The Naval Training Equipment Center (NAVTRADEQPCEN) initiated a research program to investigate automation and other aids as tools to reduce time and personnel requirements of instructional systems development (ISD). This study was conducted in three phases.

1) Determine the theoretical feasibility of using automation to reduce the cost of ISD.
2) Demonstrate feasibility by building a prototype aid to ISD.
3) Develop the prototype CASDAT into a useful operational system.
Phase one succeeded in demonstrating theoretical feasibility of using certain aids to ISD by answering four questions: Do families of tasks exist? Is it feasible to build a task data base? Are generic data bases feasible for other ISD steps? and Could time and cost savings be realized through automation? Demonstration of theoretical feasibility was accomplished by review of aircrew task data from 14 aircraft ISD efforts previously completed. Families of tasks were identified and a generic task list model was derived. Researchers found that by using the generic task list model, they could build a task list data base. Researchers were further able to use that task list data base as a basis for developing aids to complete other ISD steps. By virtue of their algorithmic nature, task listing, objectives hierarchy, media selection, syllabus design and lesson specification were identified as ISD steps suitable for automation. An analysis of aiding systems and their capabilities indicated that cost and time savings could be best achieved using a computer/text editor system in conjunction with the generic task model approach.

The second phase of the study resulted in development of a prototype set of computer based aids. The prototype, the Computer Aided System for Developing Aircrew Training (CASDAT) was installed at NAVTRAEEQUIPCEN in April 1980. It provided seven user aiding routines that allowed a system developer to accomplish five ISD steps: task list development, objectives hierarchy development, media selection, syllabus development, and lesson specification. At that stage of development, CASDAT provided automated aid to the five ISD steps for two mission phases (preflight and navigation) and three aircrew jobs (pilot, copilot, and radar intercept officer/Naval Flight Officer).

The third phase of the study brought CASDAT to its current stage of development. The system contains aircrew training data from seven aircrew phases of flight: pre-mission planning, pre-flight, take-off/departure, navigation, approach/landing, post-mission debrief, and special procedures. Supporting software routines allow these data to be manipulated over five ISD steps: task list development, objectives hierarchy development, media selection, syllabus design, and lesson specification development.

Taking inputs from a training developer on the features and capabilities of an aviation weapons system, CASDAT uses a generic task model to define a task listing and an objectives hierarchy for that aircraft. After validation by the developer, these tasks and objectives become the basis for the remaining ISD steps aided by the system.

Preliminary data indicate that the system generates quality ISD products for aircrew training programs in significantly less time than is required using traditional ISD methods. A full-scale field trial of CASDAT is recommended in order to fully measure its contribution to aircrew training design.

The future direction of CASDAT awaits government definition of requirements, i.e., expansion of CASDAT to more ISD steps, other mission phases and/or other aircrew jobs.
PREFACE

Human factors is strongly influenced by revolutionary technology (e.g., computers) from other disciplines; however, it apparently has not yet enjoyed the glamour, support and heuristics that derive from breakthroughs that are distinctively its own. It is important and interesting to speculate, therefore, about human factors developments that augur breakthroughs that are revolutionary in magnitude.

Speculation about revolutionary contributions from the human factors field appears to be quite scant. The impact of human factors products, however, frequently are not readily apparent, even to the scientists themselves. Methods and concepts from the behavioral and social sciences trickle into common use, making their application difficult to detect. Further, even where such applications are known, their effects often are difficult to objectively evaluate. This appears to be the case with the instructional systems development (ISD) methodologies.

It might make some uncomfortable, therefore, to consider that something as apparently unremarkable as ISD methodology deserves high praise. Nevertheless, the ISD movement has reached a point where the potential of the ISD approach is becoming increasingly evident, impressive, and deserving of attention. One revolutionary aspect of ISD lies in its ability to organize and mobilize human factors techniques and information for applied and R&D purposes.

This conception of ISD might be dismissed as another case of wishful thinking, if not for preliminary but significant confirmations of the concept by a number of independent investigators. Encouraged by the progress to date, momentum from these pioneering efforts appears to be increasing. However, the tasks of developing an ISD system that for the first time enables orderly, efficient and comprehensive applications and enhancements of human factors technology are neither obvious or simple. Significant programs for improving the ISD process with computer aids, cognitive approaches, and procedural refinements have been underway at TAEG and the NAVPERSRANDCEN, as well as the NAVTRAEOIPCEN. Plans for continuing these efforts are being coordinated among these three organizations, and more efforts are needed.

A major contribution of the current project to the overall goals projected for ISD is that a system was produced (CASDAT) which enables apparently the first and only application of a generic data base to the ISD process. Further, CASDAT is one of a very few systems to provide specially designed computer-based programs for assisting ISD applications. In CASDAT, support is provided to the instructional developer through the automation of five key steps in the instructional design process. These five steps include the development of task lists, objective hierarchies, media selection, training syllabi and lesson specifications. Source data for task, objective and syllabus development is drawn from a generic data base. This data base contains a standardized form of aircrew task and objective data derived from previous ISD efforts on fourteen military aircraft. The generic data
base structure in CASDAT applies across all types of aircraft, missions and flight crew positions and provides a substantial portion, at least 70 percent, of the information needed in the development of task lists or objectives hierarchies. Communication programs within CASDAT guide and allow the Instructional Developer to interact with the generic data base to manipulate, update and create new material to meet the requirements of the aircrew training program being developed.

CASDAT is presently capable of providing instructional data for seven of eight mission phases: pre-launch, pre-mission planning, take-off/departure, navigation, approach/landing, post-mission debrief and special procedures. Further expansion of CASDAT awaits a more definitive evaluation of its contributions to ISD. However, a preliminary assessment indicates that CASDAT will improve the efficiency of conducting aircrew training system analysis and design for the five ISO steps by between 37 and 62 percent. This is a significant improvement. Costs for conducting these analyses commonly range between $200,000 and one million dollars.

Some benefits resulting from CASDAT perhaps can be anticipated. Others may only be known through routine use of the system. It is expected that CASDAT's speed in searching, sorting, typing, etc., will: (a) decrease ISO man-hour, lead-time and dollar requirements; (b) increase the time available for more creative aspects of ISD, including improving the ISD methodology; and (c) allow ISO applications where time, money or people are inadequate for traditional ISO approaches.

CASDAT is designed to aid the design of new training systems, as well as improve the training system modification process—an unwieldy job and a major concern. By relating student performance and equipment change information to CASDAT's data base via word searches, areas of the training systems can be designed based on common features of different jobs—as identified by CASDAT's generic data base and amplified by word search speed.

In addition to speed advantages, CASDAT also offers management benefits. CASDAT manages the ISO process by providing cues, instruction, menus, etc., which lead a person through the ISO procedures. These features decrease the demand on high-level ISO experts who normally serve these management functions. These management features will help ISO team members learn more about ISO procedures as part of the process of using the system.

CASDAT standardizes ISO processes by facilitating repeated applications of the same procedures by different people. This, in turn, standardizes ISO products and facilitates the identification of deficiencies in the system, which then can be improved. Because some improvements will require R&D, CASDAT can help define R&D issues. Implementation of improvements will be more likely with CASDAT since the implementation is automatic. Standardization of ISO outputs will encourage similar training at different sites, which will allow interchange of personnel, training materials and equipment.
Such improvements to ISD should significantly contribute to its usefulness. User misconceptions, however, can impede progress. Some CASDAT users might misuse the system by doing too little, because CASDAT does so much. On the other hand, even where CASDAT is used properly, people may misperceive that human control over CASDAT is less than it is, and reject the products for this reason.

A related effort under this project produced an automated instructional media selection system (AIMS), an endeavor to improve CASDAT's automated media selection model. CASDAT will be field implemented along with AIMS in actual training analysis and design applications at the NAVTRAEOIPCN in FY 1983.
ACKNOWLEDGEMENTS

This project was conducted by the Naval Training Equipment Center under the direction of Dr. Arthur Blaiwes of the Human Factors Laboratory and Mr. Robert Bird of the Aviation/EW Analysis and Design Branch. The effort was accomplished between September 1978 and July 1982. This report is the result of contributions from many people. In particular, special thanks are owed to:

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Mr. P. Scott
Mr. R. Browning

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Mr. B. J. McGuire

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Mr. P. Brown
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SECTION I

INTRODUCTION

The Naval Training Equipment Center (NAVTRADEQUIPCEN) has procured many instructional programs for aviation weapon systems. Aircrew training programs procured by NAVTRADEQUIPCEN over the past 10 years have included the A-6E, E-2C, EA-6B, SH-2F, F-14 and F-4. Currently aircrew training programs are being designed for the CH-46, F/A-18 and AV-8B.

NAVTRADEQUIPCEN has found instructional systems development (ISD) technology to be useful when developing large training programs for major aviation weapon systems. ISD combines the results of research in human learning with the methodology of systems analysis to provide a structure for training design. This structure helps ensure that the resulting training program will be both complete and efficient. Despite this advantage, there are built-in disadvantages with the ISD process. One indication of the size of merely the "front-end" portion (i.e., steps including job/task analysis through lesson specification) of an ISD effort required to develop an aircrew training system shows manhours ranging from 6008 for the E-2C to 13006 for the A-6E (Table 1).

NAVTRADEQUIPCEN recognized the costly nature of ISD and initiated a research and development program to investigate ways to reduce time and personnel requirements of instructional design. A major result of this research effort is a system which provides automated aid to the instructional design process. The system is a Computer Aided System for Developing Aircrew Training (CASDAT).

CASDAT was developed first as a prototype to demonstrate the feasibility of enhancing the cost-effectiveness of ISD by automating portions of the process. Later, it was further developed into an operational tool for developing aircrew training. In its current configuration it provides automated support for completing five ISD steps; task list development, objectives hierarchy, media selection, syllabus design, and lesson specification development. It can be used to design training for seven aircrew mission phases (pre-mission planning, pre-flight, take-off/departure, navigation, approach/landing, post-mission debrief, and special procedures) and three crew positions (pilot, copilot and radar intercept officer). In using CASDAT, the training developer interacts with the system on a real time basis via a terminal consisting of a CRT display screen and a typewriter-like keyboard. Based on the developer's real time inputs, CASDAT generates lists delineating the tasks to be trained and the objectives for the training; selects media; develops a prototype syllabus for training; and summarizes information needed by the developer to write training lessons.

<table>
<thead>
<tr>
<th>EFFORT CATEGORY</th>
<th>A-6E</th>
<th>E-2C</th>
<th>EA-6B</th>
<th>SH-2F</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Hours</td>
<td>% of Total</td>
<td>Hours</td>
<td>% of Total</td>
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<td>Work Plan</td>
<td>174</td>
<td>1</td>
<td>224</td>
<td>3</td>
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<td>Task Analysis</td>
<td>3,654</td>
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<td>1,740</td>
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<td>Training Objectives</td>
<td>3,045</td>
<td>26</td>
<td>965</td>
<td>15</td>
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<tr>
<td>Trng. Prog. &amp; Lesson Specifications</td>
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<td>28</td>
<td>3,652</td>
<td>55</td>
</tr>
<tr>
<td>Other</td>
<td>1,479</td>
<td>13</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td>Professional Effort Total</td>
<td>11,658</td>
<td>100</td>
<td>6,581</td>
<td>100</td>
</tr>
<tr>
<td>Navy SME Effort</td>
<td>1,348</td>
<td>100</td>
<td>87</td>
<td>100</td>
</tr>
<tr>
<td>Total Effort</td>
<td>13,006</td>
<td>100</td>
<td>6,668</td>
<td>100</td>
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</table>

a NS = Not Shown

CASDAT has evolved from an effort by NAVTRAEEUIPCEN to reduce the costs of ISD. Impetus for research in this area came after the gradual maturing of ISD technology had led to general acceptance of its role in Department of Defense training programs. However, system program managers, tasked with funding ISD efforts, pointed to the high "up front" costs of ISD and as a result questioned its overall cost-effectiveness.

NAVTRAEEUIPCEN began in 1977 to systematically address the problem. First, a specification and data item descriptions (MIL-T-29053) were produced which standardized design, development, procurement and evaluation of training systems. This should make good progress toward solving a problem of lack of standardization in ISD.

Looking next to automation as an approach to reducing labor costs, NAVTRAEEUIPCEN procured functional specifications for a Computer Assisted Training System Development and Management Model (CATSDM). The objective of the study was to identify functional specifications for a series of computer programs and data bases needed to support ISD steps from problem analysis through system implementation. The results of the effort identified 24 individual ISD steps as candidates for automation (see Figure 1). CATSDM provided the theoretical basis for future study in that it mapped the course that needed to be followed. Although quite comprehensive, it left to other research the practical issues that had to be addressed before automation and ISD could be melded into a useful and economical combination.

The necessary practical considerations became the subject of the current research study to demonstrate feasibility of attaining cost effective ISD by using automation and generic data bases as aids to the process. The problem addressed during this study was the duplication of effort on similar ISD programs and consequential duplication of costs. As a result, ISD data common to a number of aircrew training applications were developed repeatedly. In effect, some portion of every ISD effort was paid for more than once. In a cooperative effort between NAVTRAEEUIPCEN and Veda Incorporated, a study was undertaken to determine if some investment made in previous ISD projects could be recouped by using products from past efforts to reduce the cost of future ISD efforts.


The study consisted of three phases:

<table>
<thead>
<tr>
<th>Phase</th>
<th>Purpose</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>I Feasibility Study</td>
<td>Determine the theoretical feasibility of using automation to reduce the cost of ISD.</td>
<td>September 1978 - May 1979</td>
</tr>
<tr>
<td>II Prototype Development</td>
<td>Build a prototype system to verify the feasibility of using automation to reduce the cost of ISD.</td>
<td>October 1980 - May 1981</td>
</tr>
<tr>
<td>III Operational Development</td>
<td>Expand the prototype system into a useful, operational tool to aid the ISD process.</td>
<td>September 1981 - July 1982</td>
</tr>
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</table>

Each phase of the study is described in the following sections of this report. Section III describes the procedures used to determine the feasibility of using an automated data base to reduce the costs of ISD. Section IV describes the prototype system which was developed to verify feasibility. Section V describes the fully operational computer aided system for developing aircrew training (CASDAT).
NAVTRA'EQUIPCEN tasked Veda Incorporated with investigating the feasibility of using automated aids and general data bases to reduce ISD costs. Specifically, the feasibility study was designed to investigate whether data bases could be created to support critical steps in the ISD process. Further, the study investigated the contribution to this purpose of using aircrew training program data developed during previous ISD efforts. Additionally, could an instructional developer be provided with a system of computer programs, which aid in the editing and manipulating of data, in order to save time and money?

The study effort was divided into two parts, each of which was structured to answer specific questions. This served to direct the activities of each part. The specific questions, by part were:

Part 1: Do families of tasks exist among aircrew training data from different aircraft types?

Part 2: If task families exist, is a general task data base feasible to aid ISD?

If a general task data base is feasible, are general data bases feasible for other ISD steps?

What are the potential savings in resources and time when a general data base system is applied to steps in the ISD process?

These questions were stated so that the answer to each determined whether or not the next question would be asked. The procedure established whether or not work progressed to subsequent questions of the study, thus allowing NAVTRA'EQUIPCEN to make go, no-go decisions at several crucial points. Following a review of the results of this study, NAVTRA'EQUIPCEN made the decision to develop a computer-based prototype aid to ISD (Phase 2). This section of the report will describe the procedure and results of the feasibility study.

PROCEDURES AND RESULTS

PART I PROCEDURES AND RESULTS. The first part of the study addressed the question: Do families of tasks exist? The purpose of this part was to identify a common framework of task families which could be ordered into a data base and accessed and manipulated to support one or more steps of the ISD process. A preliminary review of available Navy aviation training data revealed broad similarities in aircrew tasks across various aircraft types. This observation was expected since flight training in general and military flight training in particular is highly standardized. A more in-depth review of these same data, however, indicated a wide range of
variability in the terminology, data organization, type of content and level of detail. It was concluded that these data, in their present form, could not be used in subsequent analyses to determine the existence of families of tasks. These data had to be restructured into a common format in order to facilitate the search for task families.

The task data were organized into a generic structure, i.e., a hierarchy for analyzing and displaying existing aircrew training data in a common form. The generic structure was developed by comparing the existing task listing data from previously completed aircrew training analyses, as well as from military instructions and directives (MIL-T-29053A, NAVEODTRA 105A and AFP50-58). The result was a generic task listing structure composed of seven elements. These seven elements are shown in Table 2 to illustrate the variability found in these data.

Once the generic task listing structure was established, project researchers reviewed each level of the generic task listing structure to standardize the data within each level. At the mission phase level, mission phase data from available aircrew training analyses were collapsed into eight generic phases. The results of this analysis are shown in Table 3. Similar analyses at the task and subtask levels produced additional generic task families. Because of the increased detail at these levels of task listing, the number of generic statements produced was increased. The product of this analysis was the generic task listing model shown in Table 4. Task listing data contained in the model are displayed at the mission phase, task, and subtask levels of the task listing hierarchy.

Researchers validated the generic task listing model by comparing it with task data from nine individual aircraft across mission, mission phase, task and subtask levels. These nine, F-14, F-4, E-2, P-3, A-6, SH-2F, A-10, F-16 and F-18, were selected because the analyses had been done using the mission, mission phase, and task organizations. This comparison identified the presence or absence of a given task for a particular aircraft with the same generic task identified in the model. A review of the results indicated a very high level of comparability between these generic statements and those from individual aircraft task listings.

An additional step was taken to verify the generic task listing model. Researchers were concerned about whether the generic model would be useful in generating a task listing for a given aircraft, independently of any existing task listing for that aircraft. To ensure that the model would be useful in generating a full range of tasks for one specific aircraft, it was necessary to develop a series of questions that would aid in providing necessary task data in the task listing development process. These questions are contained in Appendix A and serve to help create and organize information required for the final product. When this model was used to derive a task listing, tasks contained in the new task listing were compared with those listed in an existing task list. It was found that the generic task listing model together with
Table 2. A COMPARISON OF THE GENERIC TASK LISTING STRUCTURE WITH THE
TASK LISTING STRUCTURES CONTAINED IN MILITARY ISD DOCUMENTATION
AND FROM SELECTED AIRCRAFT ISD PROJECTS.

<table>
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<th>Aircraft ISD Project Task Listing Structures</th>
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<tbody>
<tr>
<td>1. Aircraft Type</td>
<td>MIL-T-24939 HAYEDRA 106A AFF50-18</td>
<td>F-16 Job Job Job F-16 A6 F-16</td>
</tr>
<tr>
<td>2. Aircrew Position</td>
<td>Job or function Responsibility area</td>
<td>Job or function Responsibility area Responsibility area</td>
</tr>
<tr>
<td>4. Phase</td>
<td>Phase Duties Duties</td>
<td>Mission Phase Mission Segment Mission Phase Event Phase</td>
</tr>
<tr>
<td>5. Task</td>
<td>Task Tasks Tasks</td>
<td>Mission Element Task Task Segment Task Task</td>
</tr>
<tr>
<td>6. Subtask</td>
<td>Elements Subtasks</td>
<td>First Or-Subtask der Task Task Perform Step Subtask</td>
</tr>
<tr>
<td>7. Step</td>
<td>-- Activities</td>
<td>Task Objective Task Element Task Checklist Task Statement -- --</td>
</tr>
</tbody>
</table>
Table 3. A COMPARISON OF A GENERIC MISSION PHASE STRUCTURE WITH THOSE OF SELECTED NAVY AND AIR FORCE AIRCRAFT

<table>
<thead>
<tr>
<th>GENERIC MISSION PHASE</th>
<th>Y-4</th>
<th>Y-14</th>
<th>SB-27</th>
<th>Y-3 (TASS)</th>
<th>A-10</th>
<th>Y-16</th>
<th>Y-18</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-mission Planning</td>
<td></td>
<td></td>
<td></td>
<td>Mission Preparation and Briefing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Planning Brief</td>
<td>None</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-takeoff</td>
<td>Pre-launch</td>
<td>Pre-launch</td>
<td>Pre-launch</td>
<td>Pre-takeoff Procedures</td>
<td>Pre-takeoff Procedures</td>
<td>Pre-launch</td>
<td></td>
</tr>
<tr>
<td>Takeoff/Departure</td>
<td>Takeoff/Departure</td>
<td>Takeoff/Post-Launch</td>
<td>Takeoff</td>
<td>Takeoff/Departure</td>
<td>Takeoff/Departure</td>
<td>Aircraft Launch</td>
<td></td>
</tr>
<tr>
<td>Tactics</td>
<td>Conduct Mission</td>
<td>Surveillance</td>
<td>Tactics</td>
<td>Tactics</td>
<td>Mission</td>
<td>Mission</td>
<td>Combat</td>
</tr>
<tr>
<td>Approach/Landing</td>
<td>Approach/Loading</td>
<td>Approach/Loading</td>
<td>Approach</td>
<td>Descent</td>
<td>Final Approach &amp; Landing</td>
<td>Missed Appr.</td>
<td>Approach/Landing</td>
</tr>
</tbody>
</table>
Table 4. GENERIC TASK LISTING MODEL

1.0 PREMISSION PLANNING

1.1 Collect Mission Data
   1.1.1 Select Pubs
   1.1.2 Gather Data
1.2 Determine Mission Data
   1.2.1 Compute T/O and Landing Data
   1.2.2 Compute Aircraft Data
   1.2.3 Compute Navigation Data
   1.2.4 Compute Mission Data
1.3 Record Data
1.4 Conduct Brief

2.0 PRELAUNCH

2.1 Prepare/Check
   2.1.1 Personal Equipment
2.2 Exterior Preflight Checks
   2.3 Interior Preflight Checks
   2.3.1 Before Entering Cockpit Inspection
   2.3.2 Before Electrical Power Checklist
   2.3.3 After Electrical Power Checklist
2.4 Engine Start
   2.4.1 Before Starting Engines Checklist
   2.4.2 Engine Start Procedures Checklist
   2.4.3 Respond to Emergencies During Engine Start
2.5 Systems Check/Setup
   2.5.1 Flight Controls Checks
   2.5.2 Avionics Systems Checks
2.6 Taxi
   2.6.1 Before Taxi Checklist
   2.6.2 Perform Taxi
   2.6.3 Respond to Emergencies During Taxi
   2.6.4 Perform Communications During Taxi
2.7 Before Takeoff Checklist
   2.7.1 Takeoff Checklist

3.0 TAKEOFF/DEPARTURE

3.1 Execute Takeoff
   3.1.1 Perform After Takeoff Checklist
   3.1.2 Perform Departure Transition
   3.1.3 Respond to Emergencies During Takeoff
   3.1.4 Perform Communications During Takeoff
   3.2 Reconfigure Systems
   3.3 Maneuver on Departure Profile

4.0 NAVIGATION

4.1 Establish Objectives
4.2 Evaluate Systems
   4.2.1 Respond to Failures/Degrades
4.3 Configure/Update Systems
4.4 Maneuver Aircraft
   4.4.1 Fly a Course/Heading
   4.4.2 Fly a Vector
   4.4.3 Fly a Point to Point
   4.4.4 Fly an Arc

5.0 TACTICS

5.1 Exterior Preflight Checks
   5.1.1 Perform Ordnance Preflight Checklist
5.2 Configure Aircraft
   5.2.1 Perform Missile Tuning/Arming
5.3 Navigation
   5.3.1 Perform Search/Patrol
5.4 Acquire Targets
   5.4.1 Intercept Targets
   5.4.2 Engage Targets
5.5 Perform Tactical Communications
5.6 Deliver Weapon
5.7 Evaluate Delivery Results
5.8 Counter Threats During Engagement
5.9 Respond to Emergencies During Tactical Mission
5.10 Disengage

6.0 APPROACH/LANDING

6.1 Prepare Aircraft
   6.1.1 Perform Descent Checklist
6.2 Execute Approach Profile
   6.2.1 Perform Landing Checklist
   6.2.2 Execute Landing
   6.2.3 Respond to Emergencies During Approach/Landing
6.2.4 Perform Communications During Approach/Landing

7.0 POST MISSION

7.1 Taxi
7.2 Check Systems
   7.2.1 Perform Post Landing Checklist
7.3 Shut Down
   7.3.1 Perform Engine Shutdown Checklist
7.4 Inspect Aircraft
7.5 Maintenance Debrief
7.6 Flight Debrief

8.0 SPECIAL OPERATIONS

8.1 Conduct Hot Refueling
   8.1.1 Perform Hot Refueling Checklist
   8.1.2 Perform Hot Refueling Comm
   8.1.3 Respond to Emergencies During Hot Refueling
8.2 Conduct Air Refueling
   8.2.1 Redevous With Tanker Aircraft
   8.2.2 Perform Air Refueling Checklist
   8.2.3 Perform Air Refueling Comm
   8.2.4 Reconfigure Aircraft After Air Refueling
the task analysis questions could produce a task list which matched approximately 75 percent of the tasks listed in the original document.

PART II PROCEDURES AND RESULTS. Part II of the study addressed three questions:

a. If the task families exist, is a general task data base feasible for ISD?

b. If a general task data base is feasible, are general data bases feasible for other ISD steps?

c. What are the potential savings in resources and time when a general data base system is applied to steps in the ISD process?

Instructional programs for Navy aviation are designed in response to two categories of training situations: (1) training required to operate an entire training system whether new or existing, and (2) training required for some portion of an existing training system. In the first situation, training must be developed for an entire range of crew duties and aircraft missions. In the second situation, training must be selectively altered for an existing program to accommodate such changes as equipment modification, expanded aircraft missions or alterations in crew complement.

At this point, the general data base concept was not sufficiently developed to be regarded as an answer to every kind of training problem. Therefore, a decision was reached to investigate the technical feasibility of establishing a task listing data base for those situations where training is required for the operation of a whole aircraft weapons systems, regardless of whether it is emerging or existing. A number of important factors entered into this decision. The preponderance of available training data was from this training environment. Additionally, more personnel, time and money are involved in these programs, making it more likely that a general data base would have a greater impact. Finally, the problems to be solved in developing an emerging system training program are more complex than encountered in modifying an existing training program. That is, there are typically more skills and knowledge to be acquired by the student over a wider range of learning environments: classroom, flight trainers, and actual aircraft. If the data base concept were found feasible as an aid to ISD for an emerging training system development effort, it would also be feasible for modifying an existing training program.

The next major step was to determine the format of the data base system. Candidate data base formats were selected that were compatible with ISD objectives. These system formats are described in Table 5. Criteria were identified for the evaluation and final selection of the system format with the most potential for meeting present and future ISD requirements. A strategy was developed to apply these criteria.
### Table 5. DESCRIPTIONS OF FEATURES OF VARIOUS DATA BASE FORMAT CANDIDATES

<table>
<thead>
<tr>
<th><strong>SYSTEM FEATURES</strong></th>
<th><strong>DATA BASE FORMAT CANDIDATES</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A. Storage Medium</strong></td>
<td><strong>Document System</strong>&lt;br&gt;This is a print-based, manually operated system which uses the following features.</td>
</tr>
<tr>
<td></td>
<td><strong>Word Processor System</strong>&lt;br&gt;This is an electronic semi-automatic data (word) processing system which uses the following features.</td>
</tr>
<tr>
<td></td>
<td><strong>Computer Text-Editor System</strong>&lt;br&gt;This system is similar to the word processor system but also provides for the use of automatic data storage and retrieval capabilities and uses the following features.</td>
</tr>
<tr>
<td></td>
<td>A library of printed volumes which contain the organized data base contents.</td>
</tr>
<tr>
<td></td>
<td>A library of magnetic tape or magnetic disk units which contain the coded data base contents.</td>
</tr>
<tr>
<td></td>
<td>An indexing system which retrieves, displays, and loads the desired data base contents based on user query or command.</td>
</tr>
<tr>
<td><strong>B. Input/Output System</strong></td>
<td>An indexing system for organizing the data base library.</td>
</tr>
<tr>
<td></td>
<td>An indexing system which either accesses the desired portion of a data base with electronic code selection or displays the tape library list at the user for manual selection of material.</td>
</tr>
<tr>
<td></td>
<td>On-line interactive protocols/ algorithms which aid and request the user for input information, accesses and retrieves material from the data bases as a result of user input, organizes and displays the result for review.</td>
</tr>
<tr>
<td><strong>C. Processing System</strong></td>
<td>A printed set of instructions which guides the user through the ISD process by eliciting the known information about the training program from the user, augmenting it by directed access to the data base library, and organizing it in some predetermined fashion.</td>
</tr>
<tr>
<td></td>
<td>A set of printed instructions for the user to follow which guides him through the construction/assembling steps of data base manipulation.</td>
</tr>
<tr>
<td></td>
<td>A &quot;generic model&quot; of the final product to be produced as a result of interacting with data base programs. Stored on receiving tape for review.</td>
</tr>
<tr>
<td><strong>D. Output Product</strong></td>
<td>A &quot;workbook&quot; which provides the physical location for assembling the material gathered from the library and matching it with inputs.</td>
</tr>
<tr>
<td></td>
<td>A &quot;receiving&quot; or working tape upon which desired material is first loaded and then displayed for review.</td>
</tr>
</tbody>
</table>
The information processing/storage loads required for each ISD step were determined in sufficient detail to assess their effects upon each candidate system. Information such as numbers of task statements, word/character counts, and total storage requirements for a generic data base approach to the eight mission phases was compiled. This information is shown in Table 6. Next, a list of system features of the desired generic data base was identified and evaluated by the project staff. Functional variables such as final system costs, personnel requirements, support resources, portability, and system capabilities were considered for both data base implementation and use (see Table 7). Sources of costing data were obtained from equipment manufacturers and research reports. These variables and features were assigned a weight to reflect the relative importance of each to final system selection. The data loads identified earlier were applied to each candidate system format. Finally, each format was evaluated in terms of weighted system features and functional variables to arrive at a prioritized list of format candidates (see Table 8). Ratings for each candidate system on each system feature and functional variable (i.e., the selection criteria) are presented in Table 8.

