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ANALYSIS OF REQUIREMENTS AND METHODOLOGY FOR DECISION TRAINING IN OPERATIONAL SYSTEMS

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Prepared For:

Naval Training Equipment Center
Orlando, Florida 32813

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This report describes the first phase of a one-year program of research and development. The program investigates the use of decision analysis techniques in the design of instructional materials for decision training in military systems. The long range goal is to define a decision training approach that can be applied to a wide variety of system training courses. As a first step toward that goal, the present program focuses on the decision training requirements of the SH-2F (LAMPS) ASW helicopter. In

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20. ABSTRACT Continued

this environment decision analysis techniques are used to (1) identify and select critical decision making situations during helicopter operations, (2) define the decision making tasks required of the Pilot/ATO and/or the Sensor Operator, and (3) specify the skills and knowledge necessary to make effective decisions.

Outlined in the report are the results of the first phase of the research and development program. The technical approach methodology for decision task identification and classification is described. The methodology is utilized to identify and classify the decision tasks involved in the LAMPS operation. The job analysis performed for the LAMPS/ASW operation was conducted using three major sources of information: objective hierarchies, instructional materials, and expert interviews. Tables of results for each of these materials appear in appendices. Finally, the results of the materials analysis and the required data on which the task selection analysis was performed is presented.

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1. INTRODUCTION

1.1 Overview

This report describes the first phase of a one-year program of research and development. The program will investigate the use of decision analysis techniques in the design of instructional materials for decision training in military systems. The long range goal is to define a decision training approach that can be applied to a wide variety of system training courses. As a first step toward that goal, the present program focuses on the decision training requirements of the SH-2F (LAMPS) ASW helicopter. In this environment decision analysis techniques are used to (1) identify and select critical decision making situations during helicopter operations, (2) define the decision making tasks required of the Pilot/ATO and/or the Sensor Operator, and (3) specify the skills and knowledge necessary to make effective decisions.

To an ever-increasing extent, the operators of advanced military systems, such as aircraft, ships, weapons, C3, etc., act primarily as decision makers. That is, the operator's most important functions are to select from alternative data sources and to choose among alternative courses of action. But although he may be well trained to carry out each alternative procedure, he is virtually never trained in how to most effectively make the crucial decision among them. Traditionally, acquiring the judgment to make sound decisions has been considered an art, which must be developed over years of experience, or through long apprenticeship to a veteran decision maker. This approach, aside from being of dubious validity, is inappropriate in today's military environment, where an operator must step into a job and function well from the start.

Within the past several years, the general rules of effective decision making have been consolidated into the technical area termed decision analysis. During the same period, the systems approach to training has established a generalized methodology for dealing with diverse content areas in the design of training courses. Accordingly, it is the objective here to bring these two areas together in order to define the decision training objectives of typical military systems and to specify ways of meeting them. Successful joining of the two technologies should have a profound effect on future system performance and lifetime cost.

The program has the following major objectives:

(1) To analyze a specific military training system, the SH-2F (LAMPS) helicopter, in terms of specific decision analysis techniques.

(2) To identify the decision situations that occur during regular and emergency system operations.

(3) To isolate the decision tasks that are required to resolve a selected set of decision situations.

(4) To identify, for each decision task, (a) the required facts, (b) the underlying concepts, (c) the decision rules, and (d) the step-by-step procedures that determine the optimal choice of alternatives.

(5) To contribute to the production of training materials for one or more of the decision tasks, to include: (a) training analysis, and (b) production of instruction.

(6) To evaluate the materials produced for this test case, and to analyze the implications for (a) similar system-oriented courseware; (b) courseware for generalized decision training; and (c) decision-aiding software for the SH-2F and related systems.

1.2 Background

1.2.1 Problem Statement. Instructional System Development (ISD) currently provides a systematic and scientific methodology for (1) identifying the tasks that operators must perform, (2) specifying the hierarchy of training objectives, and (3) developing the procedures and schedules for training the operators to perform the identified tasks. However, decision making tasks have typically not been among those identified and treated by the ISD methodology. Decision tasks are thus neglected in present training courses. In most cases, alternative selection has been considered as a well-structured "cookbook" response, rather than as a decision consisting of specific sequences of tasks to be trained. In those cases where critical decision points have been recognized, performance is assumed to come "from experience" rather than by explicit instruction. Research is definitely required to develop a methodology for identifying and isolating decision tasks in current system training functions, as well as for developing procedures for training in decision making.

1.2.2 Decision Making. Investigation of human decision making has focused on the process of choosing among alternatives under various conditions of risk and uncertainty. Research has identified sequences of tasks included

in general decision making. Although many sets of tasks have been suggested in the literature on decision making, the list given by Nickerson and Feehrer (1975) provides a comprehensive set for purposes of discussion and comparison. It consists of (a) information gathering, (b) data evaluation, (c) problem structuring, (d) hypothesis generation, (e) hypothesis evaluation, (f) preference specification, (g) action selection, and (h) decision evaluation.

