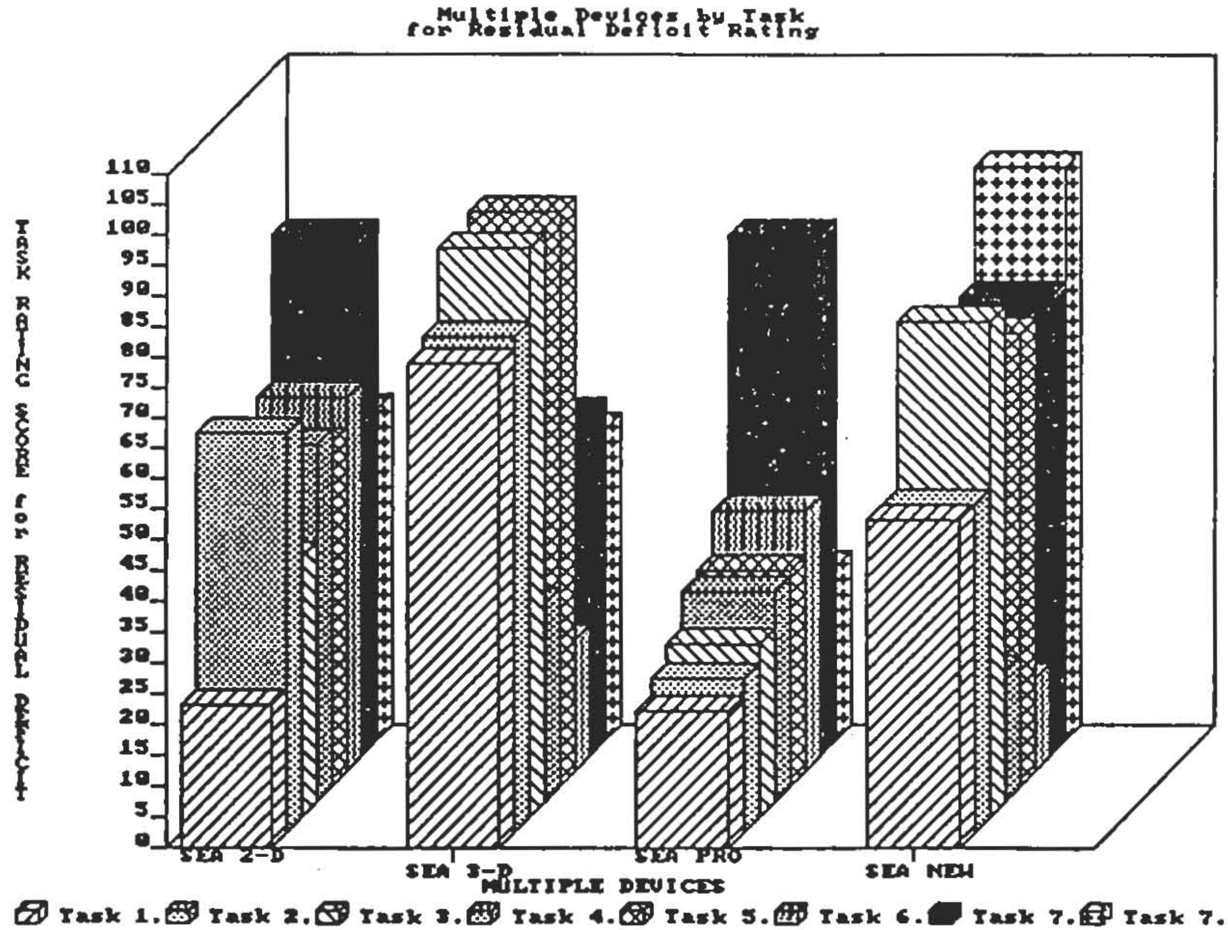
F3=QUERY
F8=MAIN MENU

F4=ANALYSIS
F9=DOS

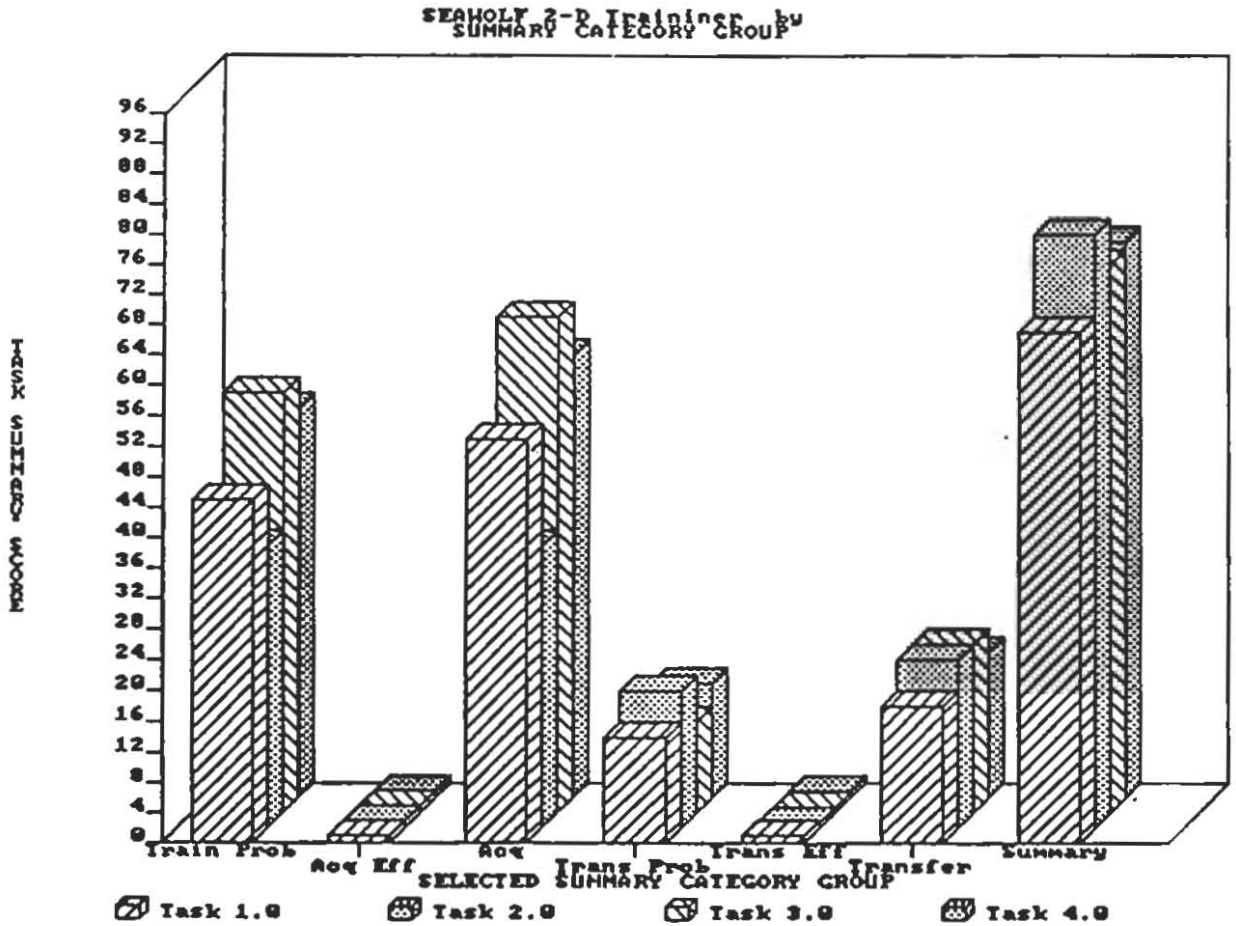
F10=QUIT



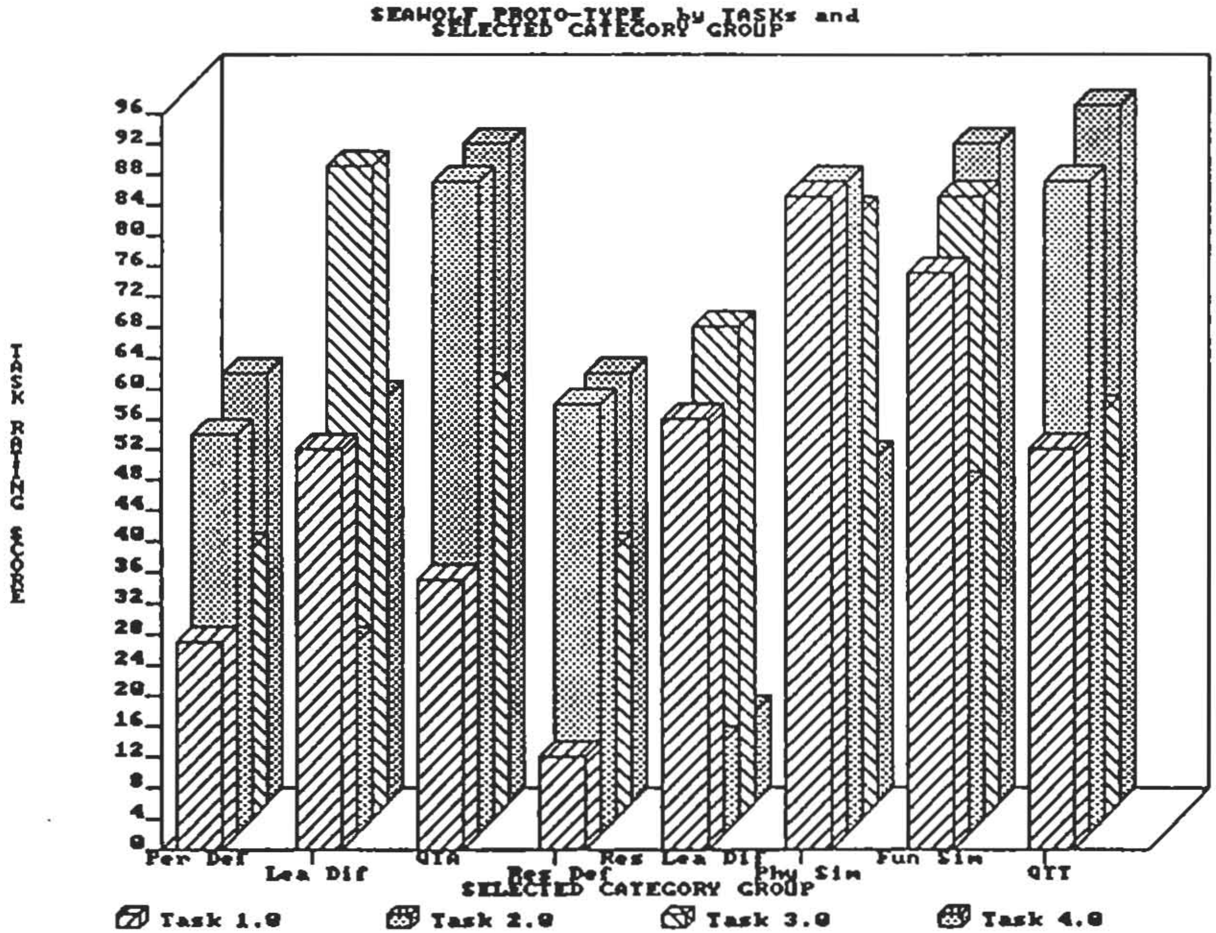
F1=HELP F3=QUERY F4=ANALYSIS
F6=PRINT F8=MAIN MENU F9=DOS F10=QUIT



F1=HELP F3=QUERY F4=ANALYSIS
F6=PRINT F8=MAIN MENU F9=DOS F10=QUIT



F1=HELP F3=QUERY F4=ANALYSIS
F6=PRINT F8=MAIN MENU F9=DOS F10=QUIT



F1=HELP F3=QUERY F4=ANALYSIS
F6=PRINT F8=MAIN MENU F9=DOS F10=QUIT

```
                    ASTAR II  Level 1
                       Raw Ratings
                       DEVICE NAME

Performance Deficit       =  XX
Learning Difficulty       =  XX
Quality of Trn-Acq        =  XX
Residual Deficit          =  XX
Residual Learn Diff       =  XX
Physical Similarity       =  XX
Functional Similarity     =  XX
Quality of Trn-Trans      =  XX

     F1=HELP                        F3=QUERY       F4=ANALYSIS
     F6=PRINT                       F8=MAIN MENU   F9=DOS         F10=QUIT
```

ASTAR II Level 2
Raw Ratings, Tasks 7.0-12.0
DEVICE NAME

TASK NUMBER		7.0	8.0	9.0	10.0	11.0	12.0
Performance Deficit	=	XX	XX	XX	XX	XX	XX
Learning Difficulty	=	XX	XX	XX	XX	XX	XX
Residual Deficit	=	XX	XX	XX	XX	XX	XX
Residual Learn Diff	=	XX	XX	XX	XX	XX	XX
Physical Similarity	=	XX	XX	XX	XX	XX	XX
Functional Similarity	=	XX	XX	XX	XX	XX	XX

The following two Rating Categories are not made on a task basis.