When the functional analysis was completed for the list of data base format candidates, a cost-benefit analysis was performed for each. This analysis was conducted in the following manner:

a. Based on researcher experience with ISO and available data from Prophet (see Table 1) and others, the percentage of effort for each ISO step was assessed. In addition, the development procedures or functions common to all ISO steps were delineated and the percentage of effort for each was estimated. The results are shown in Table 9.

b. Next, the candidate data base formats were rated using a scale of 1 (low) to 4 (high) to determine their relative capabilities in aiding development procedures. As shown by Table 10, the computer text editor format scored highest in all procedure categories. For comparison purposes, the score of 1 was assigned to current practice and was used as a baseline.

c. The next step was to project time savings which could be expected when using each computing system for performing ISD. In order to accomplish this, percentage figures were assigned to each rating, based on expected reduction in time required to perform each ISO step. After analyzing each computing system, it was assumed that the greatest possible time savings which could be expected was 80 percent. The following is the scale used to estimate time savings expected from each computing system:

\[
\text{Rating from Table 10} = \frac{\text{Expected percentage time reduction}}{\text{compared to baseline}}
\]

<table>
<thead>
<tr>
<th>Rating</th>
<th>Expected Percentage Time Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0 percent</td>
</tr>
<tr>
<td>2</td>
<td>26.6 percent</td>
</tr>
<tr>
<td>3</td>
<td>53.2 percent</td>
</tr>
<tr>
<td>4</td>
<td>80 percent</td>
</tr>
</tbody>
</table>
Table 6. DATA BASE INFORMATION PROCESSING STORAGE REQUIREMENTS

<table>
<thead>
<tr>
<th>Data Description</th>
<th>DATA BASES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Task Listing</td>
</tr>
<tr>
<td>Estimated No. of Statements</td>
<td>300 *</td>
</tr>
<tr>
<td>Average Word Length of Each Statement</td>
<td>10</td>
</tr>
<tr>
<td>No. of Characters/Word</td>
<td>8</td>
</tr>
<tr>
<td>Storage Requirement</td>
<td>24K</td>
</tr>
</tbody>
</table>

* Original Estimate. Final number of task statements in CASDAT was significantly higher. See page 49.
<table>
<thead>
<tr>
<th>FUNCTIONAL VARIABLES</th>
<th>DATA BASE FORMAT CANDIDATES</th>
<th>Computer Text-Editor System</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. System Costs</td>
<td>$5,000 to $10,000</td>
<td>$10,000 to $35,000</td>
</tr>
<tr>
<td>B. Ease of System</td>
<td>Difficult since data is</td>
<td>Moderately easy; computing system</td>
</tr>
<tr>
<td>Operation &amp; Data</td>
<td>frozen in print form in</td>
<td>permits random storage and retrieval</td>
</tr>
<tr>
<td>Maintenance</td>
<td>numerous documents.</td>
<td>of coded data. On-line user protocols</td>
</tr>
<tr>
<td>C. Time to Develop A</td>
<td>4 - 6 man months</td>
<td>14 - 18 man months</td>
</tr>
<tr>
<td>Working System</td>
<td>10 - 12 man months</td>
<td></td>
</tr>
<tr>
<td>D. System Updating and</td>
<td>Difficult, (see ease</td>
<td>Easy, but expensive. System assembled</td>
</tr>
<tr>
<td>Expansion</td>
<td>of system operation)</td>
<td>from readily available, interchangeable</td>
</tr>
<tr>
<td>E. System Flexibility</td>
<td>Relatively inflexible</td>
<td>off-the-shelf components.</td>
</tr>
<tr>
<td>to Meet Data Output</td>
<td>because data is frozen in</td>
<td>Little difficulty in locating system compat-</td>
</tr>
<tr>
<td>Requirements</td>
<td>documents that are not</td>
<td>ible peripherals.</td>
</tr>
<tr>
<td></td>
<td>responsive to change.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>User system instructions,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&quot;workbooks&quot;, etc., in</td>
<td></td>
</tr>
<tr>
<td></td>
<td>similar state.</td>
<td></td>
</tr>
<tr>
<td>F. Portability</td>
<td>Individual volumes are</td>
<td>Individually, system com-</td>
</tr>
<tr>
<td></td>
<td>relatively portable. Large</td>
<td>ponents are</td>
</tr>
<tr>
<td></td>
<td>library of printed volumes</td>
<td>relatively portable.</td>
</tr>
<tr>
<td></td>
<td>and user materials would be</td>
<td>System can be</td>
</tr>
<tr>
<td></td>
<td>difficult and expensive to</td>
<td>readily broken down for</td>
</tr>
<tr>
<td></td>
<td>move.</td>
<td>transportation.</td>
</tr>
<tr>
<td>G. Personnel Qualifications</td>
<td>Instructional Psychologist,</td>
<td>Instructional Psychologist,</td>
</tr>
<tr>
<td></td>
<td>Subject Matter Specialist,</td>
<td>Subject Matter Specialist,</td>
</tr>
<tr>
<td></td>
<td>Information Storage and</td>
<td>Word Processor System</td>
</tr>
<tr>
<td></td>
<td>Retrieval Specialists</td>
<td>System Operator</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 8. RESULTS OF RATING DATA BASE SYSTEM CANDIDATES AGAINST SYSTEM SELECTION CRITERIA

<table>
<thead>
<tr>
<th>CRITERIA</th>
<th>DATA BASE SYSTEM CANDIDATES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Weight</td>
</tr>
<tr>
<td>SYSTEM FEATURES</td>
<td>Rating</td>
</tr>
<tr>
<td>A. Storage Medium</td>
<td>(5)</td>
</tr>
<tr>
<td>B. Input/Output Medium</td>
<td>(5)</td>
</tr>
<tr>
<td>C. Processing System</td>
<td>(15)</td>
</tr>
<tr>
<td>D. Output Product</td>
<td>(20)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FUNCTIONAL VARIABLES</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Cost</td>
<td>(10)</td>
</tr>
<tr>
<td>B. Ease of Operation</td>
<td>(20)</td>
</tr>
<tr>
<td>C. System Development Time</td>
<td>(5)</td>
</tr>
<tr>
<td>D. System Update, Expansion</td>
<td>(15)</td>
</tr>
<tr>
<td>E. System Flexibility</td>
<td>(10)</td>
</tr>
<tr>
<td>F. Portability</td>
<td>(5)</td>
</tr>
<tr>
<td>G. Personnel Qualifications</td>
<td>(5)</td>
</tr>
</tbody>
</table>

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>E. System Flexibility</td>
<td>1</td>
</tr>
<tr>
<td>F. Portability</td>
<td>2</td>
</tr>
<tr>
<td>G. Personnel Qualifications</td>
<td>2</td>
</tr>
</tbody>
</table>

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>TOTAL SCORE:</td>
<td>195</td>
</tr>
</tbody>
</table>

| PERCENT OF TOTAL:           | 34%                  | 63%                 | 74%                     |
Table 9. ESTIMATES OF PERCENTS OF TOTAL PROJECT TIME REQUIRED TO PERFORM DEVELOPMENT PROCEDURES WITHIN SELECTED ISD STEPS.

<table>
<thead>
<tr>
<th>DEVELOPMENT PROCEDURES</th>
<th>TASK LISTING</th>
<th>OBJECTIVE HIERARCHY</th>
<th>COURSE SYLLABUS</th>
<th>MEDIA SELECTION</th>
<th>LESSON SPEC.</th>
<th>PERCENT OF TOTAL PROJECT TIME</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. COLLECTING INFORMATION</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>o Identify Information Sources</td>
<td>4</td>
<td>3</td>
<td>.5</td>
<td>.5</td>
<td>10</td>
<td>18</td>
</tr>
<tr>
<td>o Develop Information Collection Strategies</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>o Collect the Information</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>o Verify Quality of Information Gathered</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. AUTHORING PRODUCT</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>o Select Appropriate Information</td>
<td>6</td>
<td>12</td>
<td>5</td>
<td>1.5</td>
<td>30</td>
<td>54.5</td>
</tr>
<tr>
<td>o Arrange Selected Information Into Desired Format or Concepts</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>o Identify Missing Content; Author This Information</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. ENCODING</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>o Transform Authored Material From One Medium to Another; i.e., Prepare Typed Copy from Handwritten or Dictated Sources</td>
<td>1</td>
<td>2</td>
<td>.25</td>
<td>.25</td>
<td>4</td>
<td>7.5</td>
</tr>
<tr>
<td>o Additional Encoding May Be Required in Procedures 4, 5, and 6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. EDITING</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>o Identify Omissions, Duplications, or Errors in Authored Product</td>
<td>.75</td>
<td>2</td>
<td>1</td>
<td>.25</td>
<td>3</td>
<td>7.0</td>
</tr>
<tr>
<td>o Reformat, Resequence or Correct Material</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>o Perform Additional Encoding, Included in No. 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. VERIFYING PRODUCT</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>o Ensure That Product Content Reflects Real World Requirements</td>
<td>1</td>
<td>3.75</td>
<td>1</td>
<td>.25</td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td>o Perform Additional Editing As Required</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>o Perform Additional Encoding As Required; Part of No. 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. PRODUCING FINAL PRODUCT</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>o Prepare &quot;Smooth&quot; Copy of Product in User Compatible Format</td>
<td>.25</td>
<td>.25</td>
<td>.25</td>
<td>.25</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>o Incorporate Product Into Storage/ Retrieval System</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>o Perform Any Additional Encoding; Included as Part of No. 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ISD STEP TOTALS</td>
<td>13%</td>
<td>23%</td>
<td>8%</td>
<td>3%</td>
<td>53%</td>
<td>100%</td>
</tr>
</tbody>
</table>
### Table 10. RELATIVE CAPABILITIES OF DATA BASE SYSTEM FORMATS

<table>
<thead>
<tr>
<th>DEVELOPMENT PROCEDURE</th>
<th>Current Practice</th>
<th>Document System</th>
<th>Word Process System</th>
<th>Computer Test-Editor System</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. COLLECTING INFORMATION</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Identify Information Sources</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Develop Information Collection Strategies</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Collect the Information</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Verify Quality of Information Gathered</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td>1</td>
<td>2.3</td>
<td>3</td>
<td>3.75</td>
</tr>
<tr>
<td><strong>2. AUTHORING PRODUCT</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Select Appropriate Information</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Arrange Selected Information</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Into Desired Format or Concepts</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Identify Missing Content; Author This Information</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td>1</td>
<td>1.3</td>
<td>2.3</td>
<td>3.3</td>
</tr>
<tr>
<td><strong>3. ENCODING</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transform Authored Material From One Medium to Another; e.g., Prepare Typed Copy From Handwritten or Dictated Sources</td>
<td>1</td>
<td>1</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Additional Encoding May Be Required In Procedures 4, 5, and 6</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td><strong>4. EDITING</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Identify Omissions, Duplications, or Errors in Authored Product</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Reformat, Resquence or Correct Material; Perform Additional Encoding, Included in No. 3</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td>1</td>
<td>1</td>
<td>2.5</td>
<td>3.5</td>
</tr>
<tr>
<td><strong>5. VERIFYING PRODUCT</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ensure that Product Content Reflect Real-World Requirements</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Additional Encoding As Required: Part of No. 3</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td>1</td>
<td>2</td>
<td>2.5</td>
<td>2.5</td>
</tr>
<tr>
<td><strong>6. PRODUCING FINAL PRODUCT</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prepare “Smooth” Copy of Product in User Compatible Format</td>
<td>1</td>
<td>3</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Incorporate Product Into Storage/Retrieval System; Perform Any Additional Encoding: Included as Part of No. 3</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td>1</td>
<td>2.5</td>
<td>3.5</td>
<td>3.4</td>
</tr>
</tbody>
</table>

**SUM 1-6** | 15 | 23 | 37 | 51 |

**RELATIVE SYSTEM CAPABILITY AVE 1-6** | 1 | 1.5 | 2.5 | 3.4 |

Key: Expected Percentage Time Reduction: 1=5%; 2=26.6%; 3=53.2%; 4=80%
In using this scale, researchers were able to assess the percentage reduction in time using the ratings shown in Table 10. Therefore, the time requirements for an ISD effort shown in Table 9, were reduced by the percentages assigned as a result of the analysis in Table 10.

For example, the 11 percent of total ISD time projected for performing task listings by the document system (see Table 11) was derived by a three-step process: (1) the percent of project time estimated for performing each development procedure of task listings (from Table 9) is reduced (i.e., multiplied) by the percent of time reductions expected for the same development procedures as a result of using the document system (see Table 10); (2) the products resulting from the multiplications performed in Step 1 are added to obtain the total percent time savings expected for performing all the development procedures for task listings with use of the document system; and (3) the total percent time savings for the document system is subtracted from the percent of time estimated for performing task listings by current methods, to obtain the estimated percent of total ISD time to perform task listings by the document system.

Actual computations for these three steps for the foregoing example are as follows:

<table>
<thead>
<tr>
<th>% OF TIME FOR TASK LISTINGS BY CONVENTIONAL METHODS</th>
<th>% OF TIME REDUCTIONS WITH DOCUMENT SYSTEM</th>
<th>% TIME SAVINGS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collecting Information</td>
<td>X 4.00 X 39</td>
<td>= 1.60</td>
</tr>
<tr>
<td>Authoring Product</td>
<td>X 6.00 X 8</td>
<td>= 0.48</td>
</tr>
<tr>
<td>Encoding</td>
<td>X 1.00 X 0</td>
<td>= 0</td>
</tr>
<tr>
<td>Editing</td>
<td>X .75 X 0</td>
<td>= 0</td>
</tr>
<tr>
<td>Verifying Product</td>
<td>X 1.00 X 0</td>
<td>= 0</td>
</tr>
<tr>
<td>Producing Final Product</td>
<td>X .25 X 13</td>
<td>= 0.03</td>
</tr>
</tbody>
</table>

TOTAL TIME SAVED FOR TASK LISTINGS = 2.11%

Time required for task listings with current method = 13.00%
Time saved for task listings with document system = 2.11%
Time required for task listings with document system = 11.00%

The other estimates (in Table 11) of the time required for performing ISD steps by the document system, word processors and computer text-editors were computed by the same method.

Estimates were made of cost savings that would accrue from applying each data base system format to an instructional development project. A project budget of $200,000 was assumed as a conservative estimate of costs for front end analyses for a full aircrew ISD effort following current ISD practices. Percentages of man-hour savings for each data base system were then applied to the assumed project to arrive at an estimated cost savings for conducting ISD for each system format. An
Table 11. PROJECTED TIME SAVINGS* OFFERED BY EACH OF THE DATA BASE SYSTEM OPTIONS FOR COMPLETING SELECTED STEPS OF THE ISD PROCESS

<table>
<thead>
<tr>
<th>SYSTEM FORMATS</th>
<th>ISD STEPS</th>
<th></th>
<th>System Format Totals</th>
<th>Percent of Total Project Manhours Saved</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Task Listing</td>
<td>Objectives Hierarchy</td>
<td>Course Syllabus</td>
<td>Media Selection</td>
</tr>
<tr>
<td>CURRENT PRACTICE</td>
<td>13%</td>
<td>23%</td>
<td>8%</td>
<td>3%</td>
</tr>
<tr>
<td>DOCUMENT SYSTEM</td>
<td>11%</td>
<td>21%</td>
<td>7.5%</td>
<td>2.5%</td>
</tr>
<tr>
<td>WORD PROCESSOR</td>
<td>8%</td>
<td>15%</td>
<td>5%</td>
<td>2%</td>
</tr>
<tr>
<td>COMPUTER TEXT-EDITOR</td>
<td>4.5%</td>
<td>9.5%</td>
<td>3%</td>
<td>1%</td>
</tr>
</tbody>
</table>

*Time savings estimates are expressed in terms of percent of total project manhours and were determined by subtracting total time for each system format from the total for current practice.
examination of the results of these calculations in Table 12 suggested that the computer text-editor system provides the most savings ($124,000.00) of the three candidate system formats. Somewhat less savings would result from the use of a word processor system ($74,000.00) or a document system ($23,000.00).

The analyses conducted in this part of the project were intended to address the technical feasibility of establishing an automated system to support the ISO process. It was clear from the analyses that of the three system formats deemed worthy of consideration for providing automated aid to ISO, the computer text-editor system appeared to offer the most advantages. Of the three system candidates, a computer text-editor system could most readily be programmed to manipulate, rearrange, and update data based information to produce new training programs, which reflect new insights or new requirements. As part of this analysis, it was further indicated that the costs of conducting ISD would be reduced if the instructional developer were provided with the computer based system containing on-line, interactive statements which guide him through the various steps in the ISO process, thus reducing many of the redundancies and inefficiencies inherent in present ISO methodology. Therefore, the total process could be completed in a shorter period of time by fewer and less skilled ISO personnel.

CONCLUSIONS

The investigation into the feasibility of establishing an automated aid to ISO proceeded systematically through both parts by producing affirmative answers to the four questions. Task families were identified at the Mission, Mission Phase, Task, and Subtask levels. This effort resulted in the development of a generic task listing model. This model represented a wide variety of aircrew task listing data from a number of aircraft types, having the same underlying rationale, organizational structure, type of content and level of detail. Not only was the model a powerful tool in generating a comprehensive task listing for a given aircraft, but it facilitated future research in the development of a prototype automated aid to ISO.

A general data base for ISD was shown to be feasible. This area of the investigation was in essence divided into two parts. The first part addressed the technical issues of feasibility and focused on the format for the data based system. Three system options were identified as a result of evaluating the functional requirements of designing, developing and managing a data base of aircrew training data and those requirements of the training environment. These three systems were an aided document based system, a word processor system, and a computer text-editor system. Of the three systems, the computer text-editor system possessed more capabilities needed to support an aircrew training program development effort. It possessed the memory capacity essential for storing large amounts of training data and interactive capabilities for user aids. It permitted random storage and retrieval of these data as well as on-line review and edit capabilities. The principal shortcoming of this system was the amount of time required to establish the data base system. This cost was negligible, however, when compared with the anticipated benefits of the system over long-term use and with subsequent improvements to the system.
Table 12. ESTIMATED COST SAVINGS FOR CONDUCTING ISD BY DATA BASE SYSTEM FORMAT

<table>
<thead>
<tr>
<th>DATA BASE SYSTEM FORMAT</th>
<th>PROJECTED PERCENT OF MANHOUR SAVINGS</th>
<th>ISD BUDGET SAVINGS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. DOCUMENT BASED SYSTEM</td>
<td>11.5%</td>
<td>$23,000</td>
</tr>
<tr>
<td>2. WORD PROCESSOR SYSTEM</td>
<td>37%</td>
<td>$74,000</td>
</tr>
<tr>
<td>3. COMPUTER TEXT-EDITOR</td>
<td>62%</td>
<td>$124,000</td>
</tr>
</tbody>
</table>
The second part of answering the feasibility issue for selecting an automated aid to ISD was to assess the potential cost savings of format systems to support the process. The results of this analysis clearly indicated that the computer text-editor system would provide the greatest potential cost savings benefits. This would result from the reduction of redundancies and inefficiencies in the use of aircrew training data while developing various steps in the ISD process. Moreover, it was thought feasible that the computer text-editor system could be programmed to contain instructional development guidelines to guide the user through the development process. This feature would further reduce ISD costs by obviating the requirement of having a full-time instructional psychologist available who typically would provide the same information during development. Thus, the computer text-editor system was determined capable of providing effective, efficient instructional development support at a lower cost and with fewer ISD personnel than the current expensive, labor-intensive methodology.

Because of the positive results of this feasibility study, NAVTRAEOIPCEN undertook to demonstrate feasibility by building a prototype system which could provide an automated aid to ISD. Section IV of this report describes this prototype Computer Aided System for Developing Aircrew Training (CASDAT).
PHASE II: THE PROTOTYPE SYSTEM

The CASDAT prototype was built in order to verify and demonstrate the principles theoretically derived during the feasibility study. CASDAT's purpose was to demonstrate that an automated aid to ISD could, indeed, result in cost savings during the training design process. Furthermore, it was designed to demonstrate that an automated aid could be designed based upon a data base created from existing aircrew training data. For demonstration purposes, researchers selected a portion of the recognized ISD steps and a portion of the possible subject matter with which to demonstrate cost and time savings as a result of automation. This computer aiding of a "slice" of the aircrew training design process could be demonstrated and compared to the efficiency and effectiveness of more traditional aircrew training design practices.

Five ISD steps were selected to be included in the CASDAT prototype. These five ISD steps, task list, objectives hierarchy, media selection, syllabus design and lesson specifications, were selected from 24 candidate ISD steps identified from a previous investigation. They were selected because of such criteria as manpower requirements, skill level requirements or compatibility with automation. Media selection, for example, required a large amount of manpower to assess media requirements of each learning objective within a training course. At the same time it is conducive to automation because of the algorithmic nature of the selection process.

Two mission phases, prelaunch and navigation, were selected from the eight mission phases defined in the generic task listing model to provide aircrew data to be manipulated over the five ISD steps. Researchers recognized that if the CASDAT software programming could manipulate prelaunch and navigation data sufficiently to generate task lists, objective hierarchies, media selection, syllabus and lesson specifications, it would indicate the feasibility of manipulating other aircrew data.

The prototype CASDAT was designed to be used by either a trained instructional developer or a subject matter expert with a minimum of instructional design background. Taking inputs from the user on the characteristics of the aircraft, CASDAT generated a task list and objectives hierarchy for the user's particular aircraft. This became the user's data base which was modified and expanded by the system through each of the ISD steps.

---


A computer text-editor system was selected after having been proven most cost-effective during the feasibility study. The prototype software package was written in FORTRAN for the PDP-11/34 computer system.

The prototype CASDAT will not be described in detail because it was very similar to the full-scale CASDAT which is described in Section V.

PROTOTYPE EVALUATION

As a prototype, CASDAT was incomplete. Additional work was required to transition the system from an experimental concept to an operational tool. To this end, NAVTRAEOIPCEN undertook two separate efforts to evaluate the prototype version of CASDAT and to provide recommendations for improving the system to bring it closer to the status of an operational tool. During the first of these efforts, Appli-Mation Incorporated was tasked with evaluating the system's user interface, i.e., the set of interactions that occur between the training developer and CASDAT as the system is used to assist the developer in completing a training development effort. The second effort was an evaluation of CASDAT conducted by NAVTRAEOIPCEN to assess the utility of the CASDAT concept, and to make recommendations for further enhancement. When evaluation of the prototype system showed that the system did, in fact, generate quality ISO products in significantly less time than is required using traditional ISD methods, additional development of CASDAT was recommended.

EVALUATION PROCEDURES. NAVTRAEOIPCEN's internal evaluation was conducted in order to achieve two major objectives:

a. Demonstrate the cost/time savings of CASDAT as compared to manual instructional systems design.

b. Determine future development needs of the CASDAT system.

In addressing the first objective, the evaluation attempted to compare two task listings and objective hierarchies for the same aircraft system; one using the CASDAT system, one using manual procedures. Four aircraft were used: F-4, F-14, SH-2F and CH-46. All had previously had ISD performed using conventional methods. The evaluation was structured to measure the development time differential between CASDAT and a manually developed baseline following the procedures specified in MIL-T-29053(A). Data recorded included:

a. time elapsed for each ISD step

b. user interface problems

c. estimate of accuracy of CASDAT data

The second objective was met through analysis of the data gathered and review of the needs of potential users of an operational CASDAT system. Specifically, training design and development specialists and managers within NAVTRAEOIPCEN were polled to identify areas within their purview that could be aided by CASDAT.
EVALUATION RESULTS

COST/TIME SAVINGS. Test results indicated that a user aircraft subject matter expert (SME) with marginal ISD knowledge could generate and validate the task list and objective hierarchy for two mission phases (prelaunch and navigation) in about two hours. Table 13 provides time data collected for developing task lists and objective hierarchies for four aircraft using CASDAT. It was estimated, based on evaluating SME's experience with traditional ISD approaches to the same weapon system, that performance of the same tasks by conventional ISD methods would require 168 hours; a savings of 99 percent. Furthermore, the CASDAT generated task lists and objective hierarchies for the two mission phases were consistently 75 percent complete. That is, 75 percent of the tasks and objectives in the final, validated task listings and objective hierarchies were provided by CASDAT.

The data collected from two mission phases were used to estimate savings for an entire aircrew training program. This was done very conservatively to allow for differences between the test situation and an actual ISD. For example, because the evaluation was not conducted in an actual training environment, training designers may not have been as careful (i.e., used as much time) to validate tasks and objectives as they might have if they had actually been responsible for developing training for an aircraft. In contrast, the two mission phases within the prototype CASDAT were two of the more simple phases for developing training. Conventional development of the tactics mission phase, for instance was expected to take considerably more time. Thus, considerable time savings could be expected in developing task lists, objective hierarchies, media selection, syllabus, and lesson specifications using CASDAT.

Table 14 shows the expected time savings for each of the five ISD steps using CASDAT. Time figures shown in the table for traditional ISD were taken from NAVTRAQUCPCE data on the F-14 aircrew training effort; expected CASDAT time figures were estimated for a comparable training design effort. Time estimates were made by assuming that the prototype CASDAT contained approximately one-twelfth the data a full-scale CASDAT would contain. Therefore, the estimated time required to perform each ISD step using CASDAT for all eight mission phases, was twelve times the time required for the two mission phases. An estimated 37 percent savings was derived by dividing the total man-months (104.5) predicted for performing these ISD steps with CASDAT by the total man-months (166.5) in the baseline (F-14) effort and subtracting this number from 100 percent.


7The 37 percent savings is less than the 62 percent savings projected in an earlier section of this report. This discrepancy is due to an unusually large amount of time required for lesson specifications for the F-14 project and a relatively small advantage of CASDAT for this step.
Table 13. TIME REQUIRED TO DEVELOP AND VALIDATE TASK LISTING AND OBJECTIVES HIERARCHY FOR PRELAUNCH AND NAVIGATION MISSION PHASES USING CASDAT (BASED ON DATA FROM SYSTEM EVALUATION)

<table>
<thead>
<tr>
<th>AIRCRAFT TYPE</th>
<th>F-14</th>
<th>F-4</th>
<th>CH-46</th>
<th>SH-2F</th>
<th>AVERAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISD STEP</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TASK LISTING</td>
<td>79 min</td>
<td>69 min</td>
<td>56 min</td>
<td>47 min</td>
<td>63 min</td>
</tr>
<tr>
<td>OBJECTIVES HIERARCHY</td>
<td>85 min</td>
<td>60 min</td>
<td>-----</td>
<td>40 min</td>
<td>62 min</td>
</tr>
</tbody>
</table>
Table 14. PROJECTED TIME SAVINGS WHEN DEVELOPING AIRCREW TRAINING PROGRAMS USING CASDAT (BASED ON DATA FROM SYSTEM EVALUATION).

<table>
<thead>
<tr>
<th>ISO STEPS</th>
<th>Traditional</th>
<th>CASDAT</th>
<th>% Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>TASK LISTING</td>
<td>12</td>
<td>&lt; 1</td>
<td>92%</td>
</tr>
<tr>
<td>OBJECTIVES HIERARCHY</td>
<td>19</td>
<td>&lt; 1</td>
<td>95%</td>
</tr>
<tr>
<td>MEDIA SELECTION</td>
<td>1.5</td>
<td>.5</td>
<td>66%</td>
</tr>
<tr>
<td>SYLLABUS DEVELOPMENT</td>
<td>20</td>
<td>2</td>
<td>90%</td>
</tr>
<tr>
<td>LESSON SPECIFICATIONS</td>
<td>114</td>
<td>100</td>
<td>13%</td>
</tr>
<tr>
<td>TOTAL</td>
<td>166.5</td>
<td>104.5</td>
<td>37%</td>
</tr>
</tbody>
</table>
Analysts were very careful not to overestimate the time savings to be gained from CASDAT. For example, in the evaluation test mentioned previously, SMEs reported that it took two hours to generate and validate a task list and objective hierarchy. If this were multiplied by 12, the time estimates in table 14 should read 24 hours, or .14 man months. However, analysts chose to project that SMEs in an actual training environment, would use something closer to one-man month. A similar conservative estimate was made to compute time savings during syllabus generation. Theoretically, with the objectives validated and media selected, CASDAT should be able to produce a syllabus in a matter of minutes. Again, analysts chose to be very conservative in their estimates of time savings, assuming that SMEs would do a great deal of study of the syllabus and several individuals would be involved in its validation and final approval.