Theoretical research on normative (ideal) decision making has also identified sources of human decision-making deficiencies. Such deficiencies include stereotyped choice sequences, conservative probability application, incomplete data acquisition, etc. Several investigators (Hammell and Mara, 1970; Kanarick, 1969; Pesch, Hammell, and Ewalt, 1974) have suggested that decision training programs can diagnose and give instruction regarding decision deficiencies.

1.2.3 Decision Analysis. Techniques of decision analysis have been developed that can be used to identify the decision points in a sequence of actions performed by a system operator. These techniques also provide a systematic method for identifying the decision parameters specific to the situation at hand (i.e., alternatives, rules, attributes). Thus, the tasks and associated inputs of decision making can be explicitly defined for training purposes.

The multi-attribute utility approach to analyzing decision situations is one example of these techniques (Gardiner and Edwards, 1975; Gardiner, 1977). Essentially, this approach first establishes dimensions of value -- attributes -- for the relevant set of decision outcomes. Each outcome to be evaluated is located on each dimension--i.e., assigned an attribute utility--by means of observation of judgment. Utility can be thought of as gain to the operator; gain can be positive; negative gains

are costs. An overall utility for the outcome is achieved by aggregating the multiple utilities, most often by calculating a weighted average over attributes. The expected utility of an outcome is its aggregated utility multiplied by its probability of occurring, and the usual decision rule is to select the outcome with maximum expected utility, although in some cases other rules may be preferred.

1.2.4 Decision Aiding. Introduction of decision aids to the decision environment provides a framework for familiarizing the operator with decision theoretical concepts and decision training approaches. It has been shown that adaptive decision aids can be an effective instructional tool for behavior change and performance improvement (May, Crooks, and Freedy, 1976). Adaptive decision aiding has also been effectively used to show that when decision models based on real operators are used for decision making, performance is superior to that of the operator himself, both in terms of performance scores and in terms of decision consistency (Dawes, 1970; Freedy, Davis, Steeb, Samet, and Gardiner, 1976).

1.3 Technical Approach

1.3.1 Overview. Attention has been initially focused on a single military system able to provide good examples of decision making tasks which are important to system operation and which are likely to be improved by training in an instructional program. This system is the SH-2F (LAMPS) ASW helicopter. An instructional course for the LAMPS crew members (Pilot/ATO and Sensor Operator) is currently being developed by Courseware, Inc., San Diego. Accordingly, a main feature of the technical approach is that Perceptronics is coordinating its efforts with those of Courseware. In effect, Perceptronics acts as "subject matter expert" in the area of decision making. The final output of Perceptronics' decision analysis will be presented in a form suitable for incorporation by Courseware into the

specification of instructional objectives, the planning of strategies, the selection of media, and the other steps required for the production of instruction.

The main tasks involved in the current program effort are the following:

(1) Analysis of LAMPS Operators' Functions
(2) Decision Selection
(3) Description of Decision Tasks
(4) Development of Instruction
(5) Recommendation of Decision Aids

These tasks are described separately in the following sections.

1.3.2 Analysis of LAMPS Operators' Functions. Analysis of LAMPS helicopter operations identified decision points that occur during execution of the operator's functions. This task corresponds to the Job Analysis phase of the instructional development process and is the main subject matter contained in this report. Decision points in an operator's sequence of functions have the following characteristics:

(1) The operator is required to make a choice between a number of alternatives.

(2) The criteria for selecting among the alternatives are not completely specified, and may have significant judgmental components.

(3) The operator is required to either define the possible choices (problem structuring) or evaluate the potential outcomes (action selection).

Indicators for identifying decision points in the operator's functions include the following.

(1) Additional information may be necessary before a choice can be completely defined.

(2) The possible outcomes of the choice are uncertain and some estimate of their likelihood may be required.

(3) The consequences of the actions are composed of a number of factors that must be aggregated.

(4) The alternative consequences of the current action will differentially affect future actions.

1.3.3 Decision Selection. From the list of decisions identified in the job analysis, a limited number were selected for the examination of decision training methodology. Selection focused on highly critical decisions. The criteria for selection was the following:

(1) Safety Criticality
(2) Time Criticality
(3) Frequency of Occurance
(4) Current Decision Making Effectiveness
(5) Tractability
(6) Demonstrability

Candidate lists of potential decision tasks in the LAMPS emergency procedures were ranked by LAMPS expert instructors according to the above criteria. A composite ranking was then obtained and provided the basis for final decision task selection. The results of this selection are presented in Section 4. The decisions were thus chosen to represent both general classes of decisions and decisions that are specific to particular crew positions.

1.3.4 Description of Decision Tasks. This corresponds to the Task Analysis phase of Instructional System Development. Researchers in decision making have suggested various classifications of tasks that decision makers perform (Adelson, 1961; Drucker, 1967; Edwards, 1965; Hill and Martin, 1971; Howard, 1968; and Schrenk, 1969). These classifications provide a framework for enumerating the tasks that the LAMPS operators must perform in each of the selected decisions. A preliminary list of steps for generalized decision making include:

(1) Recognize the decision point
(2) Formulate the alternative courses of action
(3) Establish the possible outcomes of each course
(4) Estimate the multi-attribute utility -- i.e., gains or losses -- associated with each outcome
(5) Estimate the probability of achieving the various outcomes
(6) Apply decision rule(s) or criteria
(7) Select a best course of action

It is anticipated that the set of decision tasks will include both generalized tasks (i.e., decision problem structuring) and tasks that are unique to each specific decision (i.e., list of possible alternative classes).