Quality of Training-Acquisition
1. Directions Provided = XX   2. Practice Provided = XX
3. Feedback Provided = XX   3. Varying Practice Levels = XX

Quality of Training-Transfer
1. Similar Performance = XX   2. Similar Conditions = XX
3. Extensive Practice = XX

F1=HELP   F3=QUERY   F4=ANALYSIS
F6=PRINT   F8=MAIN MENU   F9=DOS   F10=QUIT

ASTAR II Level 2
Raw Ratings, Tasks 1.0-6.0
DEVICE NAME

TASK NUMBER		1.0	2.0	3.0	4.0	5.0	6.0
Performance Deficit	=	XX	XX	XX	XX	XX	XX
Learning Difficulty	=	XX	XX	XX	XX	XX	XX
Residual Deficit	=	XX	XX	XX	XX	XX	XX
Residual Learn Diff	=	XX	XX	XX	XX	XX	XX
Physical Similarity	=	XX	XX	XX	XX	XX	XX
Functional Similarity	=	XX	XX	XX	XX	XX	XX

The following two Rating Categories are not made on a task basis.

Quality of Training-Acquisition
1. Directions Provided = XX 2. Practice Provided = XX
3. Feedback Provided = XX 3. Varying Practice Levels = XX

Quality of Training-Transfer
1. Similar Performance = XX 2. Similar Conditions = XX
3. Extensive Practice = XX

F1=HELP F3=QUERY F4=ANALYSIS
F6=PRINT F8=MAIN MENU F9=DOS F10=QUIT

ASTAR II LEVEL 3

RAW RATINGS Task 3.0 DEVICE NAME

Performance Deficit	= XX	Residual Deficit	= XX
Learning Difficulty		Residual Learn Diff	
Job Aids Used	= XX	Job Aids Used	= XX
Number of Steps	= XX	Number of Steps	= XX
Done in Sequence	= XX	Done in Sequence	= XX
Built-In Logic	= XX	Built-In Logic	= XX
Mental Demands	= XX	Mental Demands	= XX
Motor Demands	= XX	Motor Demands	= XX
Quality of Trn-Acq		Physical Similarity	= XX
Current Standing	= XX	Functional Similarity	= XX
Progressive Examp	= XX	Quality of Trn-Trans	
Feedback Provided	= XX	Similar Trn Tasks	= XX
Enough Practice	= XX	Similar Features	= XX
Faded Help	= XX	Clear Objectives	= XX
Material Organized	= XX	Reduce Training	= XX
Memory Aids	= XX	Task Similarity	= XX
Error Tolerance	= XX	Enough Practice	= XX
Many Examples	= XX	Overlearning	= XX
Different Levels	= XX	Different Levels	= XX
Funct of Perform	= XX		

F1=HELP F3=QUERY F4=ANALYSIS
F6=PRINT F8=MAIN MENU F9=DOS F10=QUIT

ASTAR II LEVEL 3

RAW RATINGS Task 2.0 DEVICE NAME

Performance Deficit	= XX	Residual Deficit	= XX
Learning Difficulty		Residual Learn Diff	
Job Aids Used	= XX	Job Aids Used	= XX
Number of Steps	= XX	Number of Steps	= XX
Done in Sequence	= XX	Done in Sequence	= XX
Built-In Logic	= XX	Built-In Logic	= XX
Mental Demands	= XX	Mental Demands	= XX
Motor Demands	= XX	Motor Demands	= XX
Quality of Trn-Acq		Physical Similarity	= XX
Current Standing	= XX	Functional Similarity	= XX
Progressive Examp	= XX	Quality of Trn-Trans	
Feedback Provided	= XX	Similar Trn Tasks	= XX
Enough Practice	= XX	Similar Features	= XX
Faded Help	= XX	Clear Objectives	= XX
Material Organized	= XX	Reduce Training	= XX
Memory Aids	= XX	Task Similarity	= XX
Error Tolerance	= XX	Enough Practice	= XX
Many Examples	= XX	Overlearning	= XX
Different Levels	= XX	Different Levels	= XX
Funct of Perform	= XX		

F1=HELP F3=QUERY F4=ANALYSIS

F6=PRINT F8=MAIN MENU F9=DOS F10=QUIT