Cost savings were estimated by multiplying the development time estimates from table 14 by an average cost per man month of $6,000. Table 15 shows that an F-14 sized training program costs approximately $999,000 for a conventional ISD application. This compares to $627,000 for ISD operations if developed using CASDAT, resulting in a savings of $372,000.

USER INTERFACE EVALUATION. Both Appli-Mation Incorporated (see a report by Maxie, 1980) and NAVTRA EQUIP CEN human factors specialists evaluated CASDAT from the users' standpoint. Evaluators were asked to use CASDAT and identify user problems or additional needed system capabilities. Several refinements to CASDAT were identified as being especially desirable. They are summarized below.

Additional Flexibility. The prototype CASDAT was programmed for a lockstep process. The user could not go back and forth easily between ISD steps. Further development of CASDAT could modify this to allow the user to access various ISD steps at will to make changes and review material.

Easier Validation of Tasks and Objectives. The prototype CASDAT required the user to validate each task and objective on-line by answering yes or no to the question: Is this task or objective valid? This process could get extremely tedious, especially if it were to be done for an entire syllabus - not just the two mission phases that resided in the prototype CASDAT. It was suggested that in future development, CASDAT could be refined to allow validation by exception. Then tasks and objectives could be added or deleted by number. All CASDAT-generated tasks and objectives could be assumed valid unless otherwise indicated by the user.

Enhanced Media Selection for Psychomotor Skills. CASDAT was programmed using the media selection algorithm as specified in an early version of MIL-T-29053A. Since incorporation into the specification, the media
Table 15. ESTIMATED COST SAVINGS FOR EACH ISD STEP WHEN DEVELOPED USING CASDAT (BASED ON DATA FROM SYSTEM EVALUATION).

<table>
<thead>
<tr>
<th>ISD STEP</th>
<th>Cost Traditional</th>
<th>Cost CASDAT</th>
<th>Estimated Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>TASK LISTING</td>
<td>$72,000</td>
<td>$6,000</td>
<td>$66,000</td>
</tr>
<tr>
<td>OBJECTIVES HIERARCHY</td>
<td>$114,000</td>
<td>$6,000</td>
<td>$108,000</td>
</tr>
<tr>
<td>MEDIA SELECTION</td>
<td>$9,000</td>
<td>$3,000</td>
<td>$6,000</td>
</tr>
<tr>
<td>SYLLABUS</td>
<td>$120,000</td>
<td>$12,000</td>
<td>$108,000</td>
</tr>
<tr>
<td>LESSON SPECIFICATIONS</td>
<td>$684,000</td>
<td>$600,000</td>
<td>$84,000</td>
</tr>
<tr>
<td>TOTAL</td>
<td>$999,000</td>
<td>$627,000</td>
<td>$372,000</td>
</tr>
</tbody>
</table>
selection algorithm has been questioned for its ability to specify psychomotor training media. CASDAT's usefulness to both media selection and the training device procurement process could be greatly enhanced if additional programming were added to enable selection of specific trainer device requirements.

As a result of the evaluation of the prototype system, the decision was made to develop it into an operational system. Section V describes the operationally capable CASDAT system.
PHASE III: OPERATIONAL DEVELOPMENT

The purpose of this effort was to enhance the previously developed prototype computer aided system for developing aircrew training (CASDAT) by making it a useful, operational system. The prototype CASDAT system consisted of a series of integrated computer programs necessary to provide automated aid to five instructional systems development (ISD) steps: task list development, objectives hierarchy development, media selection, syllabus design, and lesson specification development. In addition, the prototype CASDAT contained a limited amount of aircrew training data.

The purpose of this phase of the project was to add enough aircrew training data to make CASDAT much more useful to an instructional design effort. Earlier research under this project showed that all aircrew training data could be organized into eight categories, representing phases of an aircraft mission. Data from two of the eight mission phases, preflight and navigation, had been incorporated into the prototype CASDAT. The goal of this effort was to incorporate data representing five additional mission phases into the existing CASDAT system.

At the completion of this effort, CASDAT contained aircrew training data representing seven of the eight mission phases:

- a. pre-mission planning
- b. preflight
- c. take-off/departure
- d. navigation
- e. approach/landing
- f. post-mission debrief
- g. special procedures

Supporting software routines allowed these data to be manipulated over five ISD steps:

- a. task list development
- b. objectives hierarchy development
- c. media selection
- d. syllabus design
- e. lesson specification development

REQUIREMENTS

CASDAT was built as an aid to the instructional developer. It was, and is, to be used as an interactive device, providing draft ISD products to a user who can then modify and improve them for his own purposes.

9Tactics data have not yet been incorporated into CASDAT
CASDAT was designed as a tool which could save the instructional developer time and labor in various aspects of an ISD effort such as formatting instructional products, tracking tasks and objectives through each ISD step, and providing first draft versions of ISD products. CASDAT relieves the user from some of these mundane, and time consuming tasks. On the other hand, the user's portion of the job—to verify and improve CASDAT outputs—remains the most critical. CASDAT can save the instructional developer much time and anguish in creating the first draft of task list, objectives hierarchy, media selection, syllabus, and lesson specifications. It is, however, the user who transforms these data into products specific to the instructional design needs of a specific training system.

ASSUMPTIONS

It is assumed that the user knows something about instructional systems design. The user need not be an ISD expert, but should be familiar with ISD terms and recognize the use of each step in the ISD process.

The design of CASDAT is based upon the assumption that all aircrew training programs require training of similar tasks. This was proven to be true in a previous study which compared task lists and syllabi across fourteen aircrew training programs. These generic tasks are embedded in CASDAT's programming.

Tasks are made more specific by tying them to equipment. The assumption is made that specific aircrew tasks are dictated by the requirements to operate equipment. Therefore, CASDAT programming allows generic tasks such as "configure systems for takeoff" to be broken into more specific tasks such as "configure flight control system for takeoff."

CONSTRAINTS

The ISD products created by CASDAT follow the guidelines presented in military specification MIL-T-29053 and associated data item descriptions. In addition to the formats specified, the media selection algorithm specified in an early version of MIL-T-29053 has been incorporated into CASDAT.

The task listing and objectives hierarchies created by CASDAT are focused on the fleet readiness squadron (FRS) level of training. Fleet training and undergraduate (i.e., training command) level objectives are not necessarily included in CASDAT at this time.

The tasks and objectives created by CASDAT are generic in nature. Specific actions and procedures that support the tasks and objectives are aircraft-specific and, therefore, were not included in CASDAT.


Thus, although CASDAT will create a task which states "configure weapon control system," it is for the user to specify the actual procedures required to configure the system.

The CASDAT program is designed to run on the NAVTRAEEQUIPCEN N-712 PDP 11/34 system under RSX11-M V3.2. The programming language is FORTRAN.

SYSTEM DESCRIPTION

Casdat was designed to be used either by a trained instructional developer or a subject matter expert with a minimum of instructional design background. CASDAT is not a totally automated instructional design system which provides the developer with a predetermined finished product. The user must validate and tailor the CASDAT output at each step of the ISD process to reflect the peculiarities of the system for which instruction is being designed.

By asking questions of the user, CASDAT generates a data base. This data base is then used and modified by both CASDAT and the user during each ISD step until the final syllabus and lesson specifications are produced. Figure 2 illustrates this process. This approach is made possible by the systematic nature of ISD itself.

ISD was built upon systems analysis techniques which specify that each step in an analysis problem has an input, process and output. Furthermore, the output of the first step in the analysis serves as the input for the next step, and so on through as many steps as are necessary to solve the problem. This provides for a continuous flow of information through each step in the ISD process and allows CASDAT to work upon the same data base throughout each ISD step. In simplistic terms, CASDAT aids the ISD process as follows:

a. CASDAT asks questions of the user and generates a task listing based upon the answers given.

b. The user corrects, adds to, modifies the task listing.

c. CASDAT generates an objectives hierarchy based upon the validated task listing.

d. The user corrects, adds to, modifies the objectives hierarchy.

e. CASDAT asks questions of the user in order to select media for tasks and objectives.

f. The user modifies media selection as necessary.

g. CASDAT uses objectives hierarchy and media selection to create a syllabus.

h. The user modifies the syllabus as necessary.
Figure 2. An Operational Flowchart of CASDAT
i. CASDAT uses the syllabus and media data to create lesson specifications.

j. The user modifies and completes the lesson specifications.

The CASDAT software package was written in FORTRAN for the PDP-11/34 computer system. It is portable in that it can be utilized on any computer with the following attributes: FORTRAN compiler, overlay capability, 32K-16 bit word user space, disk I/O with random access capability, five megabyte disk, line printer, CRT and keyboard. The package consists of system programming for each of the five ISD steps, programs for generating data bases and archives for the storage of data bases that have been generated by the interaction of the user with the generic models and the ISD algorithms. The package allows either the generation of a totally new data base for a given aircraft and crew position, or the modification of existing data bases.

CASDAT generates a data base for the users' particular needs. The user then manipulates and refines the data base in order to design the required syllabus. The following paragraphs discuss each step in the ISD process as it is aided by CASDAT.

TASK LIST DEVELOPMENT. The aircraft-specific task list becomes the user's data base which is manipulated and refined throughout each ISD step. The aircraft-specific task list is generated through interaction of the following:

a. The generic task list model represented by generic task statements. For example, "respond to emergency" or "Fly a vector." The task statements, which consists of verbs and objects without equipment description, are transparent to the user. The generic task list model is presented in Appendix B of this document.

b. A menu of aircraft characteristics such as, aircraft mission, weapons loading and avionics.

c. A set of questions which allows the user to select from the menu of aircraft characteristics.

d. A data base creation and management structure used to create the aircraft-specific data base. This allows data from a, b, and c above to interact and create an aircraft-specific task list. For instance, after the CASDAT user answers the questions as to aircraft mission, weapons loading, avionics, etc., CASDAT data base management structure matches the equipment with the generic task listing to create an aircraft-specific task: e.g., "Respond to fuel transfer system emergency" or "Fly a vector using TACAN." Figure 3 illustrates the system programming concept using these data.

Once the aircraft-specific task list is generated, a printout is produced for the user. Figure 4 presents a portion of a typical task list generated by CASDAT. The user can revise the task list in any of the following ways:
Figure 3. System Programming Concept Distinguished By Four Sets of Data.
NAVTRAEEQPCEN 79-C-0076-1

F-4S TASK LIST

<table>
<thead>
<tr>
<th>CREW POSN</th>
<th>SEQ. NO.</th>
<th>TASK</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.2.2</td>
<td></td>
<td>PERFORM ORDNANCE PRE-FLIGHT INSPECTIONS</td>
</tr>
<tr>
<td>2.2.2.1</td>
<td></td>
<td>PERFORM PRE-FLIGHT INSPECTION OF AIM-9</td>
</tr>
<tr>
<td>2.2.2.2</td>
<td></td>
<td>PERFORM PRE-FLIGHT INSPECTION OF AIM-7</td>
</tr>
<tr>
<td>2.2.2.3</td>
<td></td>
<td>PERFORM PRE-FLIGHT INSPECTION OF 2.75-FFAR</td>
</tr>
<tr>
<td>2.2.3</td>
<td></td>
<td>PERFORM WCS PRE-FLIGHT INSPECTIONS</td>
</tr>
<tr>
<td>2.2.3.1</td>
<td></td>
<td>PERFORM PRE-FLIGHT INSPECTION OF RADAR</td>
</tr>
<tr>
<td>2.2.3.2</td>
<td></td>
<td>PERFORM PRE-FLIGHT INSPECTION OF GUNSIGHT</td>
</tr>
<tr>
<td>2.3</td>
<td></td>
<td>PERFORM INTERIOR PRE-FLIGHT INSPECTIONS</td>
</tr>
<tr>
<td>2.3.1</td>
<td></td>
<td>PERFORM BEFORE-ENTERING COCKPIT INSPECTIONS</td>
</tr>
<tr>
<td>2.3.2</td>
<td></td>
<td>PERFORM BEFORE-ELECTRICAL POWER CHECKLIST</td>
</tr>
<tr>
<td>2.3.3</td>
<td></td>
<td>PERFORM AFTER-ELECTRICAL POWER CHECKLIST</td>
</tr>
<tr>
<td>2.3.4</td>
<td></td>
<td>PERFORM EJECTION-SEAT INSPECTION</td>
</tr>
<tr>
<td>2.4</td>
<td></td>
<td>PERFORM ENGINE-START PROCEDURE</td>
</tr>
<tr>
<td>2.4.1</td>
<td></td>
<td>PERFORM BEFORE-STARTING ENGINE CHECKLIST</td>
</tr>
<tr>
<td>2.4.2</td>
<td></td>
<td>PERFORM STARTING-ENGINE CHECKLIST</td>
</tr>
<tr>
<td>2.4.3</td>
<td></td>
<td>RESPOND TO ENGINE-START EMERGENCIES</td>
</tr>
<tr>
<td>2.4.3.1</td>
<td></td>
<td>RESPOND TO ENGINE HUNG-START EMER</td>
</tr>
<tr>
<td>2.4.3.2</td>
<td></td>
<td>RESPOND TO ENGINE HOT-START EMER</td>
</tr>
<tr>
<td>2.4.3.3</td>
<td></td>
<td>RESPOND TO ENGINE FIRE-ON-START EMER</td>
</tr>
<tr>
<td>2.4.3.4</td>
<td></td>
<td>RESPOND TO ENGINE WET-START EMER</td>
</tr>
<tr>
<td>2.4.3.5</td>
<td></td>
<td>RESPOND TO ENGAGED-STARTER EMER</td>
</tr>
<tr>
<td>2.4.3.6</td>
<td></td>
<td>RESPOND TO RUNAWAY ENGINE-ON-START EMER</td>
</tr>
<tr>
<td>2.5</td>
<td></td>
<td>PERFORM SYSTEMS CHECK/SET-UP</td>
</tr>
<tr>
<td>2.5.1</td>
<td></td>
<td>PERFORM FLIGHT-CONTROLS CHECK/SET-UP</td>
</tr>
<tr>
<td>2.5.2</td>
<td></td>
<td>PERFORM AVIONICS SYSTEMS CHECK/SET-UP</td>
</tr>
<tr>
<td>2.5.2.1</td>
<td></td>
<td>PERFORM CHECK/SET-UP OF DATA-LINK</td>
</tr>
<tr>
<td>2.5.2.2</td>
<td></td>
<td>PERFORM CHECK/SET-UP OF UHF</td>
</tr>
<tr>
<td>2.5.2.3</td>
<td></td>
<td>PERFORM CHECK/SET-UP OF KY-2B</td>
</tr>
<tr>
<td>2.5.2.4</td>
<td></td>
<td>PERFORM CHECK/SET-UP OF TACAN</td>
</tr>
<tr>
<td>2.5.2.5</td>
<td></td>
<td>PERFORM CHECK/SET-UP OF ADF</td>
</tr>
<tr>
<td>2.5.2.6</td>
<td></td>
<td>PERFORM CHECK/SET-UP OF IFF</td>
</tr>
<tr>
<td>2.5.2.7</td>
<td></td>
<td>PERFORM CHECK/SET-UP OF RADAR</td>
</tr>
<tr>
<td>2.5.2.8</td>
<td></td>
<td>PERFORM CHECK/SET-UP OF GUNSIGHT</td>
</tr>
<tr>
<td>2.5.2.9</td>
<td></td>
<td>PERFORM CHECK/SET-UP OF VISUAL</td>
</tr>
</tbody>
</table>

Figure 4. Portion Of Typical Task List Generated By CASDAT
a. assign tasks to aircrew members  
b. add new tasks  
c. replace existing tasks  
d. delete tasks

Once the user finishes validating and modifying the task list, a final printout is produced for the user. Figure 5 presents a sample validated task list. In addition, CASDAT produces a draft objectives hierarchy printout. The following matrix describes how the user and CASDAT work together to create the task list.

<table>
<thead>
<tr>
<th>USER ACTIONS</th>
<th>SYSTEM ACTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>The user types in name, date, and aircraft identifier.</td>
<td>The system retains the user's name, date and aircraft identifier to be used in the header of reports.</td>
</tr>
<tr>
<td>If the training program is partially complete, the user will be required to tell the system which phase is to be entered, e.g., task validation, objective validation, media selection, syllabus generation, lesson edit or lesson specification.</td>
<td>The system uses the aircraft identifier to determine the status of the training program; i.e., new or existing within CASDAT. The system determines from the first record of the data base (a header record) what phase the training program is currently in. The system will tell the user what phase he is in and what phase he has completed. The user can enter the current phase or re-enter a completed phase. The system will not allow the user to skip phases or enter them out of sequence.</td>
</tr>
</tbody>
</table>
| If the training program is new, the user will be required to answer a series of questions about the aircraft system. These questions consist of:  
  - The number of aircrew positions and their designations, e.g., pilot, copilot and RIO.  
  - The features or applications of the aircraft's weapon control system, e.g., infrared, laser, camera, sonar, etc. | If the system cannot find the requested aircraft name in the aircraft "ID" table a data base for the requested aircraft will be generated. The data base is generated by linking the generic data base with the defined characteristics of the aircraft. |
**F-4S Task List**

<table>
<thead>
<tr>
<th>CREW POSN</th>
<th>SEQ. NO.</th>
<th>TASK</th>
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<tr>
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<td>PERFORM PRE-FLIGHT INSPECTION OF GUN SIGHT</td>
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<tr>
<td>PR</td>
<td>2.3</td>
<td>PERFORM INTERIOR PRE-FLIGHT INSPECTIONS</td>
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<tr>
<td>PR</td>
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<tr>
<td>PR</td>
<td>2.3.3</td>
<td>PERFORM AFTER-ELECTRICAL POWER CHECKLIST</td>
</tr>
<tr>
<td>PR</td>
<td>2.3.4</td>
<td>PERFORM EJECTION-SEAT INSPECTION</td>
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<tr>
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</tr>
<tr>
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<tr>
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</tr>
<tr>
<td>PR</td>
<td>2.5</td>
<td>PERFORM SYSTEMS CHECK/SET-UP</td>
</tr>
<tr>
<td>PR</td>
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</tr>
<tr>
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<td>2.5.2.2</td>
<td>PERFORM CHECK/SET-UP OF UHF</td>
</tr>
<tr>
<td>PR</td>
<td>2.5.2.3</td>
<td>PERFORM CHECK/SET-UP OF KY-28</td>
</tr>
<tr>
<td>PR</td>
<td>2.5.2.4</td>
<td>PERFORM CHECK/SET-UP OF TACAN</td>
</tr>
<tr>
<td>PR</td>
<td>2.5.2.5</td>
<td>PERFORM CHECK/SET-UP OF ADF</td>
</tr>
<tr>
<td>PR</td>
<td>2.5.2.6</td>
<td>PERFORM CHECK/SET-UP OF IFF</td>
</tr>
<tr>
<td>R</td>
<td>2.5.2.7</td>
<td>PERFORM CHECK/SET-UP OF RADAR</td>
</tr>
<tr>
<td>PR</td>
<td>2.5.2.8</td>
<td>PERFORM CHECK/SET-UP OF GUN SIGHT</td>
</tr>
<tr>
<td>PR</td>
<td>2.5.2.9</td>
<td>PERFORM CHECK/SET-UP OF VISUAL</td>
</tr>
</tbody>
</table>

*Figure 5. Portion of Typical Validated Task List*
**TASK LIST DEVELOPMENT (continued)**

<table>
<thead>
<tr>
<th>USER ACTIONS</th>
<th>SYSTEM ACTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>* The ordnance carried by the aircraft, e.g., gun, depth charge, missiles.</td>
<td>For example, if the aircraft is defined as a fixed-wing aircraft, the system will only build upon those generic tasks that are linked to the fixed wing characteristic. The generic tasks that are linked to helicopter will be bypassed.</td>
</tr>
<tr>
<td>* The aircraft's wing structure, e.g., vector-thrust, helicopter, fixed wing.</td>
<td>The system will print out the generated task listing. Figure 4 presents a typical task list generated by CASDAT.</td>
</tr>
<tr>
<td>* Whether or not the aircraft is carrier capable.</td>
<td></td>
</tr>
<tr>
<td>* The avionics suite of the aircraft, including which are used for communication, navigation, and identification, e.g., datalink, INS, UHF.</td>
<td></td>
</tr>
<tr>
<td>* The personal survival equipment carried on the aircraft, e.g., helmet, g-suit, parachute.</td>
<td></td>
</tr>
</tbody>
</table>

Prior to validating the task list, the user should do an off-line review of the generated task list.

While in the task list validation phase the user can:

* assign aircrew members to the tasks

* add new tasks

* replace existing tasks

Once the task has been validated for an aircrew member, the system will put an indicator into the data base record. This indicator is in the form of a P, C and/or R indicating whether the task is validated for pilot, co-pilot and/or Radio Intercept Officer (RIO).

The system will add the task to the data base where the task falls into the task hierarchy along with pointers indicating that it is a new task. The system informs user of invalid task statements by checking new tasks against a menu of acceptable terms. (See Appendix C)

The system will replace the old task statement of the data base record with the user-entered task statement.
### TASK LIST DEVELOPMENT (continued)

<table>
<thead>
<tr>
<th>USER ACTIONS</th>
<th>SYSTEM ACTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>* delete tasks (this is accomplished by not validating the task for any of the aircrew members)</td>
<td>The system will indicate in the data base record that no aircrew member performs this task.</td>
</tr>
<tr>
<td>* exit the task list validation at any time</td>
<td>If the task list validation is completed, the system recognizes this and alerts the user. Wherever the user stops, CASDAT takes note and reminds the user of that point the next time he or she signs on.</td>
</tr>
<tr>
<td>* request a hardcopy printout of the validated task list</td>
<td>The system will print on the line-printer all validated tasks and the aircrew members assigned to each task. Figure 5 presents an example validated task list.</td>
</tr>
<tr>
<td></td>
<td>In addition the system will generate an objectives hierarchy which will be printed for the user at this time.</td>
</tr>
</tbody>
</table>

### OBJECTIVES HIERARCHY DEVELOPMENT

The objectives hierarchy is generated by CASDAT through the use of a subset of the generic task list model. For each task in the generic model, learning objectives are specified. For each CASDAT-generated task which the user validates, the associated objectives are printed in the CASDAT-generated objectives hierarchy. The user must add objectives for user-created tasks, and may add to, or modify CASDAT-generated objectives. Once the user has completed objectives validation, a completed task and objectives hierarchy is printed. A sample portion of a CASDAT-generated objectives hierarchy is presented in figure 6. Figure 7 presents a portion of a typical validated objectives hierarchy.

Currently, the generic task list model residing in CASDAT is capable of generating approximately 2000 tasks and an additional 3000 supporting objectives. Of course, a single aircrew training program would not contain the entire set of tasks and objectives. In addition to the CASDAT-generated tasks and objectives, CASDAT can store and track the full set of tasks and objectives the user may wish to add to his specific data base.

The following matrix describes how the user working with CASDAT can validate the objective hierarchy:
Figure 6. Portion of Typical Objectives Hierarchy Generated By CASDAT
Prior to entering this phase, the user should do an off-line review of the generated objectives hierarchy.

While in the objectives validation phase the user can:

- **assign aircrew members to the objectives**

  Once the objectives have been validated for an aircrew member, the system will put an indicator into the data base record. This indicator is in the form of a P, C and/or R indicating whether the objective is validated for the pilot, co-pilot or RIO.

- **add new objectives**

  The system will add the objective to the data base where it falls into the objective hierarchy along with pointers indicating that it is a new objective. The system informs user of invalid objectives(s) against a menu of acceptable terms. (See Appendix C).

- **replace existing objectives**

  The system will replace the old objective statement of the data base record with the user entered objective statement.

- **delete objectives (this is accomplished by not validating the objectives for any of the aircrew members)**

  The system will indicate in the data base record that no aircrew member performs this objective.

- **exit the objectives validation at any time**

  If the objectives validation is completed, the system recognizes this and alerts the user. Wherever the user stops, CASDAT keeps track, and reminds the user of that point the next time he or she signs on.

- **request a hardcopy printout of the validated objectives hierarchy.**

  The system will print on the line-printer the objectives hierarchy and the aircrew members assigned to each objective. Figure 7 presents an example validated objectives hierarchy.
Figure 7. Portion of Typical Validated Objectives Hierarchy
MEDIA SELECTION. During media selection, CASDAT aids the user in selecting media for each validated objective. CASDAT prompts the user to identify learning type, behavior type, display requirements, etc. for each objective. CASDAT then selects primary and secondary media choices for each objective. CASDAT currently contains an algorithm which was specified in an early version of MIL-T-29053 and focuses primarily on selecting media for academic objectives. Using this algorithm, media selection is accomplished by answering five questions:

a. What is the level of behavior expected of the student in this objective?
   1. Familiarization
   2. Remember
   3. Use

b. What is the level of content being taught in this objective?
   1. Familiarization
   2. Fact
   3. Concept
   4. Rule/procedure
   5. Principle

c. Is the minimum critical set of instances the student needs to see small or large?
   1. Small
   2. Large

d. What is the minimum display requirement?
   1. Verbal and/or symbolic and/or static simple pictorial
   2. Verbal and/or symbolic and/or static complex pictorial
   3. Dynamic pictorial
   4. Interactive

e. Is the memorization component of this objective large or small?
   1. Small
   2. Large

Once media selection is complete, CASDAT generates a printout. A sample portion of media selection printout is provided in figure 8.
### F-4S Media Selection

**Media Key:**
- A/C: Aircraft
- CAI: Computer Aided Instruction
- VT: Video Tape
- WB: Workbook
- RAS: Random Access Slide Workbook
- ST: Slide Tape
- MIL: Mediated Interactive Lecture

<table>
<thead>
<tr>
<th>CREW POSN</th>
<th>SEQUENCE NO.</th>
<th>OBJECTIVE</th>
</tr>
</thead>
<tbody>
<tr>
<td>PR 2.2</td>
<td></td>
<td>Perform exterior pre-flight inspections</td>
</tr>
<tr>
<td></td>
<td>PRIMARY MEDIA: A/C</td>
<td>SECONDARY MEDIA:</td>
</tr>
<tr>
<td>PR 2.2.1</td>
<td></td>
<td>Perform pre-flight A/C exterior inspections</td>
</tr>
<tr>
<td></td>
<td>PRIMARY MEDIA: A/C</td>
<td>SECONDARY MEDIA:</td>
</tr>
<tr>
<td>PR 2.2.1.0.1</td>
<td></td>
<td>State location of inspection points for pre-flight A/C exterior inspections</td>
</tr>
<tr>
<td></td>
<td>PRIMARY MEDIA: ST</td>
<td>SECONDARY MEDIA: MIL</td>
</tr>
<tr>
<td>PR 2.2.1.0.1.1</td>
<td></td>
<td>Identify location of inspection points for pre-flight A/C exterior inspections</td>
</tr>
<tr>
<td></td>
<td>PRIMARY MEDIA: ST</td>
<td>SECONDARY MEDIA: MIL</td>
</tr>
<tr>
<td>PR 2.2.1.0.2</td>
<td></td>
<td>Identify discrepancies for each point for pre-flight A/C exterior inspections</td>
</tr>
<tr>
<td></td>
<td>PRIMARY MEDIA: CAI</td>
<td>SECONDARY MEDIA: RAS</td>
</tr>
<tr>
<td>PR 2.2.1.0.3</td>
<td></td>
<td>State required action for each item of pre-flight A/C exterior inspections</td>
</tr>
<tr>
<td></td>
<td>PRIMARY MEDIA: ST</td>
<td>SECONDARY MEDIA: MIL</td>
</tr>
<tr>
<td>PR 2.2.2</td>
<td></td>
<td>Perform ordnance pre-flight inspections</td>
</tr>
<tr>
<td></td>
<td>PRIMARY MEDIA: A/C</td>
<td>SECONDARY MEDIA:</td>
</tr>
<tr>
<td>PR 2.2.2.1</td>
<td></td>
<td>Perform pre-flight inspection of AIM-9</td>
</tr>
<tr>
<td></td>
<td>PRIMARY MEDIA: A/C</td>
<td>SECONDARY MEDIA:</td>
</tr>
<tr>
<td>PR 2.2.2.1.0.1</td>
<td></td>
<td>State location of inspection points for pre-flight inspection of AIM-9</td>
</tr>
<tr>
<td></td>
<td>PRIMARY MEDIA: ST</td>
<td>SECONDARY MEDIA: MIL</td>
</tr>
<tr>
<td>PR 2.2.2.1.0.2</td>
<td></td>
<td>Identify discrepancies for each point for pre-flight inspection of AIM-9</td>
</tr>
<tr>
<td></td>
<td>PRIMARY MEDIA: CAI</td>
<td>SECONDARY MEDIA: RAS</td>
</tr>
<tr>
<td>PR 2.2.2.1.0.3</td>
<td></td>
<td>State required action for each item of pre-flight inspection of AIM-9</td>
</tr>
<tr>
<td></td>
<td>PRIMARY MEDIA: ST</td>
<td>SECONDARY MEDIA: MIL</td>
</tr>
</tbody>
</table>

**Figure 8. Portion Of Typical Media Selection Listing**
The following matrix describes the media selection process:

<table>
<thead>
<tr>
<th>USER ACTIONS</th>
<th>SYSTEM ACTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>The media selection phase allows the user to:</td>
<td>The system will select the available resources from the resources which are available through the media selection algorithm. Example: media choices might be CAI, slide tape, and workbook; but if the installation does not have CAI, workbook, and slide tape, the only choices become the only choices.</td>
</tr>
<tr>
<td>* identify the resources, e.g., slide tape, workbook, CAI which are available at the training installation.</td>
<td>The system will assign primary and secondary media to each objective based on the inputs to the media selection algorithm described in Paragraph 6.4 of MIL-T-29053(A).</td>
</tr>
<tr>
<td>* input answers to a series of questions (5 maximum) that deal with learning considerations for each academic objective</td>
<td>The system will put an indicator into the data base of where the user stopped. If media selection is completed CASDAT alerts the user that he can go to syllabus development.</td>
</tr>
<tr>
<td>* exit the media selection at any time</td>
<td>The system will print on the lineprinter all objectives, their aircrew assignments and primary and secondary media selections.</td>
</tr>
<tr>
<td>* request a hard copy printout of the media selected for each validated objective</td>
<td>Figure 8 presents a typical listing.</td>
</tr>
</tbody>
</table>
SYLLABUS GENERATION. CASDAT generates a syllabus for the users' aircraft. The syllabus consists of a sequence of lessons, each represented by a lesson number, lesson title and lesson media. Each objective assigned to the lesson is identified by number, text, aircrew member, environment (academic, trainer or flight) and by specific media assigned to the individual objective. This information is provided on a syllabus worksheet which the user can use to edit the syllabus. The user can change parts of lessons (e.g., title, media, objectives), split lesson into multiple lessons, combine two or more lessons, or delete a lesson. The following paragraphs explain how this is accomplished.