1.3.5 Development of Instruction. The steps involved in the actual production of training materials for all or some of the selected decision tasks include the specification of:

(1) Objective Hierarchies
(2) Strategy Planning
(3) Media/Method Selection
(4) Course Sequencing

It is realized that training crew members for more effective decision making is no trivial matter. Many years of research have been spent on each of the areas mentioned above. For example, much work has been devoted to the area of probability assessment alone. Nevertheless, it is felt that the effort is justified for the following reasons:

(1) The vast amount of theoretical and experimental work provides an invaluable guide to practical application.

(2) It appears that much of the benefits to be derived from the decision analytic approach lies in problem definition itself, that is, in the operator recognizing that a decision problem exists, and evaluating it in terms of expected costs and expected gains. This aspect of decision making, concepts and basic rules, seems highly amenable to training.

(3) By restricting initial effort to a specific system, the job of defining decision problems and prescribing procedures for training is simplified.

(4) The potential payoff is great. Tactical decision involve equipment and procedures of ever-increasing cost. Any gain in decision effectiveness realized at the training stage will have a large multiplier effect over the total system life.

1.3.6 Recommendations of Decision Aids. It is anticipated that identification of decision points and decision tasks will also suggest decision aids that could be incorporated in the operational system. Decision aids can be used in a variety of ways to improve the logical soundness or speed of decision making. In general, aids are directed towards eliminating deficiencies and

limitations in human cognitive performance. As an example of eliminating deficiencies, an aid can be used to remind a decision maker to seek more information or to help avoid a stereotyped response. As an example of overcoming limitations, decisions aids can help evaluate a larger number of alternatives than an unaided decision maker could consider. A variety of decision aiding techniques are available, ranging from printed decision trees and flow diagrams, through paper-and-pencil mathematical proceudres, to interactive computer-based techniques. The computer-based techniques include data-base retrieval and bookkeeping functions, graphical problem representation, hypothesis generation, simulation of outcome sequences, etc. Operational decision aids have implications for training, since (1) they would be expected to reduce or change the elements of the identified decision tasks, and (2) the operators would also require training on the use of any software or hardware aids introduced to the operational system.

1.4 Summary

This report outlines the results of the first phase of the research and development program for analysis of requirements and methodology for decision training in operational systems. The technical approach is the subject of the second chapter in which the methodology for decision task identification and classification is described. The methodology described is utilized to identify and classify the decision tasks involved in the operation. Chapter three presents the job analysis performed for the LAMPS/ASW operation. The job analysis was conducted using three major sources of information: objective hierarchies, instructional materials, and expert interviews. Tables of results for each of these materials appear in appendices attached to this report. Chapter four presents the results of the materials analysis and the required data on which the task selection analysis was performed.

2. TECHNICAL APPROACH

2.1 General

The functions of both the Pilot/ATO and the Sensor Operator were the subjects of the analysis performed in the first phase of the project. A primary analysis of the job situation specified the required steps in the technical approach. These steps consist of definition of decision tasks, classification of decision tasks, and identification of decision task areas.

Performance of an operator in a decision/non-decision task-pool environment obeys the scheme presented in Figure 2-1. As the input to this scheme, a set of tasks is introduced to the operator as part of the normal LAMPS operational procedures. The set contains both decision and non-decision tasks. Since processing of a decision task requires a procedure considerably different from the one for non-decision tasks, the first responsibility of the operator is to identify the task as either a decision or a non-decision. Block 1 (Figure 2-1) shows such a dichotomization. This block acts as a "filter" which identifies decision tasks and passes them to block 3 for classification.

Non-decision tasks will also be identified in block 1 and passed to block 2 for processing. It is assumed that block 2 contains a strict set of pre-defined procedures for processing non-decision tasks. Instructional objectives, outlines and materials for these procedures have already been developed by Courseware, Inc., as a part of the current LAMPS pilot training course.

The tasks identified as decision-related are input to block 3, where they are classified as Type 1 or 3. Processing of a Type 1 decision task requires consideration of problem structuring; a Type 2 decision task

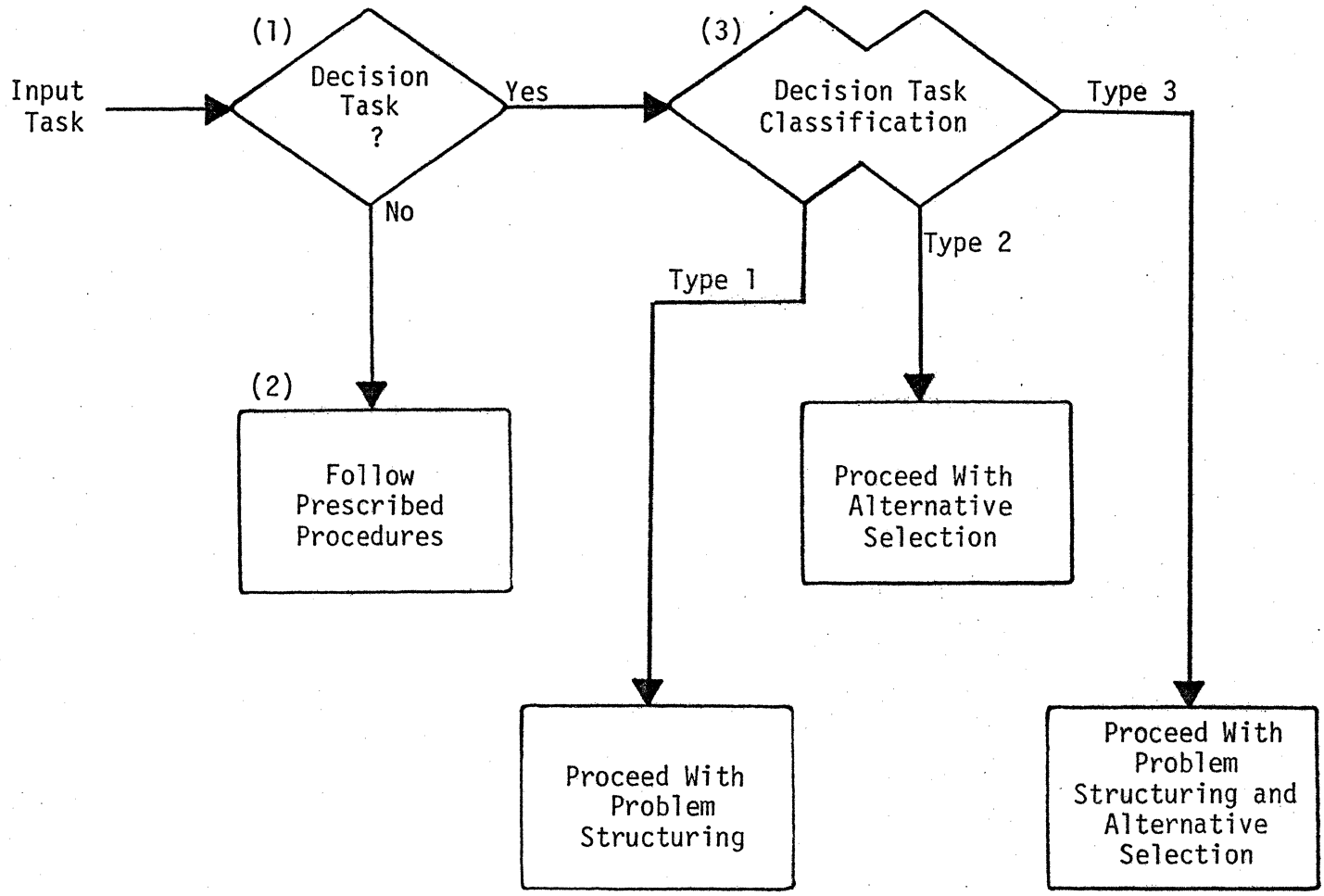


FIGURE 2-1. TASK PROCESSING SCHEME

represents action selection. Type 3 decisions represent a combination of both Type 1 and Type 2 in which both problem structuring and action selection must be considered. Blocks 1 and 3 form part of the methodology to identify and classify decision tasks in the job analysis phase. The methodology will be described in the following section.

2.2 Decision Task Definition and Classification

The mechanism of decision task identification is similar to that of a "filter" which passes all, and only, decision tasks. The characteristics of such a filter are described by the definition of a decision task:

(1) The objective of a decision task is to select an alternative from a specified set of alternatives.

(2) This selection may require the formulation of alternatives (problem structuring).

(3) There is a lack of completely specified criteria for either alternative formulation or alternative selection.

The operator actions necessary for processing a generalized decision task may involve considerations such as establishing possible outcomes and consequences of each alternative, determining utilities and probabilities of the various outcomes, evaluating major attributes of each available alternative, and applying established decision rules for selecting the best course of action. Some of these operator actions are shown in Figure 2-2 with their relationships to problem structuring and alternative selection. In general, the actions of alternative formulation and outcome formulation are related to problem structuring while actions such as utility and probability estimation are related to the action selection process.