CASDAT generates a syllabus by sorting objectives into lessons. The objectives are first sorted by topic, then by aircrew position, and finally by environment (academic, trainer and flight). Sequencing of lessons is accomplished using a predetermined sequence of topic areas. Therefore, as objectives are sorted into a topic area, they are simultaneously being sequenced. Within the topic area, lessons are sequenced by training environment. Academic lessons are trained first, then the trainer lessons and then flights. This process is illustrated in Figure 9.

In order for this process to work, the designers of CASDAT generated a generic aircrew syllabus. Most aircrew syllabi are designed using a predictable sequence of topic areas. For example, most aircrew syllabi start out with a familiarization phase consisting of such topics as aircraft systems, avionics systems and weapon system. The syllabi continue through flight proficiency, mission execution (or tactics), and special operations (e.g., carrier qualification). The generic syllabus was designed by comparing existing topical sequences and creating a sequence of phases (e.g., familiarization), topics (e.g., aircraft systems) and titles (e.g., flight controls). This generic syllabus is included in Appendix D.

CASDAT designers coded the key words used in the course objectives so that CASDAT could assign objectives to topics and lesson titles within the generic syllabus. Each objective contains a verb, modifier and object. For example:

<table>
<thead>
<tr>
<th>verb</th>
<th>modifier</th>
<th>object</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perform</td>
<td>Ejection-seat</td>
<td>Inspection</td>
</tr>
</tbody>
</table>

The verbs, modifiers and objects which CASDAT currently recognizes are listed in Appendix C. These were each assigned to one or more topic area and lesson title within the generic syllabus. This is shown in Appendix D. CASDAT reads each objective in the objective hierarchy developed by the user via CASDAT for his aircraft and assigns it to a topic area using a word search for verb, modifier and object. Specifically, the process is performed as follows:

a. CASDAT creates a file containing all validated objectives.

b. Next, the generic syllabus is read for phase (e.g., familiarization), topic (e.g., communications procedures) and title (e.g., normal communications).
Figure 9. Syllabus Generation Process
Upon getting a title, the objectives file is read. If the verb, modifier and object of an objective matches those of the lesson title, the objective and its subordinate/enabling objectives are assigned to the lesson title.

c. If the verb, modifier and object of the objective do not match those of the title, CASDAT continues to the next objective. Each objective is read and compared with the various titles until all are assigned a title.

d. All objectives have now been assigned a title. Within the title, all objectives are now sorted by aircrew member. All pilot objectives are sorted together; all radar intercept officer (RIO) objectives are sorted together; and all copilot objectives are sorted together.

e. The objectives for each aircrew member are further sorted by training environment, i.e., academic, trainer and flight. It is at this point in the process, that lessons are created. For each aircrew member, three types of lessons (representing the three environments) are possible within a title area.

<table>
<thead>
<tr>
<th>Aircrew Member</th>
<th>Environment</th>
<th>Objective Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pilot</td>
<td>Academic</td>
<td>Normal communications</td>
</tr>
<tr>
<td>Pilot</td>
<td>Trainer</td>
<td>Normal communications</td>
</tr>
<tr>
<td>Pilot</td>
<td>Flight</td>
<td>Normal communications</td>
</tr>
<tr>
<td>RIO</td>
<td>Academic</td>
<td>Normal communications</td>
</tr>
<tr>
<td>RIO</td>
<td>Trainer</td>
<td>Normal communications</td>
</tr>
<tr>
<td>RIO</td>
<td>Flight</td>
<td>Normal communications</td>
</tr>
</tbody>
</table>

No more than twenty objectives are grouped together into a single lesson. Therefore, there may be two or more of the same type of lesson within a topic area. For example, there may be two academic lessons on normal communication for the pilot.

A coding system was created to label the lessons. An alphanumeric code indicates the phase of training, the aircrew member, the training environment and the sequence of training within the phase of training. An example lesson code and title is:

\[
\text{FAPA} 20 \text{ fuel system}
\]

The lesson reference number can be interpreted as follows:

- **FA** refers to phase of training; in this case, aircraft familiarization. The other phases and their abbreviations are indicated in the generic aircrew syllabus (Appendix D).

- **P** refers to aircrew member for whom the lesson will be taught, in this case, the pilot. Others are:
  
  - **C** = copilot
  - **R** = radar intercept officer

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A refers to the training environment, in this case, academic. Others are:

\[ T = \text{trainer} \]
\[ F = \text{flight} \]

20 refers to the sequence of the academic lessons within the familiarization phase. The numbers normally start with 20 and progress in increments of 20. Therefore, a normal sequence of numbers would be 20, 40, 60, etc. The titles are sequenced in the same order that they occur on the generic syllabus. Some typical titles and their sequence numbers are:

- FAPA 20 Fuel System
- FAPA 40 Power Plant System
- FAPA 60 Hydraulic System
- FAPA 80 Electrical System
- FAPT 20 Fuel System
- FAPT 40 Power Plant System
- FAPT 60 Hydraulic System
- FAPT 80 Electrical System
- FAPF 20 Fuel System
- FAPF 40 Power Plant System
- FAPF 60 Hydraulic System
- FAPF 80 Electrical System

f. Finally, media are assigned to lessons. Trainer and flight lessons are assigned a trainer or aircraft accordingly. An academic lesson is assigned the media common to the most objectives within the lesson. "Primary and secondary" media have been assigned to individual objectives during media selection. After these objectives have been assigned to a lesson, the media previously assigned to each objective are tallied for all objectives in the lesson. The most frequently used medium is assigned to the lesson. The second most frequently used medium is assigned as the secondary medium option.

g. The syllabus worksheet is printed. The syllabus worksheet contains a listing of all lessons within the syllabus. For each lesson, the printout lists lesson number, title, primary and secondary media. Each objective assigned to the lesson is identified by number, text, aircrew member, environment and specific media assigned to the objective during media selection. Figure 10 shows an example portion of the syllabus worksheet.
SYLLABUS WORKSHEET

***FAPA 20
NORMAL COMMUNICATIONS
VT-VIDEO TAPE
MIL-MEDIATED INTERACTIVE LECTURE
2.6.1.0.1 PR A STATE REQUIRED ACTION FOR EACH ITEM OF BEFORE-TAXI CHECKLIST
ST-SLIDE TAPE
MIL-MEDIATED INTERACTIVE LECTURE
2.6.2.0.1 PR A STATE PROCEDURES FOR FIXED-WING FIELD TAXI
VT-VIDEO TAPE
MIL-MEDIATED INTERACTIVE LECTURE
2.6.2.0.2 PR A STATE APPROPRIATE RESPONSE TO PLANE CAPTAIN HAND SIGNALS
VT-VIDEO TAPE
MIL-MEDIATED INTERACTIVE LECTURE
2.6.3.0.1 PR A STATE PROCEDURES FOR FIXED-WING CARRIER-DECK TAXI
VT-VIDEO TAPE
MIL-MEDIATED INTERACTIVE LECTURE
2.6.3.0.2 PR A STATE APPROPRIATE RESPONSE TO PLANE CAPTAIN HAND SIGNALS
VT-VIDEO TAPE
MIL-MEDIATED INTERACTIVE LECTURE
2.6.4.1.0.1 PR A STATE CUES AND ALERTS FOR FAILED-BRAKE EMER
ST-SLIDE TAPE
MIL-MEDIATED INTERACTIVE LECTURE
2.6.4.1.0.2 PR A STATE CORRECTIVE ACTIONS FOR FAILED-BRAKE EMER
VT-VIDEO TAPE
MIL-MEDIATED INTERACTIVE LECTURE
2.6.4.2.0.1 PR A STATE CUES-AND-ALERTS FOR FAILED-NGS EMER
ST-SLIDE TAPE
MIL-MEDIATED INTERACTIVE LECTURE
2.6.4.2.0.2 PR A STATE CORRECTIVE ACTIONS FOR FAILED-NGS EMER
VT-VIDEO TAPE
MIL-MEDIATED INTERACTIVE LECTURE
2.6.5.0.1 PR A STATE THE STEPS REQUIRED TO ACCOMPLISH TAXI COMMUNICATIONS
CAI-COMPUTER AIDED INSTRUCTION
WB-WORKBOOK
4.5.5.1.1.0.1 PR A STATE PROCEDURES TO COMMUNICATE WITH GROUND STATIONS USING
DATA-LINK
VT-VIDEO TAPE
MIL-MEDIATED INTERACTIVE LECTURE
4.5.5.1.2.0.1 PR A STATE PROCEDURES TO COMMUNICATE WITH GROUND STATIONS USING UHF
VT-VIDEO TAPE
MIL-MEDIATED INTERACTIVE LECTURE
4.5.5.2.1.0.1 PR A STATE PROCEDURES TO COMMUNICATE WITH OTHER AIRCRAFT USING
DATA-LINK
VT-VIDEO TAPE
MIL-MEDIATED INTERACTIVE LECTURE
4.5.5.2.2.0.1 PR A STATE PROCEDURES TO COMMUNICATE WITH OTHER AIRCRAFT USING UHF
VT-VIDEO TAPE
MIL-MEDIATED INTERACTIVE LECTURE

Figure 10. Sample Portion Of Syllabus Worksheet
At the conclusion of syllabus development CASDAT generates a media cost report. This is automatically produced for the user. It computes relative costs of producing the primary and secondary media plans for the training syllabus. Relative costs, not real costs, are computed. This is because actual costs change over time and among geographic locations. The training analyst can use the media cost report to get a comparison of the cost between the two media plans generated by CASDAT. Three tables are produced in the media cost report. The first of these, "Alternative Media Plans" presents in summary form, the number and percent of lessons employing each medium used in the two media plans. Figure 11 presents an example table.

The second table, the media cost factors, is shown in Figure 12. Production time and cost factors are presented for each type of medium in terms of relative values, (i.e., how much more time/cost it takes to produce one medium over another). These values were determined by Courseware Incorporated and explained in detail in the Training Support Requirements document produced by them. Time/cost factors are itemized for each job classification required to complete authoring and production of each medium type. Time/cost factors are specified for author, instructional psychologist, script writer/editor, and production. A total time/cost factor is also given. The factors are constants; they do not change with media mix or with real production costs; and they are relative. For example, a time/cost factor of twenty indicates that the time and cost to produce that particular medium is twice that to produce a medium receiving a factor or ten. A user interpreting the media cost factors in Figure 12 would see that authoring a slide tape (ST) and authoring a workbook (WB) would take approximately the same amount of time and money. Authoring a computer aided instruction (CAI) lesson would take slightly more time. Looking at the "total" column, a completed slide tape program will take approximately twice as much time and money as a completed mediated interactive lecture (MIL). A MIL and WB lesson will take approximately the same time and money to complete.

To complete the third table, media time/cost matrix, the time/cost factors are multiplied by the percentage of lessons employing each medium, and then totaled for each time/cost factor. A sample matrix is presented in Figure 13. This table shows the relative costs of the two media plans generated by the syllabus. The user can see how much relative time is required of each job category to produce each media plan, as well as a total relative value. In Figure 13, the primary media plan is approximately 25 percent more costly than the secondary media plan.

---

<table>
<thead>
<tr>
<th></th>
<th>PRIMARY MEDIA PLAN</th>
<th>SECONDARY MEDIA PLAN</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>% of LESSONS</td>
<td>% of TOTAL</td>
</tr>
<tr>
<td>1. AC</td>
<td>18</td>
<td>37.5</td>
</tr>
<tr>
<td>2. SIM</td>
<td>12</td>
<td>25.0</td>
</tr>
<tr>
<td>3. VT</td>
<td>5</td>
<td>10.4</td>
</tr>
<tr>
<td>4. MIL</td>
<td>0</td>
<td>.0</td>
</tr>
<tr>
<td>5. ST</td>
<td>11</td>
<td>22.9</td>
</tr>
<tr>
<td>6. MB</td>
<td>1</td>
<td>2.1</td>
</tr>
<tr>
<td>7. WS</td>
<td>0</td>
<td>.0</td>
</tr>
<tr>
<td>8. CAI</td>
<td>1</td>
<td>2.1</td>
</tr>
<tr>
<td>9. RAS</td>
<td>0</td>
<td>.0</td>
</tr>
<tr>
<td></td>
<td>TOTAL</td>
<td>48</td>
</tr>
</tbody>
</table>

Figure 11. Alternative Media Plans
<table>
<thead>
<tr>
<th>MEDIA</th>
<th>AUTHOR</th>
<th>IP</th>
<th>SW/ED</th>
<th>PROD</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC</td>
<td>10.00</td>
<td>1.00</td>
<td>.00</td>
<td>20.00</td>
<td>19.00</td>
</tr>
<tr>
<td>SIM</td>
<td>10.00</td>
<td>1.00</td>
<td>.00</td>
<td>20.00</td>
<td>19.00</td>
</tr>
<tr>
<td>VT</td>
<td>10.00</td>
<td>1.00</td>
<td>15.00</td>
<td>27.00</td>
<td>30.00</td>
</tr>
<tr>
<td>MIL</td>
<td>10.00</td>
<td>1.00</td>
<td>.00</td>
<td>16.00</td>
<td>17.00</td>
</tr>
<tr>
<td>ST</td>
<td>8.00</td>
<td>3.00</td>
<td>7.00</td>
<td>37.00</td>
<td>35.00</td>
</tr>
<tr>
<td>WB</td>
<td>8.00</td>
<td>1.00</td>
<td>2.00</td>
<td>20.00</td>
<td>17.00</td>
</tr>
<tr>
<td>WS</td>
<td>3.00</td>
<td>.50</td>
<td>.50</td>
<td>3.50</td>
<td>5.00</td>
</tr>
<tr>
<td>CAI</td>
<td>10.00</td>
<td>1.00</td>
<td>.00</td>
<td>20.00</td>
<td>19.00</td>
</tr>
<tr>
<td>RAS</td>
<td>13.00</td>
<td>2.00</td>
<td>3.00</td>
<td>50.00</td>
<td>41.00</td>
</tr>
</tbody>
</table>

Figure 12. Media Cost Factors

<table>
<thead>
<tr>
<th>PLAN/CAT</th>
<th>AUTHOR</th>
<th>IP</th>
<th>SW/ED</th>
<th>PROD</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary Media Plan</td>
<td>950.00</td>
<td>145.83</td>
<td>320.83</td>
<td>2462.50</td>
<td>2377.08</td>
</tr>
<tr>
<td>Secondary Media Plan</td>
<td>1006.25</td>
<td>102.08</td>
<td>6.25</td>
<td>1929.17</td>
<td>1879.17</td>
</tr>
</tbody>
</table>

Figure 13. Media Time/Cost Matrix
The system actions and user interaction required for syllabus development are briefly described below:

<table>
<thead>
<tr>
<th>USER ACTIONS</th>
<th>SYSTEM ACTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>There is no user action required during syllabus generation.</td>
<td>The system will assign objectives to lessons by matching the objective statement taxonomy (verb, modifier and object) with generic syllabus taxonomy (allowable verb, modifier and object shown in Appendix D). After the taxonomy match is made, the objectives are further broken down into lessons by aircrew members and environment (academic, flight, trainer).</td>
</tr>
<tr>
<td>The user should do an off-line review of the generated syllabus.</td>
<td>Upon completion, a hard copy print-out of the syllabus will be printed on the line printer. Each lesson title, its lesson number, primary and secondary media for the lesson, and the objectives assigned to the lesson (including the types of the assigned objectives) are included in this report.</td>
</tr>
<tr>
<td>During syllabus validation, the user can:</td>
<td></td>
</tr>
<tr>
<td>* delete lessons</td>
<td>The system will delete the indicated lessons from the syllabus</td>
</tr>
<tr>
<td>* display lessons</td>
<td>The system will provide an on-line review of all parts of the lesson, e.g., lesson number, title, media and assigned objectives.</td>
</tr>
<tr>
<td>* change a part of a lesson, e.g., title, media for the lesson, objectives etc.</td>
<td>The system will substitute based on the user inputs. The lesson file will be updated to reflect this change.</td>
</tr>
<tr>
<td>* split a lesson into multiple lessons</td>
<td>The system will create multiple lessons from one lesson. The system will take the information given to it by the user to assign titles, media and objectives to each of the multiple lessons. The lesson that was split will be deleted from the syllabus.</td>
</tr>
<tr>
<td>* combine two or more lessons into one</td>
<td>The system will combine the objectives of a number of lessons into one lesson. The lesson title and media will be specified by the user.</td>
</tr>
</tbody>
</table>
SYLLABUS DEVELOPMENT (continued)

<table>
<thead>
<tr>
<th>USER ACTIONS</th>
<th>SYSTEM ACTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>• request a hard copy printout of the validated syllabus</td>
<td>The system will print on the line-printer each lesson number, its title, the media for the lesson, and the objectives assigned to the lesson. At the conclusion of the syllabus printout, media cost summaries are printed.</td>
</tr>
</tbody>
</table>

LESSON SPECIFICATIONS. The lesson specifications supplied to the user by CASDAT are outlines of each lesson. They provide guidelines to the lesson author; they contain no lesson content. For each lesson within the syllabus, several pages of authoring guidelines are provided:

a. Page 1 (shown in Figure 14) contains the lesson number and title, primary and secondary media, and prerequisite information map. The prerequisite information map lists the five lessons which the student should have completed before taking the subject lesson and the five lessons which he will attend after completing subject lesson. The lesson addressed by the lesson specification is identified in the prerequisite information map by an asterisk located to the left of the lesson number. Lessons are listed in the same order as they occur in the syllabus worksheet.

b. Page 2 (shown in Figure 15) lists the lesson objectives. The objectives are listed in the sequence in which they should be taught in the lesson. Objectives are identified by number, text, and conditions. The classification of each objective is also listed.

The classification of each objective is determined during media selection and referenced at this time to aid the lesson author. Each objective classification refers to a level of content and level of behavior represented by the objective. In conjunction with this, different authoring rules apply depending on the classification of the objective. This is described in MIL-T-29053B. A summary of the authoring requirements for each objective classification is provided by CASOAT and is included in this document on pages 146-153. The following is a list of possible objective classifications.

<table>
<thead>
<tr>
<th>Classification</th>
<th>Level of Content</th>
<th>Level of Behavior</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Familiarization</td>
<td>Remember</td>
</tr>
<tr>
<td>B</td>
<td>Fact</td>
<td>Remember</td>
</tr>
<tr>
<td>C</td>
<td>Concept</td>
<td>Remember</td>
</tr>
<tr>
<td>D</td>
<td>Concept</td>
<td>Use</td>
</tr>
<tr>
<td>E</td>
<td>Rules/Procedures</td>
<td>Remember</td>
</tr>
<tr>
<td>F</td>
<td>Rules/Procedures</td>
<td>Use</td>
</tr>
<tr>
<td>G</td>
<td>Principles</td>
<td>Remember</td>
</tr>
<tr>
<td>H</td>
<td>Principles</td>
<td>Use</td>
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</tbody>
</table>

65
LESSON SPECIFICATION

LESSON REFERENCE NUMBER: FAPA 100
LESSON TITLE: FLIGHT GEAR
AUTHOR: JOE SMITH

PRIMARY MEDIA: ST-SLIDE TAPE
SECONDARY MEDIA: MIL-MEDIATED INTERACTIVE LECTURE

PRE-REQUISITE INFORMATION MAP:

- FAPA 20 NORMAL COMMUNICATIONS
- FAPA 40 TACAN AND NAVID SYSTEMS
- FAPA 60 POWER PLANT OPS AND EMERGENCIES
- FAPA 80 FLIGHT GEAR
- * FAPA 100 FLIGHT GEAR
- FAPT 20 NORMAL COMMUNICATIONS
- FAPT 40 TACAN AND NAVID SYSTEMS
- FAPT 60 POWER PLANT OPS AND EMERGENCIES
- FAPT 80 FLIGHT GEAR
- FAPT 100 FLIGHT GEAR

Figure 14. Example Page 1 Of The Lesson Specification
*** LESSON SPECIFICATION ***

LESSON REFERENCE NUMBER: FAPA 100  AUTHOR: JOE SMITH

LESSON TITLE: FLIGHT GEAR

LESSON OBJECTIVES

<table>
<thead>
<tr>
<th>SEQ #</th>
<th>OBJECTIVE CODE</th>
<th>OBJECTIVES</th>
<th>OBJ. CLASS</th>
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<tr>
<td>1</td>
<td>2.1.15.0.2</td>
<td>STATE INSPECTION POINTS OF TORSO-HARNESS</td>
<td>B FACT-REM</td>
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<tr>
<td></td>
<td></td>
<td>COND: GIVEN FLIGHT GEAR</td>
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<td>D CONCEPT-USE</td>
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<td></td>
<td>COND: GIVEN FLIGHT GEAR</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>2.1.16.0.2</td>
<td>STATE INSPECTION POINTS OF LIFE-VEST</td>
<td>B FACT-REM</td>
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<td>COND: GIVEN FLIGHT GEAR</td>
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</tr>
<tr>
<td>4</td>
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<td>IDENTIFY DOWNING DISCREPANCIES OF SURVIVAL-RADIO</td>
<td>D CONCEPT-USE</td>
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<td></td>
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<tr>
<td>5</td>
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<td>B FACT-REM</td>
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<td>6</td>
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<td></td>
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</tr>
</tbody>
</table>

Figure 15. Example Page 2 Of The Lesson Specification
c. Page 3 (shown in Figure 16) lists the primary and secondary media for the lesson, and the personnel, media, facilities and evaluation support required for each.

The following matrix shows the user and system actions during lesson specification development.

<table>
<thead>
<tr>
<th>USER ACTIONS</th>
<th>SYSTEM ACTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>The user requests lesson specifications from CASDAT.</td>
<td>The system will generate the lesson specification and print on the line printer each lesson and its attributes, including pre-requisite information map, lesson objectives, lesson media and resource worksheet and authoring aids. The lesson specification format and authoring aids are based on the requirements of MIL-T-29053B.</td>
</tr>
<tr>
<td>There is no other user action required to produce the lesson specifications.</td>
<td></td>
</tr>
<tr>
<td>The user uses the lesson specifications as an aid in authoring the lessons.</td>
<td></td>
</tr>
</tbody>
</table>

Appendix E provides examples of the products generated by the system, in context of a sample run of CASDAT.

USEK AIDS. One of the major concerns in developing CASDAT was to facilitate user interaction with the system, particularly SMEs with little or no ISD experience. For this purpose, tutorial information is available to the user at critical points. When uncertain about specific responses required, a user can obtain tutorial information from CASDAT simply by typing in a question mark. Appendix E is structured as a sample run of CASDAT. The information shown is what the user sees on the CRT while using CASDAT. The sample run starts with the user signing on. It continues by showing CRT displays asking for user inputs at each ISD step and sample user inputs. At most critical points in the process, the user has typed in a question mark so that the reader of Appendix E can see what the tutorial is at each point. A sample report is provided at the completion of each ISD step. This will show the reader what the output of each ISD step looks like as it would be printed on the line printer.

A user's manual has been developed for CASDAT. The reader interested in additional information about CASDAT is urged to read this document.

SPECIAL FEATURE. CASDAT is also capable of performing key word searches. The user can type in any word, and CASDAT will search for tasks or objectives containing that word. CASDAT will print out a list of tasks.

LESSON SPECIFICATION

LESSON REFERENCE NUMBER: FAPA 100
LESSON TITLE: FLIGHT GEAR

LESSON MEDIA AND RESOURCE WORKSHEET

PRIMARY MEDIA:
SLIDE/TAPE
PERSONNEL: NONE
MEDIA: SLIDE/TAPE WORKBOOK
FACILITIES: CARREL (U) CARREL (S)
EVALUATION: SELF TEST

SECONDARY MEDIA:
MEDIATED_INTERACTIVE_LECTURE
PERSONNEL: INSTRUCTOR PILOT INSTRUCTOR NFO
MEDIA: CHALKBOARD OVERHEAD TRANSPARENCIES 35MM SLIDES WALLCHART PHOTO PANEL LECTURE GUIDE STRUCTURE NOTES
FACILITIES: CLASSROOM
EVALUATION: GRADE SHEET

Figure 16. Example Page 3 Of The Lesson Specification
and objectives and their sequence numbers which contain the word requested by the user. This capability is very useful if, for example, there is a change to the aircraft. If there is a change in the aircraft heads-up display (HUD) for instance, CASDAT can identify all listed tasks and learning objectives affected by the change. On the other hand, if designers are considering change to the aircraft, they can readily identify the extent that training would be affected if the change were implemented.
CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

Evaluation of the CASDAT system has shown that it has face, content, and construct validity. During evaluation of the prototype system, subject matter experts from several aircraft types (i.e., F-4, F-14, CH-46 and SH-2F) were able to create task listings and objective hierarchies for their aircraft in significantly less time than would be required under traditional ISD methods. In addition, the ISD products generated by CASDAT during this and an earlier evaluation were found to be at least 75 percent complete.

It is difficult to say exactly how complete the current version of CASDAT is, or exactly how much time can be saved by using CASDAT for aircrew ISD. Evaluations conducted thus far have been informal. Rigorous control over the users' activities was not practical and no evaluation has been performed on the current, more complete version of CASDAT. However, based on this partial and informal evaluation of CASDAT combined with a logical analysis of CASDAT's capabilities, one can point with confidence to some expected advantages of using CASDAT. These include:

a. Training analysis is less labor intensive and, therefore, less expensive.

b. Training product standardization is improved.

c. Data manipulation is more efficient and flexible.

d. Data redundancy is reduced.

e. Responses to training program changes are more timely.

f. SME and instructional technologist requirements for training design are reduced.

g. Assessment of effects of operational equipment change on a training program is more timely.

At this point in its developmental process, CASDAT could provide specific use to DoD training development agencies, as follows:

a. Aid the instructional designer in the design of an emerging aircrew training program.

b. Aid the instructional designer in the modification of an existing aircrew training program.

(c. Aid the training manager to quickly assess the impact on the training system of planned or proposed weapon system modifications.

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d. Aid the training system evaluator to quickly evaluate an existing training system and recommend areas for change.

e. Aid the training device manufacturer to assess the training tasks and objectives to which his device must be designed.