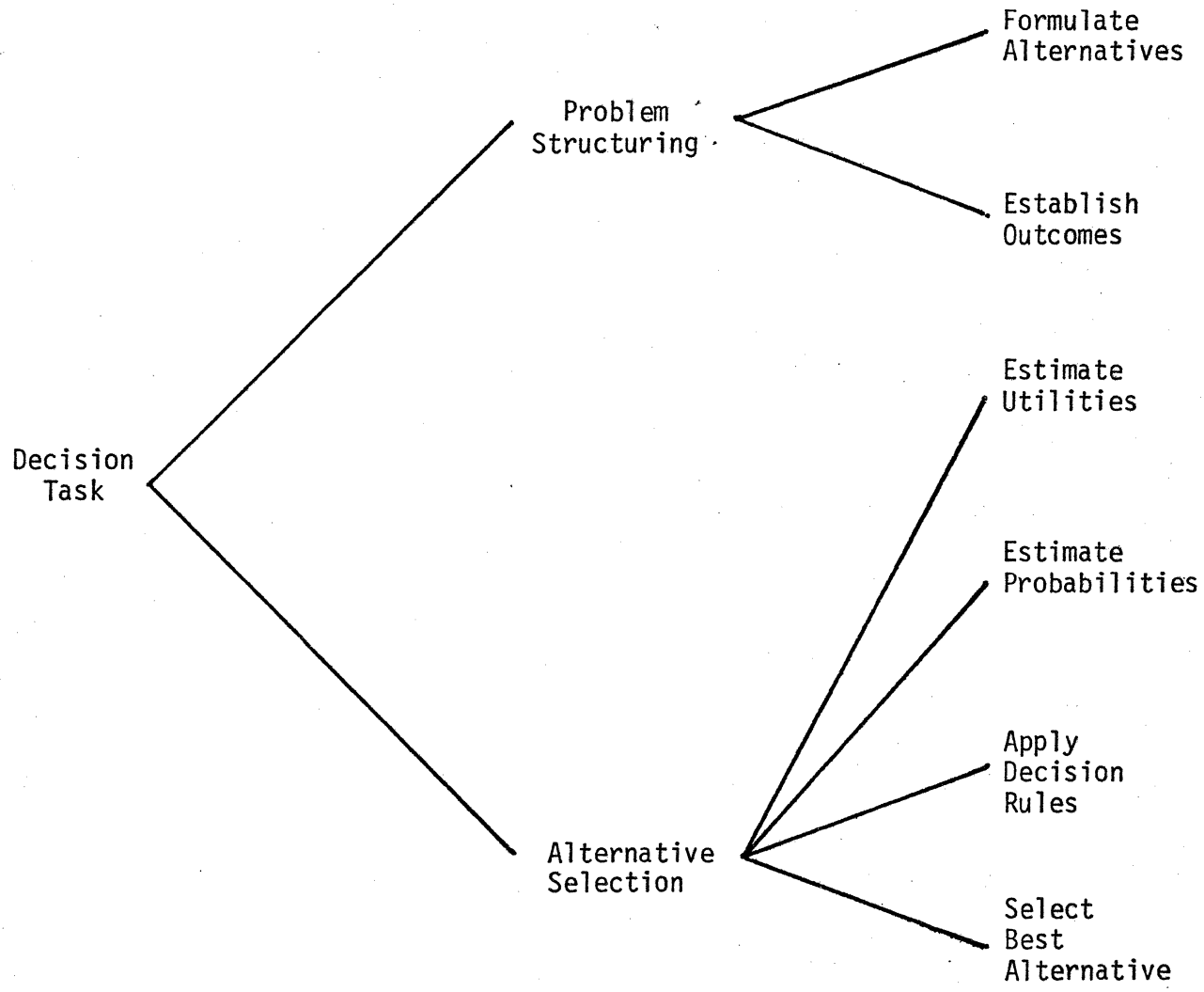


FIGURE 2-2. DECISION TASK COMPONENTS

Since there is a considerable distinction between the two tasks of problem structuring and alternative selection, there is a plausible classification scheme for decision tasks. Such a scheme is created by representing a boundary between the decision tasks requiring problem structuring and the ones requiring alternative selection. The boundary is defined by the types of operator actions necessary to process the decision task. It is this distinction which is used to identify and classify specific tasks in the LAMPS operational procedures.

2.3 Information Sources

The main information sources used in the job analysis phase originated from three main categories:

(1) Objectives Hierarchies
(2) Instructional Materials
(3) LAMPS Instructor Interviews

Objective hierarchies (provided by Courseware, Inc.) for Pilot/ATO as well as Sensor Operator courses were used as the starting point. They consist of a complete organization of all LAMPS helicopter operations and are used as a basis for creating training courses. The result gained from the analysis of objectives hierarchies led to promising LAMPS decision task area. Among instructional materials, Pilot/ATO and sensor operator tape slides as well as Pilot/ATO workbooks were the subjects of detailed studies. The tape slides and workbooks deal with specific training subjects and are presented in an informal manner conducive to efficient training. LAMPS instructor interviews provided the required information not existing in the previous two sources. Potentials, limitations, and efficiency of training elements of the present instructional system were part of the informative data captured through these interviews. Besides the three

major sources of information, informal interviews of LAMPS student trainees and inspection of actual LAMPS helicopters provided additional data for the job analysis. Results from each of these information sources is presented in the next chapter. A detailed listing of decision tasks appears in the appendices.

2.4 Selection Methodology

A composite ranking method was used to select the final LAMPS decision task areas to be used for in-depth study. Preliminary lists of potential decision task areas were initially ranked by LAMPS expert instructors according to the following criteria:

(1) safety criticality
(2) time criticality
(3) frequency of occurrence
(4) current decision making effectiveness

Perceptronics' analysts then ranked the same preliminary list according to the following criteria:

(1) tractability
(2) demonstrability

A composite ranking was then obtained and served as the basis for final decision task selection.

3. JOB ANALYSIS

3.1 Overview

During the current "Job Analysis" phase, the attention was focused on identification and selection of decision tasks in the SH-2F (LAMPS) ASW operation. An in-depth study of the entire LAMPS operations was conducted (with the exception of LAMPS tactics which involves classified materials). Figure 3-1 shows a detailed diagram of the approach followed during this phase. The following is a summary of this approach in which the individual items are numerically indicated in the figure.

(1) A preliminary methodology for the identification and classification of decision tasks was developed. This methodology enabled the separation of decision-related LAMPS tasks from procedural non-decision tasks. The methodology is described in Sections 2.2 and 2.3.

(2) Two volumes of LAMPS instructional "objective hierarchies" were analyzed for the purpose of isolating potential areas for decision tasks. These two volumes taken together comprise the document: "Instructional Design and Development Objective Hierarchies for Pilot/ATO and Sensor Courses", SH-2F (LAMPS) Instructional Systems Development Project No. N68221-75-PR-51201, Data Item No. A001, prepared by Courseware, Inc., 7851 Mission Center Court, Suite 220, San Diego, CA 92108.

(3) The results of the objective hierarchy analysis was a list of potential areas for decision tasks. The results will be described in detail in Chapter 4.

(4) An in-depth analysis of the available instructional materials for the LAMPS training courses was conducted. This consisted

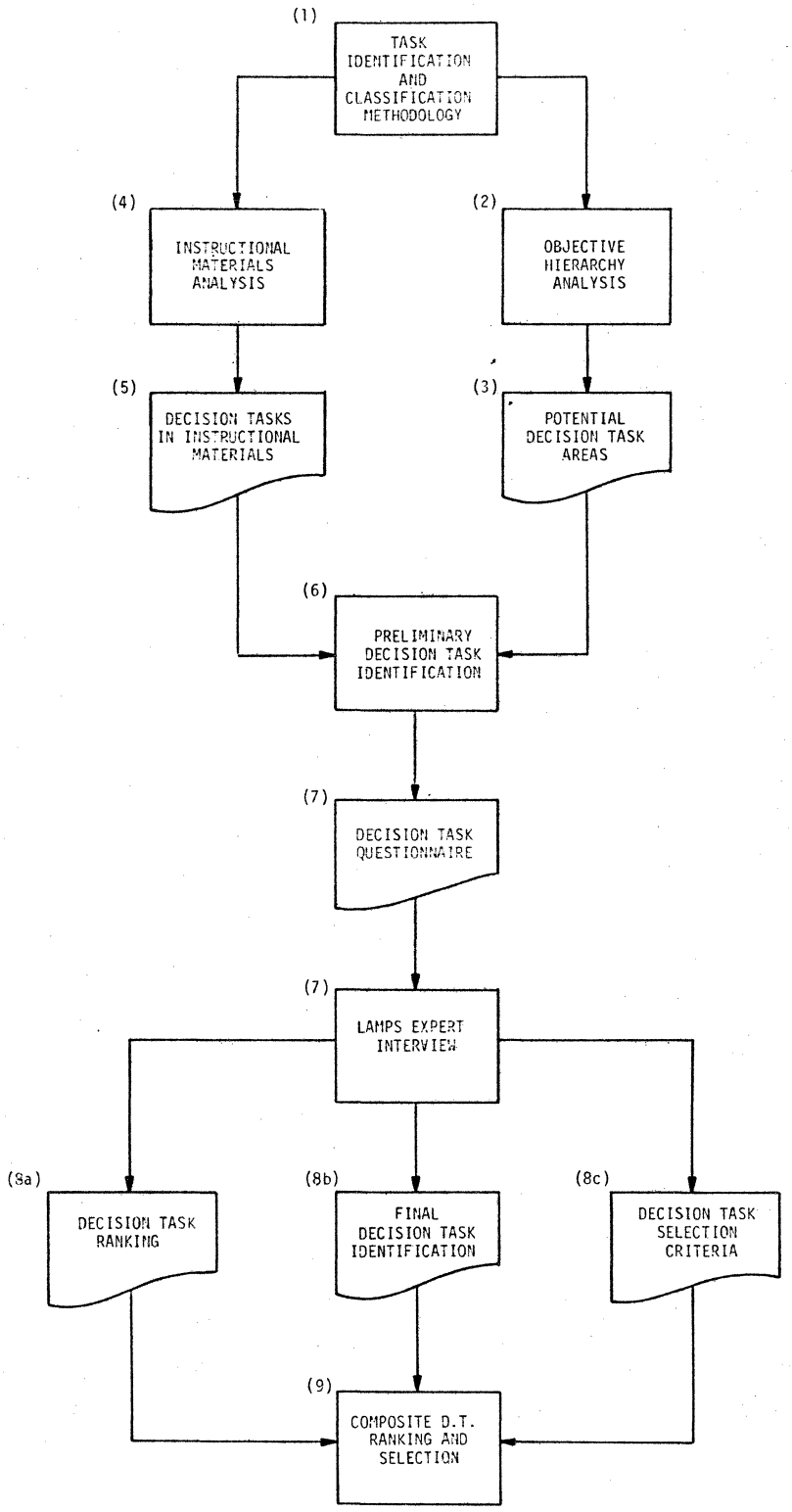


FIGURE 3-1. WORK FLOW FOR JOB ANALYSIS PHASE

of the review of 49 Pilot/ATO tape slide courses, 34 crewman tape slide courses, and 187 Pilot/ATO workbook courses.