RECOMMENDATIONS

It is recommended that a full-scale field trial of CASDAT be conducted. This trial could be accomplished by using CASDAT to design an aircrew training program for a military aircraft. This training program could be designed for an existing or emerging, complete or partial training system. The critical criterion is that the trial include a real design effort, aimed at producing training materials that would be incorporated into an operational training community. This full-scale, field trial would produce more definitive data on the quality of CASDAT's products and its time-saving capabilities. In addition, this evaluation would provide additional insight into the need for user interface enhancements that, then, could be incorporated into CASDAT.

Future research and development on CASDAT needs to address the utility of the system to the operational community. In efforts to increase CASDAT's operational utility, consideration must be given to (1) how the system can be used and (2) the needs of the DoD training community. Three stages of system development have been planned:

a. Additional Mission Phase
b. Additional ISO steps
c. Other jobs

System refinements, such as user interface requirements, will be addressed and evaluated at each phase. The following discusses each stage of CASDAT development.

ADDITIONAL MISSION PHASE. The generic task list model identified eight mission phases that comprise the aircrew job. Currently CASDAT contains aircrew data relating to all but one of these phases, tactics. In order to make CASDAT a more useful operational system, aircrew data must be added for tactics, including the various aircraft missions:

a. Air-to-air
b. Air-to-ground
c. Anti-submarine warfare
d. Airborne early warning/electronic warfare
e. Reconnaissance
f. Mine countermeasures
g. Electronic surveillance
h. Search and rescue
i. Logistics/transport
j. Troop assault/delivery
k. Air refueling

These additions would provide significant advantages to future Department of Defense (DoD) training development efforts for aircrew training. For the first time CASDAT will be able to aid an instructional developer in the design of an entire aircrew training syllabus. Once these data are added, CASDAT would be a completed aid to aircrew ISD for five ISD steps - task list, objective hierarchy, media selection, syllabus, and lesson specifications.

ADDITIONAL ISD STEPS. Twenty-four ISD steps have been documented as being appropriate for automation. Looking at the requirements of the DoD training community, some of these ISD steps are more useful than others. Additional ISD steps which seem to have the most utility to DoD training and procurement requirements at the present time are:

a. problem analysis
b. training support requirements analysis
c. enhanced media selection focused on training device functional requirements.

When these ISD steps are incorporated into CASDAT programming, CASDAT will be able to manipulate aircrew training data over seven ISD steps.

OTHER JOBS. After the developments identified in the foregoing are successfully completed, the feasibility of the concept should be sufficiently demonstrated to suggest that other job areas could benefit from this type of an ISD aid.

CASDAT can be designed to provide similar aids to ISD for other types of operator jobs (e.g., sonar operators), maintenance jobs, and leadership/management jobs. Research and development will be needed to select job areas suitable for CASDAT applications. Suitability will be based on the commonality inherent in the data bases of a particular job area, since this determines the extent to which an area can be served with a generic data base. Priorities for extending CASDAT to other job areas also need to be based on operational requirements for training development. CASDAT should be developed for job areas which need it most.
An obstacle to the extension of CASDAT to other job areas is that appropriate ISD data for specific jobs may not exist in some important areas. In these cases, ISD data would have to be generated for specific jobs before generic data bases could be developed and tested for the whole area.

IMPLICATIONS FOR TRAINING DESIGN

Implications of the CASDAT project for training are far-reaching and highly significant. Because the capabilities of the device are general, many of its applications will evolve only with repeated use, and CASDAT's contributions will be best known in this way. Most benefits to training, however, would seem to derive from the increased speed and standardization, and improved management qualities that CASDAT lends to ISD operators.

The increased speed of ISD operations via CASDAT leads directly to a decrease in man-hour requirements and consequently to dollar savings. Faster ISD operations also allow highly skilled ISD personnel to spend more of their time with more creative aspects of ISD. Instead of performing routine tasks such as collecting information and following routine algorithms, they can apply their skills to higher level problems. For example, because various combinations of media and syllabi can be generated in minutes and hours via CASDAT, instead of days, weeks or months required by traditional manual methods, instructional designers can experiment with changes in system input parameters and even change the ISD methodology itself and explore the effects of such changes on system outputs. Thus, CASDAT's speed can lead to improvements in the product resulting from the ISD effort as well as improvements to the CASDAT system.

Increased ISD speed will also enable ISD procedures to be applied to more training problems, since time, money and/or personnel shortages typically result in less systematic approaches to the development of training systems.

CASDAT's speed can also contribute importantly to the evaluation, maintenance and improvement of existing training systems. Relationships between operational equipment modifications and training program design can be determined through rapid access to the data bases. Similarly, student performance data can be quickly related to relevant portions of the data base. In these ways, training problems that otherwise would go undetected or undefined can be remedied in a timely fashion.

Finally, CASDAT's speed will enable rapid searches of the data bases for specific jobs to determine relationships and uniquenesses among the jobs. This information can be used as basis for developing generalized trainers and for the design of instruction at basic level schools.

CASDAT's management qualities will allow many ISD tasks to be performed by relatively low-skilled personnel. This will save money. It will also allow ISD to be completed where the higher levels of ISD expertise, that normally would be required, are unavailable. The management features can provide an on-the-job training ground for imparting technical ISD skills to ISD team members.
Improved training products are also expected, due to the organization and standardization of ISD operations provided by CASDAT. Deficiencies in currently available data bases and procedures should become more readily apparent with repeated applications of standard procedures and can be continually improved based on these applications. These improvements, in turn, will be passed on to all future applications. This will help assure, for example, that the task listings are generated from the best possible source materials. In the same way, the media pool can be continually improved and introduction of a new medium into the CASDAT system will help assure its consideration in all subsequent ISD applications. Thus, CASDAT can serve to improve not only the testing and implementation of new training technology, but it can also help research and development efforts by identifying technological weaknesses which need to be improved. Standardization of ISD procedures also will encourage similar training at different sites, which allow interchange of personnel and training materials and equipment.

CASDAT can fail to reach its anticipated potential for a variety of reasons having to do with funding constraints and technological barriers, problems common to research and development efforts. A danger perhaps more unique to CASDAT is that the users will attempt to "overuse" the system by accepting CASDAT's products too uncritically, and not properly performing their editing and revision functions. If this occurs, the product will suffer and CASDAT will get the blame. Human creativity is an essential ingredient in ISD and this is even more true with CASDAT.

Another potential problem is that some people will assume that CASDAT's products are produced mechanically, with little human thought and control, even where the system actually is used properly and effectively. This misperception of the CASDAT process could predispose ISD consumers to erroneously reject CASDAT's contributions, without giving them due consideration.
APPENDIX A

TASK LISTING DEVELOPMENT QUESTIONS
(USED TO VERIFY GENERIC DATA BASE FEASIBILITY)

1. What is the aircrew complement?

Indication of the aircrewman focuses all subsequent task listing development activity. Task listings for each individual aircrew member can be selectively retrieved by selecting the desired aircrew position for a given aircraft type. When the task listing is assembled into a single hierarchy, both functional and temporal relationships can be expressed. Thus, the task loading for an individual aircrew member becomes immediately apparent.

2. What are the tactical missions of the aircraft?

Specification of all projected missions provides at least Task level statements for the Mission Phase and Subtask level statements for premission planning (e.g., content of planning activities, types of publications used, etc.), prelaunch, (e.g., types of ordnance to preflight), and navigation, (e.g., navigational objectives such as penetration to a target, maintenance of a cap pattern, etc.). Sub-tasks within the Mission Phase can be generated through correlations with other branching questions, such as "type of WCS" (question 10) or other avionics (question 9) and certain "common sense" subtask additions. For example, if one task is to search for a target, a nominal subtask would be to search for it visually.

3. Will the aircraft be required to launch from an alert/scramble condition?

If the aircraft will be required to launch from a scramble or alert condition, then an additional prelaunch phase must be generated to describe the special procedures associated with this condition. Such changes are well defined for either case, so generation of new tasks is relatively simple.

4. What ordnance, or weapons, will the aircraft carry?

Listing all of the ordnance which the aircraft is capable of carrying will generate the delivery tasks or the premission planning phase and the ordnance preflight tasks during prelaunch, as these are primarily dictated by the nature of that ordnance. Delivery tasks and sub-tasks are, likewise, generated for the mission phase, although they will not be as complete due to the number and varied conditions under which they are employed.
5. Is the aircraft equipped with an ejection seat system?

If an aircraft has an ejection seat system, then prelaunch tasks must include preflight tasks of associated equipment (e.g., oxygen mask, G-suit, etc.) and the seat itself. If there is no ejection seat, various other equipment procedures may be generated, depending on information from another question (question 7)—type of aircraft; depending on the type of aircraft, there may be no seat inspection but instead a preflight of group survival equipment and personal headsets, as is the case for the P-3C.

6. How many engines and of which type does the aircraft have?

The number of engines will determine the number of starting procedures generated for the task listing and will also dictate the presence of partial/single engine flight procedures. The type of engines will affect the subtasks and steps associated with any start procedure. When correlated with question 7, aircraft type, blade engagement tasks may be appended to the start procedures. When correlated to question 17, military service, cartridge start procedures may be added to Air Force aircraft.

7. What is the basic nomenclature (i.e., type) of the aircraft?

Such information as fixed wing, variable geometry, helicopter, or vectored thrust will help to generate tasks for virtually all phases of the task analysis. Helicopters must show tasks for hovering, as well as running, takeoffs and must perform autogiro approaches. Variable geometry aircraft must have procedures for flight with malfunctioning wing programs. Vectored thrust aircraft must have task sets for performing tactical flight maneuvers using vector thrust augmentation.

8. Is the aircraft equipped with an INS?

The inertial navigation system is separated from other avionics systems due to the distinct tasks associated with this equipment. If an aircraft is equipped with an INS, then alignment procedures and updating procedures must be added to the task listing. Correlation with (question 11) carrier capability, further adds the tasks for on-deck alignment with ship sources. If the aircraft will be required to scramble start (question 3), then rapid alignment procedures must be included. With just this information (as avionics, to follow) a task listing can be generated to the subtask level; if specific equipment (e.g., the AN/ARN__) can be entered into the data base, then the task listing can be generated all the way to the step level.
9. What is the avionics suit of the aircraft?

Tasks and subtasks can be generated regarding activation, BIT checks, and basic system usage (e.g., navigate using TACAN, navigate using ADF, BIT check the data link, etc.). Basic correlations between systems may also be possible (e.g., update INS with TACAN). Again, if specific models of equipment are known in the data base, the addition of certain lower-order subtasks is possible (e.g., perform air-to-air ranging with TACAN—if the particular model of TACAN has this feature) and the task listing may even be generated to the step level.

10. What are the features/applications of the aircraft WCS?

Although weapon control systems are probably the most specific types of aircraft equipment, knowledge of certain basic features, plus correlation with other task listing development questions (e.g., 2) mission and 4) ordnance) can yield a capability to generate at least some tasks and subtasks for prelaunch, navigation, and mission requirements. A preliminary list of WCS question elements would include such information as:

1) Type of systems: Gunsight
Cameras
Infrared
Sonar
ECM systems--active/passive
Radar
TISEO
MAD/JEZEBEL
Data Link

2) Use of systems: Associate each piece of equipment (above) with all applicable missions.

Not all aircraft missions will use the WCS installed, but the association step (question 2) above will assist in the generation of sub-tasks unique to each system. For example, a radar may be used for intercepts, bombing, and navigation, while TISEO would only be used for intercepts. Thus, the radar system must show three sets of sub-tasks in the task analysis and the association operation would supply at least the first subtask for each "task tree."

11. Is the aircraft capable of carrier operations?

If the aircraft is to be carrier launched, selected mission phases will have to be repeated for the task listing in order to account for the specialized carrier procedures found in each phase. These phases are, a) prelaunch (including yet another set of procedures if the aircraft uses a scramble start, (question 3), b) takeoff/departure, c) approach/landing, and d) post mission. Addition of these tasks is relatively simple, as such procedures are broken down in the Navy
CV NATOPS manual by jet, prop, and helicopter, providing an easy generation task through correlation with questions 6 and 7.

12. Is the aircraft capable of SATS operations?

The Navy/USMC SATS system is a short airstrip with modified catapulting and arresting equipment. It is intended for operation in remote areas following rapid setup by ground troops. If an aircraft is intended for use with this system, additional tasks must be added to the basic task listing in exactly the same way as carrier procedures. Tasks sufficient to complete these portions of the hierarchy can be generated by a generic base, but use of the SATS system is practically nonexistent and it may prove most efficient to delete this question entirely.

13. Is aircraft intended for formation flight?

If the aircraft is capable of formation flight, additional tasks for this must be added for takeoff, navigation, mission phases, approach and landing. Correlation with military service can further modify the task analysis by grouping formation flight tasks in a separate category for USAF aircraft (in keeping with this service's practice).

14. Is the aircraft equipped with a tailhook?

If the aircraft has a tailhook, then landing tasks for arrestsments must be generated. Having a tailhook is not the same as being carrier capable, (e.g., USAF fighters, most of which have tailhooks).

15. Is the aircraft capable of hot refueling?

A basic refueling task set may be added to the initial list if the aircraft will be hot refueling as part of expected operations. If included, this task set occupies a discrete time slice, much the same as a mission phase.

16. Is the aircraft capable of airborne refueling?

If the aircraft can refuel airborne, an additional set of generic tasks can be added to the task listing for this activity. Like question 15, this set is a discrete "time slice."
APPENDIX B

GENERIC TASK LIST
1.1 Collect mission data

1.1.1 Select appropriate pubs
- aircraft data pubs
- navigation pubs
- tactical pubs
- special-purpose pubs

1.1.2 Gather required data
- aircraft data
- weather data
- tactical data
- navigation data
- intelligence data
- ordnance data

1.2 Compute mission data

1.2.1 Compute aircraft data
- station-load
- center-of-gravity
- drag index
1.0 Perform Mission Planning Procedures

1.2.2 Compute aircraft takeoff and landing data

1.2.3 Compute navigation data

1.2.4 Compute Tactic Data

Compute ___
- conventional takeoff distance
- vertical takeoff capability
- aircraft hover capability
- vertical landing capability
- conventional landing capability
- conventional landing distance

Compute ___
- departure navigation data
- cruise navigation data
- descent navigation data
- approach data

Compute ___
- air-to-ground data
- air-to-air data
- logistics data
- SAR data
- ASW data
- ESM data
- RECC data
- AEW data
- mine counter
- assault data
- air-refuel data
1.3 Perform navigation planning

1.3.1 Perform navigation planning using
- data-link
- INS
- UHF
- VHF
- HF
- TACAN
- ADF
- radar
- visual procedures
- VOR
- FMS
- HUD
- compass
- Loran C
- satellite
- omega
- doppler
- dead reckoning computer
- MLS
- JTIDS

1.4 Record mission planning data

1.4.1 Prepare mission planning data

Prepare
- chart data
- navigation log data
- tactical log data

Other data
- air-to-ground delivery data
- air-to-air delivery data
- logistics data
- IR data
- MW data
- MN data
- ECC data
- EW data
- counter-measures data
- assault data
- air-refueling data
1.4 Record mission planning data

1.4.1 Prepare mission planning data

Prepare:
- chart data
- navigation log data
- tactical log data

1.5 Perform briefing activities

1.5.1 Prepare mission brief

Prepare:
- briefing aids
- aircraft data
- takeoff and landing data
- navigation data
- tactical data

1.5.2 Conduct mission brief

Conduct:
- mission objective brief
- operating area brief
- weapons procedures brief
- communications plan brief
- weather brief
- navigation brief
- operational emergency brief
- intelligence and special instructions brief
- rules of engagement brief
2.1 Select/prepare personal equipment

2.1.1 Select appropriate gear
- appropriate flight gear
- appropriate survival gear

2.1.2 Prepare personal equipment
- flight gear
- survival gear

2.2.1 Perform exterior inspection of aircraft
- fuel system
- power plant system
- hydraulic system
- electrical system
- landing gear system
- catapult/arresting hook system
- flight control system
- environmental control system
- escape/egress system
2.2 Perform exterior preflight inspections

2.2.2 Perform exterior inspection of expendables

- gun
- air-to-air missiles
- air-to-ground missiles
- rockets
- bombs
- depth-charge
- torpedo
- sonar sensors
- mines
- chaff
- flares
- jammer
- fuel tanks

2.2.3 Perform exterior inspection of aircraft mission system

- infra-red
- laser
- camera
- air-to-air radar
- air-to-ground radar
- MAD
- Jezabel
- sonar
- gunsight
- INM
- sonobuoy
- TILBO/TVSU
- refuel boom
- hoist/rescue system
- cargo extraction system
- mine counter measures system
- TF/TA
- AN/ASW suite
- troop carrier equipment
- ECM/DECM

2.3.1 Perform before-entering cockpit inspections

Inspect
- aircraft cockpit
- escape system
2.3 Perform interior preflight inspections

2.3.2 Perform before-electrical power inspections

2.3.3 Perform after-electrical power inspections

2.4 Perform engine start procedure

2.4.1 Perform before-starting engine inspections

2.4.2 Perform start engine procedure
2.4.2 Respond to engine-start emergencies

2.5.1 Perform flight controls check/set-up

2.5.2 Perform avionics systems check/set-up

Respond to engine
- engine hung start
- engine hot start
- engine fire on start
- engine wet start
- engine engaged starter
- runaway engine start

Perform check/set-up of
- FMS
- HUD
- UHF
- VHF
- HF
- ADF
- "K-26
- JTIDS
- IFF
- radar
- INS
- TACAN
- VOR
- compass
- Loran C
- satellite
- Omega
- doppler
- dead reckoning computer
- visual procedures
- MLS
- data-link
PRELAUNCH

2.0
Perform prelaunch procedures

2.5.3
Perform aircraft mission systems check/set-up

- infra-red
- laser
- camera
- air-to-air radar
- air-to-ground radar
- MAD
- Jezebel
- sonar
- gunsight
- ESM
- sonobuoy
- TIGRO/TBSU
- refuel boom
- hoist/rescue system
- cargo extraction system
- mine counter measures system
- TP/TA
- AWACS/AEW suite
- troop carrier equipment
- ECM/DEM

2.5.4
Perform expendables check/set-up

- gun
- air-to-air missiles
- air-to-ground missiles
- rockets
- bombs
- depth-charge
- torpedo
- sonar-sensors
- mines
- chaff
- flares
- jammer
- fuel-tanks

2.6.1
Perform field taxi

- fixed-wing
- field taxi
2.6
Perform
taxi

2.6.1
Perform
docked
taxi

2.6.2
Perform
carrier
taxi

2.6.3
Respond
to taxi
emergencies

2.6.4
Perform
taxi
communications

- failed brake
emergencies
- failed NGS
emergencies

Perform
- helo carrier
desk taxi
- helo carrier
dock hover
taxi
- fixed wing
carrier deck
taxi

Respond to
- failures
2.7.2.2
Perform carrier takeoff checks/set-up

2.7.2.1.3
Configure avionics for takeoff

2.7.2.2.1
Configure aircraft for carrier takeoff

2.7.2.2.2
Configure aircraft mission systems for carrier takeoff

Perform takeoff configuration of

FMS
RDF
UFN
VHF
HF
ADF
KY-28
JYIDS
IFF
radar
INS
TDSW
VOR
compass
Loran C
satellite
omega
doppler
dead reckoning computer
visual procedures
RLO
data-link

Perform takeoff configuration of

- fuel systems
- power plant system
- hydraulic system
- electrical system
- landing gear system
- catapult/ arresting hook system
- flight control system
- environmental control system
- escape/ egress system
- misc. aircraft systems

Perform takeoff configuration of

- infra-red
- laser
- camera
- air-to-air radar
- air-to-ground radar
- MAD
- Javelin
- sonar
- gunnights
- ECM
- sonobuoy
- TISEO/TVSU
- refuel boom
- hoist/ rescue system
- cargo extraction system
- missile counter measures system
- TF/TA
- AN/BCS/EM suite
- troop carrier equipment
- ECM/DSM
2.7.3
Position
aircraft
for takeoff

2.7.3.1
Establish field
takeoff position

2.7.2.2.3
Configure
avionics
for carrier
takeoff

Perform takeoff
configuration
of
- FMS
  - HUD
- UHF
- VHF
- HF
- ADF
- KY-28
- JTIDS
- IFF
- radar
- INS
- TACAN
- VOR
- compass
- Loran C
- satellites
- omega
- doppler
- dead reckoning computer
- visual procedures
- MILS
- data-link

2.7.3.2
Establish carrier
takeoff position

2.7.3.2.1
Perform
catapult
hookup
3.1 Perform takeoff procedure

3.1.1 Perform field takeoff

Perform:
- field vertical takeoff
- field rolling verticle takeoff
- short field takeoff
- field conventional takeoff
- field crosswind takeoff
- field aborted takeoff
- field formation takeoff

3.1.2 Perform ship takeoff

Perform:
- ship catapult takeoff
- ship vertical takeoff
- ship ramp takeoff
- ship deck-launch takeoff
3.1.3 Perform takeoff communications

3.1.3.2 Communicate with other aircraft for takeoff

Communicate with other aircraft using:
- UHF
- VHFS
- HF
- ADV
- FY-29
- JTIDS
- VOR
- satellite
- visual procedures
- data-link

3.1.4 Respond to takeoff emergencies

Respond to:
- engine fire
- engine flameout
- afterburner failure
- electrical failure
- blown tire
- hydraulic failure
- flight control failure
- high AOA

3.2.1 Perform takeoff transition

Perform:
- forward flight transition
- takeoff altitude transition
- hover transition
- accelerated transition
3.2.2 Configure systems for departure

3.2.2.1 Configure aircraft for departure

3.2.2.2 Configure aircraft mission systems for departure

3.2.2.3 Configure avionics for departure

Perform departure configuration of
- fuel systems
- power plant system
- hydraulic system
- electrical system
- landing gear system
- catapult/arresting hook system
- flight control system
- environmental control system
- escape/egress system
- misc. aircraft systems

Perform departure configuration of
- infrared
- laser
- camera
- air-to-air radar
- air-to-ground radar
- MAD
- Jazebel
- sonar
- gun sighting
- INS
- sonobuoy
- TISEO/TVSU
- refuel boom
- hoist/rescue system
- cargo extraction system
- mine counter measures system
- LITFA
- HARM/ASM suite
- troop extraction equipment
- ECM/DEM

Perform departure configuration of
- FMS
- HUD
- UHF
- VHF
- HF
- ADP
- KY-28
- JTIDS
- IF7
- radar
- IRS
- TACAN
- VOR
- compass
- Loran C
- satellite
- anpass
- Doppler
- dead reckoning
- visual guidance
- INS
- navigation
3.2
Perform
departure
procedures

3.2.3
Perform
climbout
procedures

3.2.3.1
Perform climbout procedures using
- FMS
- HUD
- UHF
- VHF
- HF
- ADF
- JTIDS
- radar
- INS
- TACAN
- VOR
- compass
- Loran C
- satellite
- omega
- doppler
- dead reckoning computer
- visual procedures
- MLS
- data-link

3.2.3.2
Perform rendezvous using
- FMS
- HUD
- UHF
- VHF
- HF
- ADF
- JTIDS
- radar
- INS
- TACAN
- VOR
- Compass
- Loran C
- Satellite
- omega
- doppler
- dead reckoning computer
- visual procedures
- MLS
- data-link

3.2.3.3
Fly formation using
- FMS
- HUD
- UHF
- VHF
- HF
- ADF
- JTIDS
- radar
- INS
- TACAN
- VOR
- compass
- Loran C
- satellite
- omega
- doppler
- dead reckoning computer
- visual procedures
- MLS
- data-link
3.2.4 Perform departure communications

3.2.4.1 Communicate with ground stations for departure

Communicate with ground stations using:
- UHF
- VHF
- HF
- ADF
- KY-28
- JTIDS
- VOR
- satellite
- visual procedures
- data-link

3.2.4.2 Communicate with other aircraft for departure

Communicate with other aircraft using:
- UHF
- VHF
- HF
- ADF
- KY-28
- JTIDS
- VOR
- satellite
- visual procedures
- data-link

3.2.3.3 Fly formation using:
- FMS
- HUD
- UHF
- VHF
- HF
- ADF
- JTIDS
- radar
- INS
- TACAN
- VOR
- compass
- Loran C
- satellite
- omega
- doppler
- dead reckoning computer
- visual procedures
- MLS
- data-link
4.1 Configure navigation systems

Configure for navigation using:
- FMS
- HOD
- UHF
- VHF
- HF
- ADF
- JTIDS
- radar
- INS
- TACAN
- VOR
- compass
- Loran C
- satellite
- omega
- doppler
- dead reckoning computer
- visual procedures
- MLS
- data-link

4.2 Maneuver aircraft for navigation

4.2.1 Fly a navigation course/heading

Fly a course heading with:
- FMS
- HOD
- UHF
- VHF
- HF
- ADF
- JTIDS
- radar
- INS
- TACAN
- VOR
- compass
- Loran C
- satellite
- omega
- doppler
- dead reckoning computer
- visual procedures
- MLS
- data-link

4.2.2 Fly a vector with:
- FMS
- HOD
- UHF
- VHF
- HF
- ADF
- JTIDS
- radar
- INS
- TACAN
- VOR
- compass
- Loran C
- satellite
- omega
- doppler
- dead reckoning computer
- visual procedures
- MLS
- data-link
4.0
Perform Navigation Procedures

4.2.4
Fly a navigation arc

4.2.5.1
Communicate with ground stations for navigation

4.2.3
Fly a navigation point-to-point

Fly a point-to-point using:
- FMS
- NAVAID
- UHF
- VHF
- LF
- ADF
- JTIDS
- radar
- INS
- TACAN
- VOR

- compass
- Loran C
- satellite
computer
- Doppler
dead reckoning computer
- visual procedures
- INS
- data-link

Fly an arc using:
- FMS
- NAVAID
- UHF
- VHF
- LF
- ADF
- JTIDS
- radar
- INS
- TACAN
- VOR
- computer
- Loran C
- satellite
- compass
- Doppler
dead reckoning computer
- visual procedures
- INS
- data-link

Communicate with ground stations using:
- UHF
- VHF
- LF
- ADF
- KT-28
- JTIDS
- VOR
- satellite
- visual procedures
- data-link
4.3 Perform navigation systems evaluation

4.4 Respond to navigation system malfunctions

Evaluate aircraft
- FMS
- HUD
- UHF
- VHF
- HF
- ADF
- JTIDS
- radar
- INS
- TACAN
- VOR
- compass
- Loran C
- satellite
- omega
- doppler
- dead reckoning computer
- visual procedures
- MLS
- data-link

Respond to malfunctions of
- FMS
- HUD
- UHF
- VHF
- HF
- ADF
- JTIDS
- radar
- INS
- TACAN
- VOR
- compass
- Loran C
- satellite
- omega
- doppler
- dead reckoning computer
- visual procedures
- MLS
- data-link

Communicate with other aircraft
- TACAN
- VOR
- compass
- Loran C
- satellite
- omega
- doppler
- dead reckoning computer
- visual procedures
- MLS
- data-link

Communicate with other aircraft for navigation
- UHF
- VHF
- HF
- ADF
- NAV
- JTIDS
- VOR
- satellite
- visual procedures
- data-link

Communicate with other aircraft using
- UHF
- VHF
- HF
- ADF
- VHF
- JTIDS
- VOR
- satellite
- visual procedures
- data-link
4.3 Perform navigation system evaluation

4.4 Respond to navigation system malfunctions

4.5 Respond to navigation emergencies

Evaluate aircraft:
- FMS
- HUD
- UHF
- VHF
- HF
- ADF
- JTIDS
- radar
- INS
- TACAN
- VOR
- compass
- Loran C
- satellite
- omega
- doppler
- dead reckoning computer
- visual procedures
- MLS
- data-link

Respond to malfunctions of:
- FMS
- HUD
- UHF
- VHF
- HF
- ADF
- JTIDS
- radar
- INS
- TACAN
- VOR
- compass
- Loran C
- satellite
- omega
- doppler
- dead reckoning computer
- visual procedures
- MLS
- data-link

Respond to:
- BCS failure
- generator failure
- engine oil level low
- engine fire overheating
- smoke/fumes
- fuel transfer malfunction
- hydraulic system failure
- loss of cabin pressure
6.1 Perform descent

6.1.1 Configure systems for descent

6.1.1.1 Configure aircraft for descent

6.1.1.2 Configure aircraft mission systems for descent

6.1.1.3 Configure avionics for descent

Perform descent configuration of:
- fuel systems
- power plant system
- hydraulic system
- electrical system
- landing gear system
- catapult/arresting hook system
- flight control system
- environmental control system
- escape/egress system
- misc. aircraft systems