(5) The results of the instructional materials analysis was a second list of potential areas for decision tasks in the LAMPS operations.

(6) From the two preliminary decision area lists, a composite detailed list of decision tasks was compiled.

(7) To prepare for final decision task ranking and selection, two experienced LAMPS instructors and two student LAMPS trainees were interviewed with prepared questionnaires.

(8) The results of the questionnaires provided:

(a) a ranking of the tentative decision tasks in order of importance and criticality,

(b) an identification of major decisions in each potential area, and

(c) criteria for final selection.

(9) A final composite decision task ranking and selection was made based upon all of the analysis information.

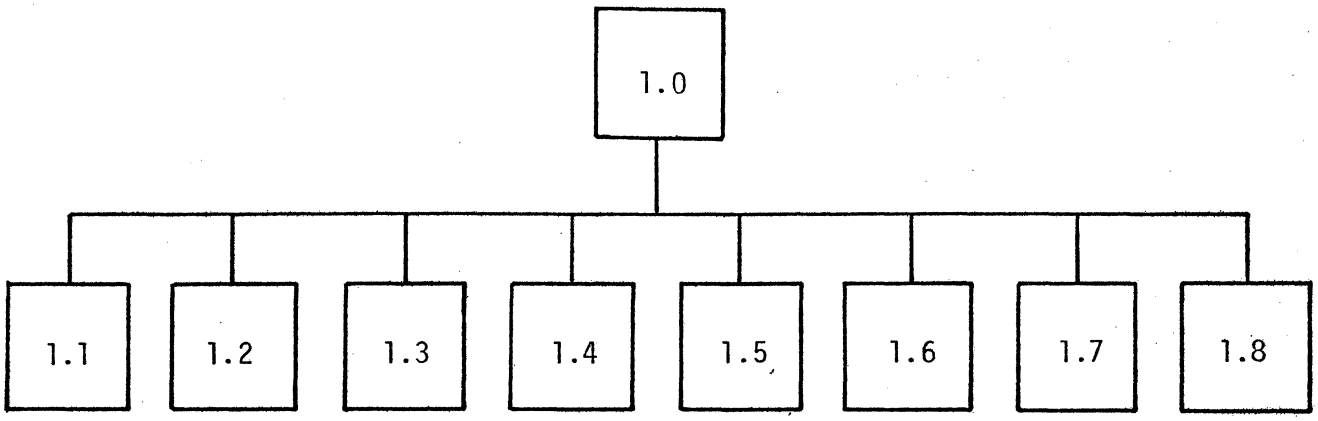
3.2 Objectives Hierarchies

Instructional design and development of SH-2F LAMPS operation has been represented thoroughly in Pilot/ATO and Sensor Operator Objectives Hierarchies. The objectives are structured in expanding levels of detail with each objective decomposed into component sub-objectives. Development

of instructional materials for courses as well as course sequence are based on these hierarchies. However, every element of the most detailed level of the hierarchies does not necessarily correspond to a single course. A course of instruction may cover many training objectives at different hierarchical levels. An example of objectives hierarchies is shown in Figure 3-2. In some cases, as many as 11 levels of objectives are given. The sample shown in the figure is only the top-most level.

The objectives hierarchies were a primary subject of analysis. The methodology for decision task identification was used to identify those objectives which could be classified as potential decision tasks. A complete list of results of this analysis of Pilot/ATO and Sensor Operator appear in tables in Appendices A and B. In these tables, every identified decision task is classified as Type 1, Type 2, or Type 3. The tasks are organized into related groups in which a problem/sub-problem relationship exists between consecutive pairs of elements. The first element of each group represents the decision task captured at a higher level. Only the task area for the first element of every group is identified since the other elements of the group consist of the subproblems of the first element.

The identification and classification process for decision tasks followed the methodology expalined in Section 2.2, Due to the large number of existing tasks, the plausibility of computerization of such an analysis was considered. A correspondence between the decision-related tasks in the objectives hierarchies and certain "keywords" used in the description was noted during the analysis. A keyword, in this case, refers to an element of a set of verbs appearing in an imperative sentence, for example, "Determine whether to land the iarcraft or to abort the recovery" (p. 112, Pilot/ATO Objective Hierarchies) or "Perform a search in accordance with NWP-37 and NATOPS" (p. 130 Pilot/ATO Objective Hierarchies). The description of every task appearing in objectives hierarchies includes at least one of these keywords.