Perform descent configuration of:
- infra-red
- laser
- camera
- air-to-air radar
- air-to-ground radar
- MAD
- Jessebel
- sonar
- gyrosight
- ESM
- sonobuoy
- TISEO/TVSU
- refuel boom
- hoist/rescue system
- cargo extraction system
- mine counter measures system
- TT/TA
- AHACS/AHWS suite
- troop carrier equipment
- ECM/DECM

Perform descent configuration of:
- FMS
- HUD
- UHF
- VHF
- HF
- ADF
- KT-28
- JTIDS
- IFF
- radar
- INS
- TACAN
- VOR
- compass
- Loran C
- satellite
- omega
- doppler
- dead reckoning
- visual procedures
- MLS
- data-link
6.1.2
Fly enroute descent

6.2.1
Configure systems for approach

6.2.1.1
Configure aircraft for approach

6.2.1.2
Configure aircraft mission systems for approach

Perform approach configuration of
- fuel systems
- power plant system
- hydraulic system
- electrical system
- landing gear system
- catapult/arresting hook system
- flight control system
- environmental control system
- escape/egress system
- misc. aircraft systems

Perform approach configuration of
- infra-red
- laser
- camera
- air-to-air radar
- air-to-ground radar
- MAD
- Jessebel
- sonar
- gunsight
- ESM
- sonobuoy
- TISEO/TVSU
- refuel boom
- hoist/rescue system
- cargo extraction system
- mine counter measures system
- TF/TA
- AWACS/AEM suite
- troop carrier equipment
- ECM/DECM
6.2
Perform approach procedures

6.2.2
Establish/depart holding fix

6.2.3
Penetrate to approach altitude

6.2.1.3
Configure avionics for approach

Perform approach configuration of:
- FMS
- HUD
- UHF
- VHF
- HF
- ADF
- KY-28
- JTIDS
- IFF
- radar
- INS
- TACAN
- VOR
- compass
- Loran C
- satellite
- omega
- doppler
- dead reckoning computer
- visual procedures
- MLS
- data-link

Establish/depart holding using:
- FMS
- HUD
- UHF
- VHF
- HF
- ADF
- JTIDS
- radar
- INS
- TACAN
- VOR
- compass
- Loran C
- satellite
- omega
- doppler
- dead reckoning computer
- visual procedures
- MLS
- data-link

Penetrate to approach altitude using:
- FMS
- HUD
- UHF
- VHF
- HF
- ADF
- JTIDS
- radar
- INS
- TACAN
- VOR
- compass
- Loran C
- satellite
- omega
- doppler
- dead reckoning computer
- visual procedures
- MLS
- data-link

Execute final approach using:
- FMS
- UHF
- VHF
- HF
- ADF
- JTIDS
- radar
- INS
- TACAN
- VOR
- compass
- Loran C
- satellite
- omega
- doppler
- dead reckoning computer
- visual procedures
- MLS
- data-link
APPROACH AND LANDING

6.0
Perform Approach/
Landing procedures

6.3.1
Configure
aircraft for
landing

6.3.1.1
Configure aircraft
for landing

6.3.1.2
Configure aircraft
mission systems
for landing

6.3.1.3
Configure
avionics
for landing

Performs landing
configuration of:
- fuel systems
- power plant system
- hydraulic system
- electrical system
- landing gear system
- catapult/arresting hook system
- flight control system
- environmental control system
- escape/egress system
- misc. aircraft systems

Perform landing
configuration of:
- infra-red
- laser
- camera
- air-to-air radar
- air-to-ground radar
- MAD
- Jezebel
- sonar
- gunsight
- ESM
- sonobuoy
- TISEO/TVSU
- refuel boom
- hoist/rescue system
- cargo extraction system
- mine counter measures system
- TF/TA
- AWACS/AEW suite
- troop carrier equipment
- ECM/DECM

Perform landing
configuration of:
- FMS
- HUD
- UHF
- VHF
- HF
- ADF
- LX-28
- JTIDS
- IFF
- radar
- INS
- TACAN
- VOR
- compass
- Loran C
- satellite
- omega
doppler
- dead reckoning
- visual procod
- MLS
- data-link
6.3
Perform landing procedures

6.3.2
Perform field landing

6.3.3
Perform ship landing

Perform
- field vertical landing
- field decelerating transition landing
- field hover landing
- field rolling landing
- field slow landing
- field brake slow landing
- field conventional landing
- field crosswind landing
- field waveoff

Perform
- ship vertical landing
- ship waveoff
- ship arrested landing
- ship bolter landing
- ship barricade landing

Respond to
- engine fail
- hydraulic fail
- electrical fail
- fuel malfun
- landing gear fail
- blown tire
- hung ordn
- brake fail
- radio out
- NGS failure
- flap fail
- no flap
6.5 Perform approach/landing communications

6.5.1 Perform descent communications

- 6.5.1.1 Communicate with ground stations for descent
  - Perform descent communications with ground stations using:
    - UHF
    - VHF
    - HF
    - ADF
    - KY-28
    - JTIDS
    - VOR
    - satellite
    - visual procedures
    - data-link

- 6.5.1.2 Communicate with other aircraft for descent
  - Perform descent communications with other aircraft using:
    - UHF
    - VHF
    - HF
    - ADF
    - KY-28
    - JTIDS
    - VOR
    - satellite
    - visual procedures
    - data-link

6.5.2 Perform approach communications

- 6.5.2.1 Communicate with ground stations for approach
  - Perform approach communications with ground stations using:
    - UHF
    - VHF
    - HF
    - ADF
    - KY-28
    - JTIDS
    - VOR
    - satellite
    - visual procedures
    - data-link

- 6.5.2.2 Communicate with other aircraft for approach
  - Perform approach communications with other aircraft using:
    - UHF
    - VHF
    - HF
    - ADF
    - KY-28
    - JTIDS
    - VOR
    - satellite
    - visual procedures
    - data-link
6.5 Perform approach/landing communications

6.5.2 Perform approach communications

6.5.2.1 Communicate with ground stations for approach

6.5.2.2 Perform approach communications with other aircraft for approach using:
- UHF
- VHF
- HF
- ADF
- KY-28
- JTIDS
- VOR
- satellite
- visual procedures
- data-link

6.5.3 Perform landing communications

6.5.3.1 Communicate with ground stations for landing

6.5.3.2 Perform landing communications with other aircraft for landing using:
- UHF
- VHF
- HF
- ADF
- KY-28
- JTIDS
- VOR
- satellite
- visual procedures
- data-link
7.1.1 Configure systems for post-landing

7.1.1.1 Configure aircraft for post-landing

- fuel systems
- power plant system
- hydraulic system
- electrical system
- landing gear system
- catapult/ arresting hook system
- flight control system
- environmental control system
- escape/ egress system
- misc. aircraft systems

7.1.1.2 Configure aircraft mission systems for post-landing

Perform post-landing configuration of:
- infra-red
- laser
- camera
- air-to-air radar
- air-to-ground radar
- MAD
- jamming
- sonar
- gunsight
- ESM
- sonobuoy
- TIGER/THBS
- refuel boom
- hoist/rescue system
- cargo extraction system
- mine counter measures system
- TVTA
- HACS/ASM suite
- troop carrier equipment
- ECM/IDB

7.1.1.3 Configure avionics systems for post-landing

Perform post-landing configuration of:
- FMS
- HUD
- UHF
- VHF
- RT
- ADF
- KU-28
- JPSDS
- EPP
- radar
- INS
- TACAN
- VOR
- compass
- Loran C
- satellite
- umage
- doppler
- dealer tracking or
- visual proccessing
- EMO-1/60
7.1.2 Perform dearm procedures

7.1.3 Perform post-flight taxi

7.1.3.1 Perform field taxi

7.1.3.2 Perform carrier taxi

Perform dearm procedures for:
- gun
- air-to-air missiles
- air-to-ground missiles
- rockets
- bombs
- depth-charge
- torpedo
- sensor-sensors
- mines
- chaff
- flares
- jammer
- fuel-tanks

Perform:
- halo shorebased ground taxi
- halo shorebased hover taxi
- fixed-wing field taxi

Perform:
- halo carrier deck taxi
- halo carrier deck hover taxi
- fixed wing carrier deck taxi
3.3 \textit{Lead to taxi agencies}

3.4 \textit{Lead brake agencies}

3.5 \textit{Lead MOS agencies}

* 7.1.1 \textit{Perform flight control and taxiing procedures}

7.1.4 \textit{Perform taxi communications}

7.1.4.1 \textit{Communicate with ground stations for post-mission}

- UHF
- VHF
- HF
- ADF
- VASI-28
- JTIDS
- VOR
- satellite
- visual procedures
- data-link

7.1.4.2 \textit{Communicate with other aircraft for post mission}

- UHF
- VHF
- HF
- ADF
- VASI-28
- JTIDS
- VOR
- satellite
- visual procedures
- data-link

7.1.5.1 \textit{Perform flight controls shut-down}
1 Perform post-landing activities

7.1.5 Perform systems shutdown

7.1.5.2 Perform expendables shutdown

7.1.5.3 Perform aircraft mission systems shutdown

7.1.5.4 Perform avionics systems shutdown

7.1.5.5 Perform engine shutdown inspection

Perform shutdown of:
- infra-red
- laser
- camera
- air-to-air radar
- air-to-ground radar
- MAD
- Jesebel
- sonar
- gunsight
- ESM
- sonobuoy
- TACAN/TACAN
- refuel boom
- hoist/rescue system
- cargo extraction system
- mine countermeasures system
- TP/TA
- AN/ACS/ASEN suite
- troop carrier equipment
- EMI/DEMI

Perform shutdown of:
- FMS
- HUD
- UHF
- VHF
- HF
- ADF
- KY-26
- JTIDS
- IFF
- radar
- INS
- TACAN
- VOR
- compass
- Loren C
- satellite
- camera
doppler
- dead reckoning computer
- visual procedures
- MLS
- data-link
POST MISSION

7.6 Perform Post-Mission Procedures

7.1.6 Perform interior post-flight inspections

7.1.5.6 Perform engine shutdown procedures

7.1.5.7 Respond to post-flight engine shutdown emergencies

Respond to
- ground emergencies
- engine fire

7.1.6.1 Perform before exiting cockpit inspections

7.1.6.1.1 Inspect cockpit

7.1.6.1.1.1 Inspect engine systems
7.1.7
Perform exterior post-flight inspections

7.1.7.1
Perform exterior inspection of aircraft

- fuel systems
- power plant systems
- hydraulic system
- electrical system
- landing gear system
- catapult/arresting hook system
- flight control system
- environmental control system
- escape/egress system
- misc. aircraft systems

7.1.7.2
Perform post-flight inspection of expendables

- gun
- air-to-air missiles
- air-to-ground missiles
- rockets
- bombs
- depth-charge
- torpedo
- sonar-sensors
- mines
- chaff
- flares
- jammer
- fuel-tanks

7.1.7.3
Perform post-flight inspection of

- infra-red
- laser
- camera
- air-to-air radar
- air-to-ground radar
- MAD
- Jazabel
- sonar
- gunsight
- ECM
- sonobuoy
- TASS/TVBU
- refuel boom
- hoist/rescue equipment
- cargo extraction system
- mine counter
- TF/TF
- AN/AAQ as
- troop-carrier
- ECM/DECM
7.2.1 Perform maintenance debrief

7.2.1.1 Prepare maintenance forms

7.2.1.2 Conduct maintenance debrief

7.2.1.2.1 Debrief aircraft mission systems

- infra-red
- laser
- camera
- air-to-air radar
- air-to-ground radar
- HUD
- Jesabel
- sonar
- gunsight
- ESM
- sonobuoy
- TISNO/TYESU
- refuel boom
- hoist/rescue system
- cargo extraction system
- mine counter measures system
- TH/TA
- AN/USQ/AV suite
- troop carrier equipment
- ECM/DECM

7.2.1.2.2 Debrief avionics systems

- FMS
- HUD
- UHF
- VHF
- HF
- ADF
- KY-28
- JTIDS
- IFF
- radar
- IIS
- TACAN
- VOR
- compass
- Loren C
- satellite
- Omega
- doppler
- dead reckoning computer
- visual procedures
- MLS
- data-link

7.2.1.2.3 Debrief expendables

- gun
- air-to-air missile
- air-to-ground missile
- rockets
- bombs
- depth-charge
- torpedo
- sonar-sensors
- mines
- chaff
- flares
- jammer
- fuel-tanks
7.2 Conduct debrief

7.2.1 Prepare mission debrief

7.2.2 Conduct debrief
- fuel systems
- power plant system
- hydraulic system
- electrical system
- landing gear system
- catapult/arresting hook system
- flight control system
- environmental control system
- escape/egress system
- misc. aircraft systems

7.2.2.4 Debrief aircraft

Debrief of:
- mission objectives
- operational areas
- weapons procedures
- communications
- weather
- navigation
- operational emergencies
- intelligence and special operations
- rules of engagement
8.1.1 Perform refueling rendezvous

8.1.1.1 Perform tanker rendezvous

8.1.1.2 Perform ship rendezvous

8.1.2 Fly refueling formation

8.1.2.1 Fly formation with tanker

8.1.2.2 Fly formation with ship
8.1.3.2
Configure for ship air refueling

8.1.3.2.2
Configure aircraft mission systems for ship air refueling

8.1.3.2.3
Configure avionics for ship air refueling

8.1.4
Perform tanker air refueling
8.1 Conduct air refueling

8.1.4.2 Perform ship air refueling

8.1.5.1 Reconfigure from tanker air refueling

8.1.5.1.1 Reconfigure aircraft from tanker air refueling

Perform reconfiguration of:
- Fuel system
- Power plant system
- Hydraulic system
- Electrical system
- Landing gear system
- Compass/Navigation system
- Flight control system
- Environmental control system
- Avionics systems

8.1.5.1.2 Reconfigure aircraft mission systems from tanker air refueling

Perform reconfiguration of:
- Avionics
- Air-to-air radar
- Air-to-ground radar
- FLIR
- Sidestick
- Controls
- Navigation
- Communications
- Radar
- EW
- Mission/Support equipment

8.1.5.1.3 Reconfigure avionics from tanker air refueling

Perform reconfiguration of:
- Avionics
- Air-to-air radar
- Air-to-ground radar
- FLIR
- Sidestick
- Controls
- Navigation
- Communications
- Radar
- EW
- Mission/Support equipment
- EW
SPECIAL OPERATIONS

8.0  Perform Special Operations Procedures

8.1.5  Reconfigure systems from air refueling

8.1.5.2  Reconfigure from ship air refueling

8.1.5.2.1  Reconfigure aircraft from ship air refueling

8.1.5.2.2  Reconfigure aircraft mission systems from ship air refueling

8.1.5.2.3  Reconfigure avionics from ship air refueling

Perform reconfiguration of:
- fuel systems
- power plant system
- hydraulic system
- electrical system
- landing gear system
- catapult/arresting hook system
- flight control systems
- environmental control system
- escape/evacuation systems
- blind aircraft systems

Perform reconfiguration of:
- infra-red
- laser
- camera
- air-to-air radar
- air-to-ground radar
- AAC
- Javelin
- laser
- gun
- MSE
t note
- TASS/TVS
- refuel hose
- hoist/rescue system
- cargo extraction system
- mine counter measures system
- W/TI
- MECH/ASM suits
- troop carrier equipment
- ECM/IRC

Perform reconfiguration of:
- INS
- EOF
- UW
- IFCT
- UF
- ADP
- EFT-20
- STIDS
- IFP
- radar
- INS
- TACAN
- WVR
- compass
- Loran C
- satellite
- compass
- Doppler
- dead reckoning
- visual procedures
- MLS
- data-link
8.1.6 Perform clearing procedures

8.1.6.2 Perform ship clearing procedures

8.1.7 Perform air refueling communications

8.1.7.1 Communicate with tanker

8.1.7.2 Communicate with other aircraft

Communicate with tanker using:
- UHF
- VHF
- HF
- MF
- MF-25
- JTIDS
- VOR
- satellite
- visual procedures
- data-link

Communicate with other aircraft using:
- UHF
- VHF
- HF
- MF
- MF-25
- JTIDS
- VOR
- satellite
- visual procedures
- data-link

8.1.7.3 Communicate ship

Communicate ship using:
- UHF
- VHF
- HF
- MF
- MF-25
- JTIDS
- VOR
- satellite
- visual
- data-link
6.1.3
Respond to air refueling emergencies

With

- emergency break-away
- disconnect-system
- receptacle failure

8.2.1.1
Configure aircraft for hot refueling

Configure
- fuel systems
- power plant systems
- hydraulic systems
- electrical systems
- landing gear systems
- catapult/ejecting hook systems
- flight control systems
- environmental control systems
- avionics/support systems
- miscellaneous aircraft systems

8.2.1.2
Configure aircraft mission systems for hot refueling

Configure
- active
- laser
- sensor
- air-to-air radar
- air-to-ground radar
- HUD
- JAM/ELIC
- sonar
- gunights
- ERA
- countermeasures systems
- TDI/TVSS
- refuel hose
- hoses/inlet systems
- cargo extraction systems
- crew emergency systems
- nose countermeasure systems
- T/A
- FKRS/HS/ERG
- buoy control equipment
- RS/EPX
8.2 Conduct hot refueling

8.2.2 Perform hot refueling communications

8.2.2.1 Communicate with ground stations for hot refueling

Communicate with ground stations using:
- UHF
- VHF
- HF
- ARP
- EN-HF
- ARP
- VOR
- satellite
- visual procedures
- data-link

8.2.2.2 Communicate with ground crew

Communicate with ground crew using:
- UHF
- VHF
- HF
- ARP
- EN-HF
- VOR
- satellite
- visual procedures
- data-link

8.1.3 Configure ionics for hot refueling.
8.2.5.1 Reconfigure aircraft after hot refueling

8.2.5.2 Reconfigure aircraft mission systems after hot refueling

8.2.5.3 Reconfigure avionics systems after hot refueling

Reconfigure:
- Fuel systems
- Power plant system
- Hydraulic system
- Electrical system
- Leading gear system
- Catapult/arresting hook system
- Flight control system
- Environmental control system
- Escape/egress system
- Misc. aircraft systems

Reconfigure:
- Infra-red
- Laser
- Sensors
- Air-to-air radar
- Air-to-ground radar
- NAS
- Scram
- Sonar
- Weapons
- TVM
- Teen
- Refuel burn
- Heat/cool system
- Cargo extraction system
- Cargo system/recovery system
- AME/NAF main
- Cargo carrier equipment
- ICV/DRS

Reconfigure:
- FMS
- HMD
- GCS
- GPS
- ITF
- AV
- KY-21
- JYF
- IFF
- Radar
- INS
- MCCS
- VHF
- Compass
- Loran C
- Satellites
- Gyro
- Doppler
- Dead reckoning computer
- Visual procedures
- MLS
- Data-link
8.3
Respond to abnormal operations

8.2.5
Reconfigure after hot refueling

8.2.5.1
Reconfigure aircraft after hot refueling

8.2.5.2
Reconfigure aircraft mission systems after hot refueling

8.2.5.3
Reconfigure avionics systems after hot refueling

- PWS
- HHD
- UWV
- WNF
- MF
- KV-26
- JTDV
- IFF
- DDR
- ACP
- TRACAN
- WVR
- compass
- Loren C
- satellite
dumps
- antennas
- shipboard equipment
- DCC/DOA
- data-link
1. Perform
2. Collect
3. Select
4. Gather
5. Compute
6. Record
7. Prepare
8. Conduct
9. Select/Prepare
10. Inspect
11. Respond
12. Configure
13. Recognize
14. Position
15. Establish
16. Communicate
17. Fly
18. Maneuver
19. Evaluate
20. Establish/Depart
21. Penetrate
22. Execute
23. Reconfigure
### MODIFIERS

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PHASE III: MISSION EXECUTION (ME)

MISSION INTRODUCTION

Introduction to Air-to-Air Mission
Introduction to Air-to-Ground Mission
Introduction to ASW Mission
Introduction to RECCE Mission
Introduction to Mine Countermeasures
Introduction to ESM Mission
Introduction to SAR Mission
Introduction to Logistics/Transport Mission
Introduction to Assault/Delivery Mission
Introduction to Air Refueling Mission

AIRCRAFT MISSION SYSTEMS

System Introduction
System Modes
System Computations
System Test Procedures
Displays/Symbology

WEAPONS

Weapons Description
Weapons Capabilities/Limitations

MISSION EXECUTION

Doctrine
Tactical Mission Planning 7,8,3.1.2, 9,10,11,12,13, 3,1,1,26,27
4,5 5,6,1,2,7,28,
31,32,33,34,
35,36,37,38,
42,43,47,50,8,
29,30

Search/Detect
Acquisition/Identification
Prepare to Execute/Employ
Execute Mission/Employ Systems
Evaluate/Assess Situation
Counter Threats
**MISSION JUDGEMENT**

Wingman Considerations
Environmental Considerations
Threat Considerations

Phase IV: Special Operations Phase (SO)

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APPENDIX E

SAMPLE RUN OF CASDAT
COMPUTER AIDED SYSTEM FOR DEVELOPING AIRCREW TRAINING

WELCOME TO CASDAT.

CASDAT IS A SERIES OF COMPUTER PROGRAMS THAT WILL AID YOU IN DEVELOPING FIVE COMPONENTS OF AN AIRCREW TRAINING SYSTEM. THESE FIVE COMPONENTS ARE PART OF THE INSTRUCTIONAL SYSTEMS DEVELOPMENT PROCESS (ISD) AND INCLUDE TASK LIST AND OBJECTIVE HIERARCHY DEVELOPMENT, MEDIA SELECTION, TRAINING SYLLABUS AND LESSON SPECIFICATION DEVELOPMENT. IF YOU WOULD LIKE MORE INFORMATION ABOUT THESE ISD COMPONENTS, PLEASE REFER TO MIL-T-29053E.

TO INITIATE DEVELOPMENT OF THE FIRST COMPONENT IN THIS PROCESS, THE TASK LIST, IT WILL BE NECESSARY TO PROVIDE CASDAT WITH THE IDENTIFICATION OF THE TYPE OF AIRCRAFT INVOLVED. IF THIS AIRCRAFT IS NEW TO CASDAT, YOU WILL BE ASKED TO PROVIDE CASDAT WITH ADDITIONAL AIRCREW AND AIRCRAFT DATA.

WHEN ENTERING DATA INTO CASDAT, WAIT FOR THE PROMPT (‘>’), ENTER THE DATA, THEN PRESS "CARRIAGE RETURN" KEY. IF MORE THAN ONE ENTRY IS MADE, PRESS THE "CARRIAGE RETURN" KEY AFTER EACH ENTRY. AFTER THE FINAL ENTRY HAS BEEN MADE, WAIT FOR THE PROMPT AND THEN PRESS THE "CARRIAGE RETURN" KEY.

IN SOME CASES, THE CRT MAY SCROLL FASTER THAN YOU WISH. TO STOP THE CRT FROM SCROLLING, HOLD THE CONTROL (CNTL) KEY DOWN WHILE TYPING IN A "S". TO RESUME CRT SCROLL, HOLD THE "CNTL" KEY DOWN WHILE TYPING IN A "Q".

IF HELP IS NEEDED IN SELECTING THE APPROPRIATE RESPONSE TO A COMPUTER INITIATED QUESTION, TYPE IN A "?" AND DEPRESS THE "CARRIAGE RETURN" KEY.

REMEMBER TO WAIT FOR THE PROMPT BEFORE ENTERING DATA, AND TO PRESS THE "CARRIAGE RETURN" KEY AFTER EACH DATA ENTRY.
GIVE DATE (MM/DD/YY)
> 09/01/82

GIVE NAME (20A1)
> ACE

GIVE AIRCRAFT ID
> TEST1

TRAINING PROGRAMS FOR THE FOLLOWING AIRCRAFT ARE IN PROGRESS
FB-111  FB111  F-111  F111  F4  TEST

DO YOU WANT TO DEVELOP A TRAINING PROGRAM FOR TEST1? Y/N
> Y

WHAT IS THE COMPLEMENT OF THIS AIRCRAFT?

1  PILOT
2  CO-PILOT
3  RIO

YOU HAVE SELECTED THE FOLLOWING AIRCREW
PILOT
RIO

IS THIS CORRECT? Y/N
> Y

WHAT ARE THE FEATURES/APPLICATIONS OF THE AIRCRAFT MISSION SYSTEMS?

1  INFRA-RED
2  LASER
3  CAMERA
4  A/A-RADAR
5  A/G-RADAR
6  MAD
7  JEZEBEL
8  SONAR
9  GUNSIGHT
10  ESM
11  SONOBUOY
12  TISEO/TVSU
13  REFUEL-BOOM
14  HOIST/RESCUE-EQ
15  CARGO-EXTRACT-EQ
16  MINE-C/M-EQ
17  TF/TA
18  AWACS/AEW-SUITE
19  TROOP-CARRIER-EQ
20  ECM/DECM
YOU HAVE SELECTED THE FOLLOWING AIRCRAFT MISSION SYSTEMS
A/A-RADAR
GUNSLIGHT
ECM/DECM

IS THIS CORRECT? Y/N
> Y

WHAT ARE THE EXPENDABLES OF THIS AIRCRAFT?

1  GUN
2  AA-MISSILES
3  AG-MISSILES
4  ROCKETS
5  BOMBS
6  DEPTH-CHARGE
7  TORPEDO
8  SONAR-SENSORS
9  MINES
10 CHAFF
11 FLARES
12 JAMMER
13 FUEL-TANKS
>
> 1
> 2
> 10
> 11
> 12
>
YOU HAVE SELECTED THE FOLLOWING EXPENDABLES
GUN
AA-MISSILES
CHAFF
FLARES
JAMMER

IS THIS CORRECT? Y/N
> Y

WHAT IS THE WING STRUCTURE OF THIS AIRCRAFT?

1  VECTOR-THRUST
2  HELICOPTER
3  FIXED-WING
YOU HAVE SELECTED THE FOLLOWING WING TYPE
VECTOR-THRUST

IS THIS CORRECT? Y/N

IS THIS AIRCRAFT CARRIER CAPABLE? Y/N

WHAT IS THE AVIONICS SUITE ASSOCIATED WITH THIS AIRCRAFT?

1. DATA-LINK
2. INS
3. UHF
4. VHF
5. HF
6. KY-2B
7. TACAN
8. ADF
9. IFF
10. RADAR
11. VISUAL-PROCEDURES
12. VOR
13. FMS
14. HUD
15. COMPASS
16. LORAN-C
17. SATELLITE
18. OMEGA
19. DOPPLER
20. D/R-COMPUTER
21. MLS
22. JTIDS

YOU HAVE SELECTED THE FOLLOWING AVIONICS
DATA-LINK
RADAR

IS THIS CORRECT? Y/N

WHICH OF THESE AVIONICS ARE USED FOR COMMUNICATION?

1. DATA-LINK
2. RADAR

>
YOU HAVE SELECTED THE FOLLOWING AVIONICS FOR COMMUNICATION
DATA-LINK

IS THIS CORRECT? Y/N
>Y

WHICH OF THESE AVIONICS ARE USED FOR NAVIGATION?

1. DATA-LINK
2. RADAR

>2

YOU HAVE SELECTED THE FOLLOWING AVIONICS FOR NAVIGATION
RADAR

IS THIS CORRECT? Y/N
>Y

PLEASE PAUSE WHILE YOUR DATA-BASE IS BEING GENERATED
6. 2. 1. 1 CONFIGURE AIRCRAFT FOR APPROACH

6. 2. 1. 1. 1 PERFORM APPROACH-CONFIG OF FUEL-SYSTEM
6. 2. 1. 1. 2 PERFORM APPROACH-CONFIG OF POWER-PLANT-SYSTEM
6. 2. 1. 1. 3 PERFORM APPROACH-CONFIG OF HYDRAULIC-SYSTEM
6. 2. 1. 1. 4 PERFORM APPROACH-CONFIG OF ELECTRICAL-SYSTEM
6. 2. 1. 1. 5 PERFORM APPROACH-CONFIG OF LANDING-GEAR-SYS
6. 2. 1. 1. 6 PERFORM APPROACH-CONFIG OF CAT/ARR-HOOK-SYS
6. 2. 1. 1. 7 PERFORM APPROACH-CONFIG OF FLIGHT-CONT-SYSTEM
6. 2. 1. 1. 8 PERFORM APPROACH-CONFIG OF ENVIRON-CONT-SYS
6. 2. 1. 1. 9 PERFORM APPROACH-CONFIG OF ESCAPE/EGRESS-SYS
6. 2. 1. 1. 10 RECOGNIZE NORMAL AND ABNORMAL OPERATION OF FUEL-SYSTEM
6. 2. 1. 1. 11 RECOGNIZE NORMAL AND ABNORMAL OPERATION OF POWER-PLANT-SYSTEM
6. 2. 1. 1. 12 RECOGNIZE NORMAL AND ABNORMAL OPERATION OF HYDRAULIC-SYSTEM
6. 2. 1. 1. 13 RECOGNIZE NORMAL AND ABNORMAL OPERATION OF ELECTRICAL-SYSTEM
6. 2. 1. 1. 14 RECOGNIZE NORMAL AND ABNORMAL OPERATION OF LANDING-GEAR-SYS
6. 2. 1. 1. 15 RECOGNIZE NORMAL AND ABNORMAL OPERATION OF CAT/ARR-HOOK-SYS
6. 2. 1. 1. 16 RECOGNIZE NORMAL AND ABNORMAL OPERATION OF FLIGHT-CONT-SYSTEM
6. 2. 1. 1. 17 RECOGNIZE NORMAL AND ABNORMAL OPERATION OF ENVIRON-CONT-SYS
6. 2. 1. 1. 18 RECOGNIZE NORMAL AND ABNORMAL OPERATION OF ESCAPE/EGRESS-SYS

6. 2. 1. 2 CONFIGURE A/C MISSION-SYS FOR APPROACH

6. 2. 1. 2. 1 PERFORM APPROACH-CONFIG OF INFRA-RED
6. 2. 1. 2. 2 RECOGNIZE NORMAL AND ABNORMAL OPERATION OF INFRA-RED

6. 2. 1. 3 CONFIGURE AVIONICS FOR APPROACH

6. 2. 1. 3. 1 PERFORM APPROACH-CONFIG OF DATA-LINK
6. 2. 1. 3. 2 RECOGNIZE NORMAL AND ABNORMAL OPERATION OF DATA-LINK

6. 2. 2 ESTABLISH/DEPART HOLDING FIX

6. 2. 2. 1 ESTABLISH/DEPART HOLDING USING DATA-LINK

6. 2. 3 PENETRATE TO APPROACH ALTITUDE
YOU HAVE COMPLETED THE
DATA BASE GENERATION

WHERE DO YOU WANT TO GO?
1 - DATA BASE GENERATION
2 - TASK LIST VALIDATION
3 - EXIT
>

2

TASK LIST VALIDATION PHASE

BASED ON THE AIRCRAFT AND AIRCREW INFORMATION PROVIDED TO CASDAT DURING THE PREVIOUS STEP, THE SYSTEM HAS GENERATED A PRELIMINARY TASK LIST. THIS TASK LIST, WHILE SPECIFIC TO THE AIRCRAFT SELECTED EARLIER, REQUIRES FURTHER DEVELOPMENT. THIS MEANS THAT TASK STATEMENTS CONTAINED IN THE PRELIMINARY LIST MUST BE VALIDATED FOR EACH AIRCREW POSITION AND EACH MISSION PHASE (PHASE OF FLIGHT) OF THE AIRCRAFT. CURRENTLY, CASDAT WILL DISPLAY THREE AIRCREW POSITIONS: PILOT, CO-PILOT AND RIO; AND SEVEN MISSION PHASES: PRE-MISSION PLANNING, PRELAUNCH, TAKEOFF/DEPARTURE, NAVIGATION, APPROACH/LANDING, POST-MISSION, AND SPECIAL PROCEDURES.

TASK STATEMENT VALIDATION IS A PROCESS OF DETERMINING WHETHER A TASK BELONGS IN THE LIST OR WHETHER NEW TASKS SHOULD BE ADDED TO IT. THIS IS ACCOMPLISHED ONE AIRCREW POSITION AT A TIME, AND ONE MISSION PHASE AT A TIME. THEREFORE, YOU WILL BE ASKED TO SELECT WHICH MEMBER OF THE CREW AND WHICH MISSION PHASE YOU WISH TO VALIDATE FIRST. ONCE SELECTED, CASDAT AUTOMATICALLY VALIDATES ALL TASKS IN THE SELECTED PHASE FOR THAT AIRCREW MEMBER. YOU CAN THEN ADD TASKS, DELETE TASKS OR MODIFY TASKS.

ON COMPLETION OF TASK LIST VALIDATION, CASDAT WILL GENERATE AN OBJECTIVES HIERARCHY BASED ON THE VALIDATED TASK LIST. THEREFORE IT IS CALLED "PRE-VALIDATED". DURING OBJECTIVES HIERARCHY YOU WILL BE ABLE TO ADD, DELETE, OR MODIFY THE OBJECTIVES ON THE PRE-VALIDATED OBJECTIVES HIERARCHY.
SELECT A MEMBER OF THE CREW

1  PILOT
2  EXIT

1

SELECT A MISSION PHASE

1  PRE-MISSION PLANNING
2  PRELAUNCH
3  TAKEOFF/DEPARTURE
4  NAVIGATION
5  MISSION/TACTICS
6  APPROACH/LANDING
7  POST-MISSION
8  SPECIAL-PROCEDURES
9  EXIT

>1

PLEASE PAUSE WHILE CASDAT VALIDATES ALL PRE-MISSION PLANNING TASKS FOR PILOT

DO YOU WANT TO
1-ADD
2-DELETE
3-REPLACE/MODIFY
4-EXIT

ANY PRE-MISSION PLANNING TASKS?

>1

** ADDING TASKS **

ENTER TASK SEQUENCE NUMBER
HIT THE "RETURN" KEY WHEN DONE

>1.6.1

GIVE TEXT

>PERFORM PRE-FLIGHT PLANNING

** ADDING TASKS **

ENTER TASK SEQUENCE NUMBER
HIT THE "RETURN" KEY WHEN DONE

>
DO YOU WANT TO
1-ADD
2-DELETE
3-REPLACE/MODIFY
4-EXIT
ANY PRE-MISSION PLANNING TASKS?
>2

** DELETING TASKS **

ENTER TASK SEQUENCE NUMBER
HIT THE "RETURN" KEY WHEN DONE
(NOTE: WHEN DELETING A TASK, ALL SUBORDINATE TASKS ARE ALSO DELETED)

THE FOLLOWING TASKS ARE NO LONGER VALID FOR PILOT

1. 2. 1
COMPUTE AIRCRAFT DATA

1. 2. 1. 1
COMPUTE STATION-LOADING DATA

1. 2. 1. 2
COMPUTE CENTER-OF-GRAVITY DATA

1. 2. 1. 3
COMPUTE DRAG-INDEX DATA

** DELETING TASKS **

ENTER TASK SEQUENCE NUMBER
HIT THE "RETURN" KEY WHEN DONE
(NOTE: WHEN DELETING A TASK, ALL SUBORDINATE TASKS ARE ALSO DELETED)

DO YOU WANT TO
1-ADD
2-DELETE
3-REPLACE/MODIFY
4-EXIT
ANY PRE-MISSION PLANNING TASKS?
>3

** REPLACING/MODIFYING TASKS **

ENTER TASK SEQUENCE NUMBER
HIT THE "RETURN" KEY WHEN DONE

1. 3. 2
1. 3. 2 DOES NOT EXIST
**NAVTRAEEQPCER 79-C-0076-1**

**REPLACING/MODIFYING TASKS**

**ENTER TASK SEQUENCE NUMBER**
**HIT THE "RETURN" KEY WHEN DONE**

> 1.1.2

**GIVE TEXT**

> PREPARE MISSION BRIEFING

**OBJECT NOT INCLUDED IN CASDAT TAXONOMY (SEE LIST)**

**CASDAT OBJECT LIST**

|------------|-----------|------------------------|-----------------|-------------|---------|---------------|--------|-------|-----|-----|---------------|-----------------|-----------|----------------|------------------|----------------|----------------|-------------|------------|----------------|-----------|-------|----------------|----------|
GIVE TEXT
> FILE NAVIGATION

VERBS NOT INCLUDED IN CASDAT TAXONOMY (SEE LIST)

> CASDAT VERB LIST

PERFORM COLLECT SELECT GATHER
COMPUTE RECORD PREPARE CONDUCT
SELECT/prepare INSPECT RESPOND CONFIGURE
RECOGNIZE POSITION ESTABLISH COMMUNICATE
FLY MANEUVER EVALUATE ESTABLISH/DEPART
PENETRATE EXECUTE RECONFIGURE

GIVE TEXT
> GATHER NAVIGATION DATA

* * * REPLACING/MODIFYING TASKS * * *

ENTER TASK SEQUENCE NUMBER
HIT THE "RETURN" KEY WHEN DONE
>

DO YOU WANT TO
1-ADD
2-DELETE
3-REPLACE/MODIFY
4-EXIT
ANY PRE-MISSION PLANNING TASKS?

112
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ENVIR: F
COND: GIVEN AIRCRAFT

ENVIR: T
COND: GIVEN TRAINER

6. 3. 1. 1. 0. 1 STATE THE PROCEDURES TO CONFIGURE FUEL-SYSTEM

ENVIR: A
COND: FROM MEMORY
COND: GIVEN SOP

6. 3. 1. 1. 2 PERFORM LANDING-CONFIG OF POWER-PLANT-SYSTEM

ENVIR: F
COND: GIVEN AIRCRAFT

ENVIR: T
COND: GIVEN TRAINER

6. 3. 1. 2. 0. 1 STATE THE PROCEDURES TO CONFIGURE POWER-PLANT-SYSTEM

ENVIR: A
COND: FROM MEMORY
COND: GIVEN SOP

6. 3. 1. 1. 3 PERFORM LANDING-CONFIG OF HYDRAULIC-SYSTEM

ENVIR: F
COND: GIVEN AIRCRAFT

ENVIR: T
COND: GIVEN TRAINER

6. 3. 1. 3. 0. 1 STATE THE PROCEDURES TO CONFIGURE HYDRAULIC-SYSTEM

ENVIR: A
COND: FROM MEMORY
COND: GIVEN SOP
OBJECTIVES HIERARCHY VALIDATION PHASE

DURING THE PREVIOUS STEP, CASDAT GENERATED A PRELIMINARY OBJECTIVES HIERARCHY. ALTHOUGH THIS HIERARCHY IS SPECIFIC TO THE AIRCRAFT AND AIRCREW POSITION SELECTED EARLIER, IT WILL REQUIRE FURTHER DEVELOPMENT. THIS MEANS THAT THE OBJECTIVE STATEMENTS CONTAINED IN THE PRELIMINARY HIERARCHY MUST BE VALIDATED FOR EACH AIRCREW POSITION AND EACH MISSION PHASE FOR THE AIRCRAFT. CURRENTLY, CASDAT WILL DISPLAY THREE AIRCREW POSITION: PILOT, CO-PILOT AND RIO; AND SEVEN MISSION PHASES: PRE-MISSION PLANNING, PRELAUNCH, TAKEOFF/DEPARTURE, NAVIGATION, APPROACH/LANDING, POST-MISSION, AND SPECIAL PROCEDURES.

OBJECTIVE STATEMENT VALIDATION IS A PROCESS OF DETERMINING WHETHER AN OBJECTIVE BELONGS IN THE HIERARCHY OR WHETHER A NEW OBJECTIVE SHOULD BE ADDED TO IT. THIS IS ACCOMPLISHED ONE AIRCREW POSITION AT A TIME, AND ONE MISSION PHASE AT A TIME. THEREFORE, YOU WILL BE ASKED TO SELECT WHICH MEMBER OF THE CREW AND WHICH MISSION PHASE YOU WISH TO VALIDATE FIRST. YOU CAN THEN ADD OBJECTIVES, DELETE OBJECTIVES, OR MODIFY OBJECTIVES.

SELECT A MEMBER OF THE CREW

1  PILOT
2  RIO
3  EXIT

>2
SELECT A MISSION PHASE

1. PRE-MISSION PLANNING
2. PRELAUNCH
3. TAKEOFF/DEPARTURE
4. NAVIGATION
5. MISSION/TACTICS
6. APPROACH/LANDING
7. POST-MISSION
8. SPECIAL-PROCEDURES
9. EXIT

>2

DO YOU WANT TO
1-ADD
2-DELETE
3-REPLACE/MODIFY
4-EXIT

ANY PRELAUNCH OBJECTIVES?

>1

* * ADDING OBJECTIVES * *

ENTER OBJECTIVE SEQUENCE NUMBER
HIT THE "RETURN" KEY WHEN DONE

>2.5.4.0.1

GIVE TEXT

>STATE THE PROCEDURE FOR ENGINE START

WHAT TYPE OF OBJECTIVE IS THIS?
1 - FLIGHT
2 - TRAINER
3 - ACADEMIC

>3

SELECT A MAXIMUM OF 2 CONDITIONS FOR THIS OBJECTIVE

1. FROM MEMORY
2. GIVEN FLIGHT GEAR
3. GIVEN AIRCRAFT, DAY OR NIGHT
4. GIVEN NATOPS CHECKLIST
5. GIVEN TACTICAL MANUAL
6. GIVEN COCKPIT DISPLAY
7. GIVEN CHECKLIST
8. GIVEN APPROPRIATE HAND SIGNALS
9. GIVEN EJECTION SEAT
10. GIVEN COCKPIT
11. GIVEN AIRCRAFT READY TO TAXI
12. GIVEN AN EMERGENCY
13. GIVEN TACTICAL SITUATIONS
14. GIVEN APPROPRIATE ORDNANCE
15. GIVEN CHECKLIST KEYED TO EACH
** ADDING OBJECTIVES **

ENTER OBJECTIVE SEQUENCE NUMBER
HIT THE "RETURN" KEY WHEN DONE

> DO YOU WANT TO
1-ADD
2-DELETE
3-REPLACE/MODIFY
4-EXIT

ANY PRELAUNCH OBJECTIVES?

> 2

** DELETING OBJECTIVES **

ENTER OBJECTIVE SEQUENCE NUMBER
HIT THE "RETURN" KEY WHEN DONE

> 2.1.3

2. 1. 3 DOES NOT EXIST

** DELETING OBJECTIVES **

ENTER OBJECTIVE SEQUENCE NUMBER
HIT THE "RETURN" KEY WHEN DONE

> 2.2.1.0.1

2. 2. 1. 0. 1 DOES NOT EXIST

THE SEQUENCE NUMBER HAS NOT BEEN TYPED IN CORRECTLY. MAKE SURE THAT:
1. THE FIRST DIGIT MATCHES THAT OF THE MISSION PHASE.
2. EACH DIGIT IS SEPARATED WITH A DECIMAL POINT.
3. THE NUMBER IS IN HIERARCHICAL SEQUENCE.
4. ONLY ONE ZERO IS IMBEDDED IN AN OBJECTIVE SEQUENCE NUMBER.

** DELETING OBJECTIVES **

ENTER OBJECTIVE SEQUENCE NUMBER
HIT THE "RETURN" KEY WHEN DONE

> 2.1.1.0.1

THE FOLLOWING OBJECTIVES ARE NO LONGER VALID FOR RIO

2. 1. 1. 1. 0. 1
IDENTIFY FLIGHT GEAR
ENTER OBJECTIVE SEQUENCE NUMBER
HIT THE "RETURN" KEY WHEN DONE

> DO YOU WANT TO
   1-ADD
   2-DELETE
   3-REPLACE/MODIFY
   4-EXIT
ANY PRELAUNCH OBJECTIVES?
>3

** ** REPLACING/MODIFYING OBJECTIVES ** **

ENTER OBJECTIVE SEQUENCE NUMBER
HIT THE "RETURN" KEY WHEN DONE

>2.1.1.2.0.1

GIVE TEXT
IDENTIFY NAVIGATION CHARTS

WHAT TYPE OF OBJECTIVE IS THIS?
1 - FLIGHT
2 - TRAINER
3 - ACADEMIC

>3
>1

SELECT A MAXIMUM OF 2 CONDITIONS FOR THIS OBJECTIVE

1 - FROM MEMORY
2 - GIVEN FLIGHT GEAR
3 - GIVEN AIRCRAFT, DAY OR NIGHT
4 - GIVEN NATOPS CHECKLIST
5 - GIVEN TACTICAL MANUAL
6 - GIVEN COCKPIT DISPLAY
7 - GIVEN CHECKLIST
8 - GIVEN APPROPRIATE HAND SIGNALS
9 - GIVEN EJECTION SEAT
10 - GIVEN COCKPIT
11 - GIVEN AIRCRAFT READY TO TAXI
12 - GIVEN AN EMERGENCY
13 - GIVEN TACTICAL SITUATIONS
14 - GIVEN APPROPRIATE ORDNANCE
15 - GIVEN CHECKLIST KEYED TO EACH
16 - GIVEN AIRCRAFT ON FLIGHT DECK
17 - GIVEN EXAM
18 - GIVEN NAVIGATION PROBLEM
19 - GIVEN NAVIGATION SYSTEMS
20 - GIVEN SYSTEM MALFUNCTION
21 - GIVEN MISSION
22 - GIVEN NATOPS MANUAL
23 - GIVEN AIRCRAFT CONFIGURATION
**REPLACING/MODIFYING OBJECTIVES**

ENTER OBJECTIVE SEQUENCE NUMBER
HIT THE "RETURN" KEY WHEN DONE

> DO YOU WANT TO
  1-ADD
  2-DELETE
  3-REPLACE/MODIFY
  4-EXIT
ANY PRELAUNCH OBJECTIVES?
>4

SELECT A MEMBER OF THE CREW

1 PILOT
2 XI0
3 EXIT
>3

IS THE OBJECTIVES HIERARCHY COMPLETED? Y/N
>Y

DO YOU WANT A LISTING OF THE OBJECTIVES HIERARCHY? Y/N
>Y
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YOU HAVE COMPLETED THE
GENERIC TASK LIST
TASK LIST VALIDATION
OBJECTIVE VALIDATION

YOU ARE IN THE FOLLOWING PHASE
MEDIA SELECTION

WHERE DO YOU WANT TO GO?
1 - TASK LIST VALIDATION
2 - OBJECTIVE VALIDATION
3 - MEDIA SELECTION
4 - EXIT
>3

*** MEDIA SELECTION PHASE ***

THE MEDIA SELECTION MODEL INCLUDED IN CASDAT PROVIDES A SYSTEMATIC
WAY OF DETERMINING HOW ANY OBJECTIVE SHOULD BE TAUGHT. THIS DETERMINATION
IS MADE BASED ON THE CONTENT LEVEL, BEHAVIOR LEVEL, DISPLAY REQUIREMENTS,
MEMORY LOAD, AND MEDIA AVAILABILITY. THE MODEL Focuses LARGELY ON THE
CLASSIFICATION OF OBJECTIVES INTO FIVE BROAD LEARNING CATEGORIES:
FAMILIARIZATION, FACT, CONCEPT, PROCEDURE-RULE, AND PRINCIPLE. IT ALSO
MATCHES THE CAPABILITIES OF EACH MEDIA WITH THE LEARNING REQUIREMENTS OF THE
OBJECTIVE. THE FINAL MEDIA DETERMINATION DISPLAYED BY CASDAT IS A
RECOMMENDATION OF PRIMARY AND SECONDARY CHOICES OF MEDIA HAVING THE NECESSARY
REQUIREMENTS. THESE CHOICES ARE ORDERED IN TERMS OF HOW EFFICIENTLY
AND EFFECTIVELY THEY PRESENT THE MATERIAL. IN CASES WHERE THE CAPABILITIES
ARE NEARLY EQUAL, THE CHOICES ARE PRESENTED IN TERMS OF COST WITH THE
MEDIA COSTING LEAST TO PREPARE BEING THE PRIMARY CHOICE.
SELECT YOUR INSTALLATION'S AVAILABLE RESOURCES BY TYPING "YES" OR "NO" AS THEY APPEAR

1. AC-AIRCRAFT
   >Y

REVIEW THE MEDIA AVAILABLE AT THIS INSTALLATION THAT WILL BE USED IN THIS TRAINING PROGRAM. SELECT ONLY FROM THOSE PRESENTED ON THE SCREEN.

SELECT YOUR INSTALLATION'S AVAILABLE RESOURCES BY TYPING "YES" OR "NO" AS THEY APPEAR

1. AC-AIRCRAFT    >Y
2. SIM-SIMULATOR  >Y
3. VT-VIDEO TAPE  >Y
4. MIL-MEDIATED INTERACTIVE LECTURE >Y
5. ST-SLIDE TAPE  >Y
6. WB-WORKBOOK    >Y
7. WS-WORKSHEET  >Y
8. CAI-COMPUTER AIDED INSTRUCTION >N
9. RAS-RANDOM ACCESS SLIDE WORKBOOK >Y

YOU SELECTED:

1. AC-AIRCRAFT
2. SIM-SIMULATOR
3. VT-VIDEO TAPE
4. MIL-MEDIATED INTERACTIVE LECTURE
5. ST-SLIDE TAPE
6. WB-WORKBOOK
7. WS-WORKSHEET
8. RAS-RANDOM ACCESS SLIDE WORKBOOK

OK TO CONTINUE, OR DONE? (YES/NO/DONE)
   >Y
PLEASE ANSWER MEDIA QUESTIONS FOR OBJECTIVES IN AN ACADEMIC ENVIRONMENT

4.1
ESTABLISH MISSION OBJECTIVES

Q1:
WHAT IS THE LEVEL OF BEHAVIOR EXPECTED OF THE STUDENT IN THIS OBJECTIVE?

1. FAMILIARIZATION
2. REMEMBER
3. USE

Q4:
WHAT IS THE MINIMUM DISPLAY REQUIREMENT?

1. VERBAL AND/OR SYMBOLIC AND/OR STATIC SIMPLE PICTORIAL
2. VERBAL AND/OR SYMBOLIC AND/OR STATIC COMPLEX PICTORIAL
3. DYNAMIC PICTORIAL
4. INTERACTIVE

MEDIA CHOICE 1 = MIL-MEDIATED INTERACTIVE LECTURE
MEDIA CHOICE 2 = SI-SLIDE TAPE
OK TO CONTINUE, OR DONE? (YES/NO/DONE)

PLEASE ANSWER MEDIA QUESTIONS FOR OBJECTIVES IN AN ACADEMIC ENVIRONMENT

4.1.0.1
DETERMINE DESTINATION

Q1:
WHAT IS THE LEVEL OF BEHAVIOR EXPECTED OF THE STUDENT IN THIS OBJECTIVE?

1. FAMILIARIZATION
2. REMEMBER
3. USE

Q2:
WHAT LEVEL OF CONTENT IS BEING TAUGHT IN THIS SEGMENT?

1. FAMILIARIZATION
2. FACT
3. CONCEPT
4. RULE/PROCEDURE
5. PRINCIPLE
4.1.0.1
DETERMINE DESTINATION

Q4:
WHAT IS THE MINIMUM DISPLAY REQUIREMENT?

1. VERBAL AND/OR SYMBOLIC AND/OR STATIC SIMPLE PICTORIAL
2. VERBAL AND/OR SYMBOLIC AND/OR STATIC COMPLEX PICTORIAL
3. DYNAMIC PICTORIAL
4. INTERACTIVE

MEDIA CHOICE 1 = ST-SLIDE TAPE
MEDIA CHOICE 2 = MIL-MEDIATED INTERACTIVE LECTURE

OK TO CONTINUE, OR DONE? (YES/NO/DONE)
Y

PLEASE ANSWER MEDIA QUESTIONS FOR OBJECTIVES IN AN ACADEMIC ENVIRONMENT

4.1.1
DETERMINE FLIGHT ROUTE
WHAT IS THE LEVEL OF BEHAVIOR EXPECTED OF THE STUDENT IN THIS OBJECTIVE?

1. FAMILIARIZATION
2. REMEMBER
3. USE

4. 1. 1
DETERMINE FLIGHT ROUTE

WHAT LEVEL OF CONTENT IS BEING TAUGHT IN THIS SEGMENT?

1. FAMILIARIZATION
2. FACT
3. CONCEPT
4. RULE/PROCEDURE
5. PRINCIPLE

4. 1. 1
DETERMINE FLIGHT ROUTE

WHAT IS THE MINIMUM DISPLAY REQUIREMENT?

1. VERBAL AND/OR SYMBOLIC AND/OR STATIC SIMPLE PICTORIAL
2. VERBAL AND/OR SYMBOLIC AND/OR STATIC COMPLEX PICTORIAL
3. DYNAMIC PICTORIAL
4. INTERACTIVE
4.1.1
Determine Flight Route

Q3:
Is the memorization component of this objective large or small?

1. Small
2. Large

>2

4.1.1
Determine Flight Route

Q3:
Is the minimum critical set of instances the student needs to see small or large?

1. Small
2. Large

>2

Media Choice 1 = Ras-Random Access Slide Workbook

Media Choice 2 = Mil-Mediated Interactive Lecture

OK to continue, or done? (Yes/No/Done)

Yes
PLEASE ANSWER MEDIA QUESTIONS FOR OBJECTIVES IN AN ACADEMIC ENVIRONMENT

4. 1. 1. 0. 1
STATE PROCEDURES TO DETERMINE FLIGHT ROUTE

Q1:
WHAT IS THE LEVEL OF BEHAVIOR EXPECTED OF THE STUDENT IN THIS OBJECTIVE?

1. FAMILIARIZATION
2. REMEMBER
3. USE

Q4:
WHAT IS THE MINIMUM DISPLAY REQUIREMENT?

1. VERBAL AND/OR SYMBOLIC AND/OR STATIC SIMPLE PICTORIAL
2. VERBAL AND/OR SYMBOLIC AND/OR STATIC COMPLEX PICTORIAL
3. DYNAMIC PICTORIAL
4. INTERACTIVE

MEDIA CHOICE 1 = WB-WORKBOOK
MEDIA CHOICE 2 = MIL-MEDIATED INTERACTIVE LECTURE
OK TO CONTINUE, OR DONE? (YES/NO/DONE)
Y
IS THE MEDIA SELECTION COMPLETED? Y/N
Y
DO YOU WANT A PRINT-OUT OF MEDIA? (Y/N)
Y
# F-14 Media Selection

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<tr>
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<td>STATE PROCEDURES TO EVALUATE INS</td>
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<td>RESPOND-TO NAVIGATION SYSTEM HALLFUNCTIONS</td>
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<tr>
<td>C</td>
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<td>RESPOND-TO HALLFUNCTIONS OF INS</td>
</tr>
</tbody>
</table>

**MEDIA KEY:**
- A/C - AIRCRAFT
- HIL - MEDIATED INTERACTIVE LECTURE
- WS - WORKSHEET
- SIM - SIMULATOR
- ST - SLIDE TAPE
- CAI - COMPUTER AIDED INSTRUCTION
- UT - VIDEO TAPE
- WD - WORKBOOK
- RAS - RANDOM ACCESS SLIDE WORKBOOK
YOU HAVE COMPLETED THE
GENERIC TASK LIST
TASK LIST VALIDATION
OBJECTIVE VALIDATION
MEDIA SELECTION

YOU ARE IN THE FOLLOWING PHASE
SYLLABUS DEVELOPMENT

WHERE DO YOU WANT TO GO?
1 - TASK LIST VALIDATION
2 - OBJECTIVE VALIDATION
3 - MEDIA SELECTION
4 - SYLLABUS DEVELOPMENT
5 - EXIT

>4

PLEASE PAUSE WHILE CASDAT GENERATES A TRAINING SYLLABUS FROM THE LESSON OBJECTIVES VALIDATED EARLIER. WHEN THIS PROCESS IS COMPLETE, CASDAT WILL AUTOMATICALLY PRINT A LIST OF OBJECTIVES NOT ASSIGNED TO ANY LESSON IN THE SYLLABUS. THEN IT WILL AUTOMATICALLY PRINT A LIST OF LESSON NUMBERS, TITLE, AND THE OBJECTIVES ASSIGNED TO EACH LESSON. AIRCREW, LEARNING ENVIRONMENT, AND PRIMARY AND SECONDARY MEDIA CHOICES ARE ALSO INDICATED FOR EACH LESSON AND FOR EACH OBJECTIVE. THIS PRINT-OUT SERVES AS A WORKSHEET THAT CAN BE REVIEWED AND MODIFIED OFF-LINE AS A FINAL VALIDATION OF THE TRAINING SYLLABUS. DURING OFF-LINE REVIEW IT WILL BE POSSIBLE TO MAKE THE FOLLOWING EDITS:

* COMBINE, SPLIT, OR DELETE EXISTING LESSONS
* MODIFY A LESSON BY CHANGING
  - THE LESSON TITLE
  - OBJECTIVES, EITHER ADD OR DELETE THEM
  - LESSON MEDIA CHOICES

WHEN ALL MODIFICATIONS HAVE BEEN MADE OFF-LINE TO THE SYLLABUS, RETURN TO CASDAT AND SELECT SYLLABUS VALIDATION AS THE NEXT STEP IN THE DEVELOPMENT PROCESS.

LESSON SORT NOW EXECUTING
<table>
<thead>
<tr>
<th>LESSON TITLE</th>
<th>LESSON MEDIA</th>
<th>AIRCREW ATF TITLE</th>
<th>OBJECTIVE MEDIA</th>
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<td>*** FAPA 20</td>
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<td>MIL-MEDIATED INTERACTIVE LECTURE</td>
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<td>MIL-MEDIATED INTERACTIVE LECTURE</td>
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<td>PR A STATE PROCEDURES TO COMMUNICATE WITH GROUND STATIONS USING DATA-LINK</td>
<td>VI-VIDEO TAPE</td>
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<td>4.5.5.2.1.0.1</td>
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### Syllabus Worksheet

**Lesson**

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<th>Aircrew ATF Title</th>
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<td>PR ATF INTERPRET STEERING COMMAND INFORMATION FOR DATA-LINK</td>
<td>CAI-COMPUTER AIDED INSTRUCTION, RAS-RANDOM ACCESS SLIDE WORKBOOK</td>
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<td>PR A STATE LOCATION OF CONTROLS/SWITCHES FOR BEFORE-STARTING ENGINE CHECKLIST</td>
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<td>PR A STATE REQUIRED ACTION FOR EACH ITEM OF BEFORE-STARTING ENGINE CHECKLIST</td>
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<td>OBJECTIVE MEDIA</td>
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<td>FAPA 80</td>
<td>FLIGHT GEAR</td>
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<td>MIL-MEDIATED INTERACTIVE LECTURE</td>
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<td>PR A IDENTIFY FLIGHT-PUBS/DOC</td>
<td>ST-SLIDE TAPE</td>
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<td>PR A IDENTIFY HELMET</td>
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<td>PR A IDENTIFY G-SUIT</td>
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<td>PR A IDENTIFY DOWNING DISCREPANCIES OF FLIGHT-PUBS/DOC</td>
<td>RAS-RANDOM ACCESS SLIDE WORKBOOK</td>
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<td>CAI-COMPUTER AIDED INSTRUCTION</td>
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</table>
YOU HAVE COMPLETED THE
GENERIC TASK LIST
TASK LIST VALIDATION
OBJECTIVE VALIDATION
MEDIA SELECTION
SYLLABUS DEVELOPMENT

YOU ARE IN THE FOLLOWING PHASE
LESSON EDIT:

WHERE DO YOU WANT TO GO?
1 - TASK LIST VALIDATION
2 - OBJECTIVE VALIDATION
3 - MEDIA SELECTION
4 - SYLLABUS DEVELOPMENT
5 - LESSON EDIT
6 - EXIT

SYLLABUS VALIDATION IS AN OPPORTUNITY TO PLACE, IN CASBAT, TRAINING SYLLABUS CHANGES PREVIOUSLY MADE DURING THE OFF-LINE REVIEW OF THE SYLLABUS WORKSHEET. DURING THIS STEP, IT WILL BE POSSIBLE TO MAKE THE FOLLOWING EDITS TO THE SYLLABUS:

* COMBINE, SPLIT, OR DELETE EXISTING LESSONS
* MODIFY A LESSON BY CHANGING
  - THE LESSON TITLE
  - OBJECTIVES, EITHER ADD OR DELETE THEM
  - LESSON MEDIA CHOICES

TO MAKE THESE CHANGES, WORK FROM THE ANNOTATED WORKSHEET PROVIDED DURING THE PREVIOUS STEP AND MODIFIED OFF-LINE. THIS PROCEDURE IS PREFERRED TO DIRECT ON-LINE EDITING. WHEN THIS IS COMPLETE, A FINAL TRAINING SYLLABUS PRINT-OUT IS OBTAINABLE.

DO YOU WANT TO
1 - DISPLAY A LESSON
2 - DELETE A LESSON
3 - CHANGE A LESSON
4 - SPLIT A LESSON INTO MULTIPLE LESSONS
5 - COMBINE LESSONS INTO ONE NEW LESSON
6 - EXIT THIS EDIT SESSION

* DISPLAYING A LESSON *

NOTE: THIS DISPLAY PROVIDES ON-LINE REVIEW ONLY
GIVE LESSON NUMBER TO BE DISPLAYED

> FAPA0020

RADIO SYSTEMS
WHICH OF THE FOLLOWING DO YOU WANT DISPLAYED?
1 - OBJECTIVES FOR THIS LESSON
2 - MEDIA FOR THIS LESSON
3 - EXIT

> 1

THERE ARE 2 OBJECTIVES IN THIS LESSON

AN OBJECTIVE IN LESSON, FAPA 20, IS

EVALUATE UHF
DO YOU WISH TO SEE DETAILS OF THIS OBJECTIVE? Y/N

> Y

EVALUATE UHF
SEQUENCE NUMBER: 4.2.2
ENVIRONMENT: ACADEMIC FLIGHT TRAINER
MEDIA FIRST CHOICE: ST-SLIDE TAPE
MEDIA SECOND CHOICE: MIL-MEDIATED INTERACTIVE LECTURE

AN OBJECTIVE IN LESSON, FAPA 20, IS
STATE PROCEDURES TO EVALUATE UHF
DO YOU WISH TO SEE DETAILS OF THIS OBJECTIVE? Y/N

> Y

STATE PROCEDURES TO EVALUATE UHF
SEQUENCE NUMBER: 4.2.2.0.1
ENVIRONMENT: ACADEMIC
MEDIA FIRST CHOICE: WB-WORKBOOK
MEDIA SECOND CHOICE: MIL-MEDIATED INTERACTIVE LECTURE
THE MEDIA COST REPORT PRESENTS THE RELATIVE COSTS OF PRODUCING THE PRIMARY AND SECONDARY MEDIA PLANS FOR THE TRAINING SYLLABUS. THESE RELATIVE COSTING FIGURES ARE BASED UPON TWO UNDERLYING ASSUMPTIONS THAT SHOULD BE MADE CLEAR. THE FIRST OF THESE IS THAT AUTHORS WORK FROM COMPLETE, WELL WRITTEN LESSON SPECIFICATIONS. MEDIA PRODUCTION COSTS UP TO AND INCLUDING THE DEVELOPMENT OF LESSON SPECIFICATIONS IS RELATIVELY INDEPENDENT OF THE MEDIA SELECTED. THE SECOND ASSUMPTION IS THAT ONLY ONE HARD COPY OF EACH FINISHED PRODUCT IS PRODUCED. COSTS OF ADDITIONAL COPIES OR SETS OF LESSON MATERIALS IS NOT INCLUDED.

TWO TABLES ARE PRODUCED IN THIS REPORT. THE FIRST OF THESE, "ALTERNATIVE MEDIA PLANS", PRESENTS IN SUMMARY FORM, THE NUMBER OF LESSONS EMPLOYING EACH MEDIUM USED IN THE TWO MEDIA PLANS.

TO DETERMINE THE RELATIVE COST REQUIREMENTS FOR EACH MEDIA PLAN, THE PERCENTAGE OF LESSONS USING EACH MEDIUM ARE MULTIPLIED BY THE CORRESPONDING RELATIVE PRODUCTION COST FACTORS STORED WITHIN CASDAT. A SUMMARY OF THE RESULTS OF THIS PROCEDURE ARE PRESENTED FOR EACH MEDIA PLAN IN THE SECOND TABLE, "MEDIA TIME/COST MATRIX". IT SHOULD BE STRESSED THAT THESE FIGURES ARE BOTH RELATIVE (NOT ABSOLUTE) AND APPROXIMATE. THEY ARE RELATIVE IN THAT IT CAN NOT BE SAID THAT THE TOTALS IN ANY CATEGORY FOR EITHER PLAN IS A CERTAIN NUMBER OF HOURS OR DAYS. BUT IN COMPARING THE TOTALS ACROSS BOTH MEDIA PLANS, IT CAN BE SAID THAT ONE MAY BE CERTAIN NUMBER TIMES AS MUCH AS THE TOTAL FOR ANOTHER.

END OF EDIT SESSION
RADIO SYSTEMS
WHICH OF THE FOLLOWING DO YOU WANT DISPLAYED?
1 - OBJECTIVES FOR THIS LESSON
2 - MEDIA FOR THIS LESSON
3 - EXIT

MEDIA FIRST CHOICE:  ST-SLIDE TAPE
MEDIA SECOND CHOICE: MIL-MEDIATED INTERACTIVE LECTURE

RADIO SYSTEMS
WHICH OF THE FOLLOWING DO YOU WANT DISPLAYED?
1 - OBJECTIVES FOR THIS LESSON
2 - MEDIA FOR THIS LESSON
3 - EXIT

DO YOU WANT TO
1 - DISPLAY A LESSON
2 - DELETE A LESSON
3 - CHANGE A LESSON
4 - SPLIT A LESSON INTO MULTIPLE LESSONS
5 - COMBINE LESSONS INTO ONE NEW LESSON
6 - EXIT THIS EDIT SESSION

* CHANGING A LESSON *

GIVE LESSON NUMBER OF LESSON TO BE CHANGED
>FFPA0020

THIS LESSON NUMBER, FPPA 20, IS NOT IN SYLLABUS

DO YOU WANT TO
1 - DISPLAY A LESSON
2 - DELETE A LESSON
3 - CHANGE A LESSON
4 - SPLIT A LESSON INTO MULTIPLE LESSONS
5 - COMBINE LESSONS INTO ONE NEW LESSON
6 - EXIT THIS EDIT SESSION

SYLLABUS FILE IS BEING SORTED - PLEASE WAIT

IS THE SYLLABUS VALIDATION COMPLETE? Y/N

Y

DO YOU WANT A PRINT-OUT OF THE SYLLABUS? Y/N

N
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--------------- ALTERNATIVE MEDIA PLAN B

NAVTRAEEPCEN 79-C-0076-1
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<tr>
<td>US</td>
<td>10.0001</td>
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**Notes:**
- AC: Author
- VT: Artist
- ST: Editor
- US: Picture
- CAI: Illustrator
- RAS: Publisher

**Legend:**
- Media: Type of content
- Cost Factors: Various production costs
- Total: Combined production cost
### MEDIA COST

---

**MEDIA TIME/COST MATRIX**

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<tr>
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YOU HAVE COMPLETED THE
GENERIC TASK LIST
TASK LIST VALIDATION
OBJECTIVE VALIDATION
MEDIA SELECTION
SYLLABUS DEVELOPMENT
LESSON EDIT

YOU ARE IN THE FOLLOWING PHASE
LESSON SPECIFICATION

WHERE DO YOU WANT TO GO?
1 - TASK LIST VALIDATION
2 - OBJECTIVE VALIDATION
3 - MEDIA SELECTION
4 - SYLLABUS DEVELOPMENT
5 - LESSON EDIT
6 - LESSON SPECIFICATION
7 - EXIT
8 - EXIT
9 - EXIT

CASDAI PRODUCES A SPECIFICATION FOR EACH ACADEMIC, TRAINER, AND FLIGHT LESSON IN THE COMPLETED TRAINING SYLLABUS. EACH LESSON SPECIFICATION CONTAINS BOTH GENERAL INFORMATION ABOUT THE LESSON AND SOME DETAILS OF THE INSTRUCTIONAL STRATEGY NECESSARY TO TEACH LESSON OBJECTIVES. SPECIFICALLY, THE INFORMATION PROVIDED TO THE LESSON SPECIFICATION AUTHOR INCLUDES THE FOLLOWING:

* LESSON REFERENCE NUMBER
* LESSON TITLE
* PRE-REQUISITE LESSON LIST
* LESSON MEDIA, PRIMARY AND SECONDARY RECOMMENDATIONS
* MEDIA RESOURCES
* INSTRUCTIONAL STRATEGY - AUTHORING AID

WHEN COMPLETED, THE LESSON SPECIFICATION BECOMES A BLUEPRINT OR PRESCRIPTION FOR FURTHER INSTRUCTIONAL DEVELOPMENT. IT PROVIDES AN OFF-LINE GUIDELINE FOR THE DEVELOPER SO THAT HE MAY CONTRIBUTE HIS CONTENT KNOWLEDGE IN AN INSTRUCTIONALLY USEFUL WAY.
** LESSON SPECIFICATION **

LESSON REFERENCE NUMBER: FAPA 80
LESSON TITLE: FLIGHT GEAR

PRIMARY MEDIA: VT-VIDEO TAPE
SECONDARY MEDIA: MIL-MEDIATED INTERACTIVE LECTURE

PRE-REQUISITE INFORMATION MAP

FACF 80 POWER PLANT EMERGENCIES IN A TRAINER ENVIRONMENT
FACF 100 FLIGHT CONTROLS
FAPA 20 NORMAL COMMUNICATIONS
FAPA 40 POWER PLANT OPS AND EMERGENCIES
FAPA 60 FLIGHT CONTROLS
*FAPA 80 FLIGHT GEAR
FAPT 20 NORMAL COMMUNICATIONS
FAPT 40 POWER PLANT OPS AND EMERGENCIES
FAPT 60 FLIGHT GEAR
FAPF 20 NORMAL COMMUNICATIONS
FAPF 40 POWER PLANT OPS AND EMERGENCIES
**LESSON OBJECTIVES**

<table>
<thead>
<tr>
<th>SEQ #</th>
<th>OBJECTIVE CODE</th>
<th>OBJECTIVES</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>2.1.1.0.1</td>
<td>IDENTIFY HELMET CONDI GIVEN FLIGHT GEAR</td>
</tr>
<tr>
<td>2</td>
<td>2.1.2.0.1</td>
<td>IDENTIFY DOWNING DISCREPANCIES OF HELMET CONDI GIVEN FLIGHT GEAR</td>
</tr>
<tr>
<td>3</td>
<td>2.1.2.0.2</td>
<td>STATE INSPECTION POINTS OF HELMET CONDI GIVEN FLIGHT GEAR</td>
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</table>
### LESSON SPECIFICATION

**LESSON REFERENCE NUMBER:** FAPA 80  
**LESSON TITLE:** FLIGHT GEAR  
**AUTHOR:** S. SIMONS

#### LESSON MEDIA AND RESOURCE WORKSHEET

##### PRIMARY MEDIA

<table>
<thead>
<tr>
<th>VIDEOTAPE</th>
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<tr>
<td>PERSONNEL</td>
<td>NONE</td>
</tr>
<tr>
<td>MEDIA</td>
<td>VIDEOTAPE, WORKBOOK</td>
</tr>
<tr>
<td>FACILITIES</td>
<td>CARREL (U), CARREL (8)</td>
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<tr>
<td>EVALUATION</td>
<td>NONE</td>
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</table>

##### SECONDARY MEDIA

**MEDIATED INTERACTIVE LECTURE**

<table>
<thead>
<tr>
<th>PERSONNEL</th>
<th>INSTRUCTOR PILOT, INSTRUCTOR NFO</th>
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<tbody>
<tr>
<td>MEDIA</td>
<td>CHALKBOARD, OVERHEAD TRANSPARENCIES, 35MM SLIDES, WALLCHART, PHOTO PANEL, LECTURE GUIDE, STRUCTURE NOTES</td>
</tr>
<tr>
<td>FACILITIES</td>
<td>CLASSROOM</td>
</tr>
<tr>
<td>EVALUATION</td>
<td>NONE</td>
</tr>
</tbody>
</table>
LEVEL OF CONTENT: "FAMILIARIZATION"  LEVEL OF BEHAVIOR: "REMEMBER"

INSTRUCTIONAL COMPONENTS TO BE DEVELOPED FOR THIS OBJECTIVE AND A DESCRIPTION OF THE PRESENTATION FORM OF EACH COMPONENT.

1. GENERALITY: PRESENT A DESCRIPTION OF THE TOPIC OR CONTENT RATHER THAN SPECIFIC INFORMATION TO BE TESTED. THIS INFORMATION IS "NICE-TO-KNOW", BUT IS NOT REQUIRED. IT IS NOT TESTED.

2. SUPPORT: N/A

3. EXAMPLES: N/A

4. PRACTICE TEST ITEMS: N/A

5. PRACTICE FEEDBACK: N/A
LEVEL OF CONTENT: "FACT" LEVEL OF BEHAVIOR: "REMEMBER"

INSTRUCTIONAL COMPONENTS TO BE DEVELOPED FOR THIS OBJECTIVE AND A DESCRIPTION OF THE PRESENTATION FORM OF EACH COMPONENT.

1. GENERALITY: WRITE A CLEAR, CONCISE STATEMENT OF THE FACT(S) WITHOUT ANY EXTRANEOUS MATERIAL.

2. SUPPORT: IF APPROPRIATE, BREAK FACT INTO SMALLER EASIER TO REMEMBER PARTS, OR LINKS TO FAMILIAR INFORMATION LEARNED EARLIER.

3. EXAMPLES: NOT APPLICABLE TO THIS TYPE OF OBJECTIVE.

4. PRACTICE & TEST ITEMS: REQUIRE THAT THE LEARNER EITHER "RECALL" OR "RECOGNIZE" ON THE ENTIRE FACT OR PART OF IT. APPROPRIATE ITEMS INCLUDE:

- Recognition
- Recall
- Matching
- Short Answer
- True-False
- Fill-In
- Multiple Choice
- Listing

Practice and test items must match in behavior (intent) and format.

5. PRACTICE FEEDBACK: DEVELOP FEEDBACK FOR "EACH" PRACTICE ITEM. PROVIDE: 1) AN ANSWER TO THE PRACTICE ITEM 2) A BRIEF EXPLANATION OF THE ANSWER.
LEVEL OF CONTENT: "CONCEPT"  LEVEL OF BEHAVIOR: "REMEMBER"

INSTRUCTIONAL COMPONENTS TO BE DEVELOPED FOR THIS TYPE OF OBJECTIVE AND A DESCRIPTION OF THE PRESENTATION FORM OF EACH COMPONENT ARE AS FOLLOWS:

1. GENERALITY: PRESENT A STATEMENT WHICH:
   1) NAMES THE CONCEPT BEING TAUGHT
   2) LISTS THE ATTRIBUTES OF THE CONCEPT

2. SUPPORT: SUPPORT SHOULD HELP THE LEARNER REMEMBER THE DEFINITION. PROVIDE A MNEMONIC, OR AN ELABORATION OF THE DEFINITION ITSELF. PRESENT BRIEF EXPLANATIONS OF ATTRIBUTES AS NECESSARY.

3. EXAMPLE: PROVIDE AN EXAMPLE(S) HAVING THESE CHARACTERISTICS:
   1) IT DEMONSTRATES AS MANY OF THE CONCEPT ATTRIBUTES AS CLEARLY AS POSSIBLE.
   2) IT IS A COMMON EXAMPLE OF THE CONCEPT.
   3) IT IS SHOWN AS SIMPLY AS POSSIBLE.

4. PRACTICE TEST ITEMS: PRACTICE SET SHOULD REQUIRE THE LEARNER TO REMEMBER THE DEFINITION. APPROPRIATE ITEMS INCLUDE:
   1) SHORT ANSWER
   2) FILL-IN
   3) LISTING

   PRACTICE AND TEST ITEMS MUST MATCH IN BEHAVIOR (INTENT) AND FORMAT.

5. PRACTICE FEEDBACK: DEVELOP FEEDBACK FOR "EACH" PRACTICE ITEM. PROVIDE ANSWERS TO EACH PRACTICE ITEM.
LEVEL OF CONTENT: "CONCEPT"  LEVEL OF BEHAVIOR: "USE"

INSTRUCTIONAL COMPONENTS TO BE DEVELOPED FOR THIS TYPE OF OBJECTIVE AND A DESCRIPTION OF THE PRESENTATION FORM OF EACH COMPONENT.

1. GENERALITY: PRESENT A STATEMENT WHICH:
   1) NAMES THE CONCEPT BEING TAUGHT.
   2) LISTS THE ATTRIBUTES OF THE CONCEPT.

2. SUPPORT: PREPARE A MORE DETAILED EXPLANATION OF THE DEFINITION. THIS EXPLANATION MAY DEFINE TERMS IN THE DEFINITION AND ELABORATE UPON IDEAS IN THE DEFINITION.

3. EXAMPLES & NON-EXAMPLES: "EXAMPLES" SHOULD SHOW ALL CRITICAL CHARACTERISTICS OF THE CONCEPT REQUIRED FOR CLASSIFICATION. "NON-EXAMPLES" SHOULD EXCLUDE ONE OR MORE OF THE CRITICAL CHARACTERISTICS. PREPARE AT LEAST ONE SET OF REPRESENTATIONAL EXAMPLES AND NON-EXAMPLES PER CONCEPT.

4. PRACTICE & TEST ITEMS: ITEMS SHOULD REQUIRE THE LEARNER TO CLASSIFY INSTANCES AS EITHER EXAMPLES OR NON-EXAMPLES. APPROPRIATE ITEMS INCLUDE: 1) PERFORMANCE 2) MATCHING 3) TRUE-FALSE 4) MULTIPLE CHOICE 5) SHORT ANSWER 6) FILL-IN

PRACTICE AND TEST ITEMS MUST MATCH IN BEHAVIOR.

5. PRACTICE & FEEDBACK: DEVELOP A STATEMENT WHICH INDICATES WHETHER THE ITEM BEING CLASSIFIED WAS AN EXAMPLE OR NON-EXAMPLE. THIS STATEMENT MAY ALSO INCLUDE: 1) EXPLANATIONS OF CRITICAL ATTRIBUTES. 2) INDICATIONS OF THE LACK OF A CRITICAL ATTRIBUTE.
LEVEL OF CONTENT: "RULES/PROCEDURES" LEVEL OF BEHAVIOR: "REMEMBER"

INSTRUCTIONAL COMPONENTS TO BE DEVELOPED FOR THIS TYPE OF OBJECTIVE AND A DESCRIPTION OF THE PRESENTATION FORM OF EACH COMPONENT AS follows:

1. GENERALITY: PREPARE A STATEMENT WHICH PROVIDES:
   1) THE NAME OF THE RULE/PROCEDURE.
   2) ALL THE STEPS AND WHERE APPROPRIATE, THE BRANCHING DECISIONS, IN THE CORRECT ORDER.
   3) THE OPERATIONS/TECHNIQUES TO USE IN APPLYING THE GENERALITY.

2. SUPPORT: SUPPORT SHOULD HELP THE LEARNER REMEMBER THE RULE/PROCEDURE. A MNEMONIC, OR AN ELABORATION OF THE GENERALITY SHOULD BE USED.


4. PRACTICE
   TEST ITEMS: INSTANCES SHOULD REQUIRE THE STUDENT TO RECALL ALL THE STEPS AND WHERE APPROPRIATE, THE BRANCHING DECISIONS IN THE CORRECT ORDER REQUIRED. ITEMS MAY BE PRESENTED IN THE FOLLOWING FORMATS:
   1) SHORT ANSWER
   2) FILL-IN
   3) LISTING

PRACTICE AND TEST ITEMS MUST MATCH IN BEHAVIOR (INTENT) AND FORMAT.
LEVEL OF CONTENT: "RULES/PROCEDURES"  LEVEL OF BEHAVIOR: "USE"

INSTRUCTIONAL COMPONENTS TO BE DEVELOPED FOR THIS TYPE OF OBJECTIVE AND A DESCRIPTION OF THE PRESENTATION FORM OF EACH COMPONENT ARE AS FOLLOWS:

1. GENERALITY: PREPARE A STATEMENT THAT CONTAINS THE FOLLOWING:
   1) THE NAME OF THE RULE/PROCEDURE
   2) ALL THE STEPS AND WHERE APPROPRIATE, THE BRANCHING DECISIONS, IN THE CORRECT ORDER.
   3) THE OPERATIONS/TECHNIQUES TO USE IN APPLYING THE GENERALITY.

2. SUPPORT: SUPPORT SHOULD INCLUDE ONE OR MORE OF THE FOLLOWING:
   1) AN ELABORATION OF GENERALITY IN SIMPLER TERMS
   2) A FLOWCHART ALGORITHM OR CHECKLIST WHICH INDICATES THE STEPS IN THE PROCEDURE/PROCESS.

3. EXAMPLE: AN EXAMPLE SHOULD BE A DEMONSTRATION WHICH SHOWS:
   1) HOW TO PERFORM EACH STEP IN ORDER
   2) THE RESULTS (OUTPUT) OF EACH STEP
   3) COMMONLY MADE ERRORS

4. PRACTICE TEST ITEMS: PRACTICE AND TEST ITEMS SHOULD REQUIRE THE LEARNER TO APPLY THE GENERALITY IN A SITUATION CONSISTENT WITH THE OBJECTIVE. ALL STEPS AND WHERE APPROPRIATE BRANCHING DECISIONS, MUST BE PERFORMED IN THE CORRECT ORDER. APPROPRIATE TEST ITEM FORMATS INCLUDE:
   1) PERFORMANCE
   2) TRUE-FALSE
   3) MULTIPLE CHOICE
   4) SHORT ANSWER
   5) FILL-IN

PRACTICE ITEM FORMAT MUST BE THE SAME AS THAT FOR THE TEST. ALL PRACTICE ITEMS MUST INCLUDE FEEDBACK.

5. PRACTICE FEEDBACK: PROVIDE AN ANSWER(S) TO EACH PRACTICE ITEM.
LEVEL OF CONTENT: "PRINCIPALS"  LEVEL OF BEHAVIOR: "REMEMBER"

THE INSTRUCTIONAL COMPONENTS TO BE DEVELOPED FOR THIS TYPE OF OBJECTIVE AND A DESCRIPTION OF THE PRESENTATION FORM OF EACH COMPONENT ARE AS FOLLOWS:

1. GENERALITY: DEVELOP A STATEMENT OF A PRINCIPAL THAT PRESENTS:
   1) ALL THE PRE- AND POST- CONDITIONS, ACTIONS, PROCESSES, CAUSES, EFFECTS AND RESULTS.

2. SUPPORT: SUPPORT SHOULD HELP THE LEARNER REMEMBER THE PRINCIPAL.
   1) HIGHLIGHT IMPORTANT FEATURES
   2) SIMPLIFY THE RELEVANT INFORMATION
   3) USE LOGICAL REPRESENTATION OF THE "IF-THEN" RELATIONSHIPS.

3. EXAMPLES: EXAMPLES SHOULD PRESENT AN INTERPRETATION OR PREDICTION BASED ON CAUSES, EFFECTS AND RELATIONSHIPS. THE SELECTED INSTANCE SHOULD BE ONE CLEARLY IDENTIFIABLE AS EXEMPLIFYING THE PRINCIPLE.

4. PRACTICE & TESTING: INSTANCES SHOULD REQUIRE THE LEARNER TO RECALL, ALL CAUSES, EFFECTS, AND RELATIONSHIPS, PERTAINING TO THE PRINCIPLE. ITEMS MAY BE PRESENTED IN ANY OF THE FOLLOWING FORMATS: 1) SHORT ANSWER
   2) FILL-IN
   3) LISTING

   PRACTICE AND TEST ITEMS MUST MATCH IN BEHAVIOR (INTENT) AND FORMAT.

5. PRACTICE FEEDBACK: PROVIDE AN ANSWER(S) TO EACH PRACTICE ITEM.
LEVEL OF CONTENT: "PRINCIPALS"  LEVEL OF BEHAVIOR: "USE"

THE INSTRUCTIONAL COMPONENTS TO BE DEVELOPED FOR THIS TYPE OF OBJECTIVE AND A DESCRIPTION OF THE PRESENTATION FORM OF EACH COMPONENT ARE AS FOLLOWS:

1. GENERALITY: DEVELOP A STATEMENT OF A PRINCIPAL THAT PRESENTS:
   1) ALL THE PRE- AND POST- CONDITIONS, ACTIONS, PROCESSES, CAUSES, EFFECTS AND RESULTS.

2. SUPPORT: DEVELOP A STATEMENT(S) WHICH INCLUDE ONE OR MORE OF THE FOLLOWING:
   1) AN ELABORATION OF THE GENERALITY IN SIMPLER TERMS.
   2) HIGHLIGHT OF IMPORTANT FEATURES.
   3) INCLUDE LOGICAL REPRESENTATIONS OF THE "IF-THEN" RELATIONSHIPS IN THE GENERALITY.

3. EXAMPLES: SELECTED EXAMPLES SHOULD PRESENT AN INTERPRETATION OR PREDICTION BASED ON RELEVANT CAUSES, EFFECTS AND RELATIONSHIPS. THE SELECTED INSTANCES SHOULD BE THOSE CLEARLY IDENTIFIABLE AS EXEMPLIFYING THE PRINCIPLE.

4. PRACTICE AND TESTING: INSTANCES SHOULD REQUIRE THE LEARNER TO PROVIDE AN EXPLANATION OR PREDICTION BASED ON THE PRINCIPLE. ITEMS MAY BE PRESENTED IN ANY OF THE FOLLOWING FORMATS:
   1) SHORT ANSWER
   2) FILL-IN
   3) LISTING

   PRACTICE AND TEST ITEMS MUST MATCH IN BEHAVIOR (INTENT) AND FORMAT.

5. PRACTICE FEEDBACK: PROVIDE AN ANSWER(S) TO EACH PRACTICE ITEM. AN EXPLANATION OF "WHY" A PARTICULAR ANSWER IS PREFERRED IS ALSO DESIRABLE.
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