1.0 Perform all Pilot/ATO functions flying an SH-2F.

1.1 Fly an SH-2F to complete an ASW mission.

1.2 Fly an SH-2F to complete an ASMD mission.

1.3 Fly an SH-2F to complete a surveillance mission.

1.4 Fly an SH-2F to complete a search and rescue mission.

1.5 Fly an SH-2F to complete an external cargo mission.

1.6 Fly an SH-2F to complete an Internal cargo/passenger transfer mission.

1.7 Fly an SH-2F to complete a Naval gunfire spotting mission.

1.8 Describe the main components and operation of SH-2F aircraft systems.

FIGURE 3-2. OBJECTIVES HIERARCHIES

The result of examination of objectives hierarchies, however, revealed an inconsistency in the use of keywords. Some critical keywords appeared in both decision tasks as well as non-decision tasks. For example, "state" and "calculate" appeared mainly in non-decision tasks; however, about 20% of their applications were in definitions of decision tasks. Future consistency in the use of keywords for decision and non-decision tasks is strongly recommended. A list of the two classes of keywords appears in Figure 3-3. In spite of the inconsistency in use, the keywords provided a reasonable starting point for identification of decision tasks. The use of a computer program for this part of decision task identification could be a means of increasing the efficiency of identification process.

In summary, the analysis of the objectives hierarchies led to the conclusion that most of the decision tasks would be found in the emergency and tactical operational procedures. Furthermore, the Pilot/ATO tasks contained many more decision-related situations than the sensor operator tasks. Since the material concerning tactical operations is classified, effort was focused on the emergency procedures.

3.3 Instructional Materials

Analysis of objectives hierarchies identified the major areas for decision making tasks. In this section of the job analysis, the study was focused on the instructional materials. Two out of four existing types of course materials are used for the instruction of LAMPS operation:

(1) Tape Slides (TS)
(2) Work Book (WB)
(3) Computer Aided Instruction (CAI)
    (classified material -- not included in the analysis)
(4) Visual Tapes (VT)
    (not included in the analysis due to unavailability)

DECISION MAKING KEYWORDS

DETERMINE	INTERPRET
CALCULATE	REVISE
STATE	SELECT
PRESCRIBE	INDICATE
IDENTIFY	RECOGNIZE
CLASSIFY	
ESTIMATE	

NON-DECISION MAKING KEYWORDS

CALCULATE	LIST
PERFORM	NAME
RECOVER	DESCRIBE
PLAN	STATE
CONDUCT	
DEMONSTRATE	

FIGURE 3-3. OBJECTIVES HIERARCHY KEYWORDS

3.3.1 Tape Slides. A series of audio cassette tapes together with corresponding synchronized slides are used to cover part of the course instruction in LAMPS operation. Tape slides for Pilot/ATO, as well as crewmen, were the subject of a detailed analysis. Tape slide materials mainly represent technical and introductory courses. The majority of tape slide courses cover the procedural tasks with no decision making steps. These were termed Non-Decision Tasks (ND). Some of the courses represented by tape slides covered decision situations in which the pilot has the full responsibility of decision making (Decision Making Tasks, DM). In the remainder, the decision making tasks were assumed to be performed by the pilot through the execution of a predefined procedure. These were termed Decision Execution Tasks (DE).

In some cases, the decision making characteristics of a particular situation are explicitly emphasized in the tape slide presentation. The trainee is told that a decision task exists and is given situations to analyze. However, it is made exceptionally clear that the final choice of actions rests with him (the pilot) and that the basis for the decision is his own judgment and experience. These decision tasks are "obvious" in the sense that they are termed "decision tasks" in the instructional materials themselves. In other cases, a decision task is evident in the instructional materials but is not presented to the student as such. These decision tasks are "hidden" within established procedures for executing a particular operational plan.

The results of tape slide analysis for 49 Pilot/ATO and 34 Crewman courses appear in Appendices C and D. Task number, type, and keyword columns are identical to the ones of objectives hierarchies analysis. The task name identifies the course title and the slide number represents the new codes replacing the previous coding system to identify different tape slides. The non-available tape slides are marked by NA. Some of the tasks are described in the notes following the result of the analysis. These tasks are marked by an asterisk on their slide numbers.

3.3.2 Workbook. A considerable portion of the LAMPS operational instructions are covered by workbooks. Figures 3-4 and 3-5 show an example of workbook courses for a "Radar Offset" approach to an unidentified contact and procedures for an "Immediate Ditching" of the helicopter, respectively. In addition to the exercise and lesson number, the first page of a workbook course always contains the objective, a general list of actions, and an introduction describing the course material. The remainder of the lesson is usually divided into procedures, actions, and remarks or comments.

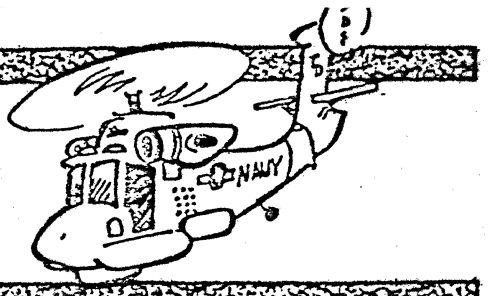
In Figure 3-4 (Page 2) of the Radar Offset Approach lesson, the action performed for procedure 2 is the "The ATO will decide if a direct or offset approach will be used." Guidelines for this decision are then given. This is an example of a Type 2 "obvious" decision in which the ATO must choose from among a specified set of two alternatives. However, on page 1 of the Immediate Ditching Workbook course, section 4.b.2 under "pilot" shows a hidden decision in which the pilot is not given guidelines or told how to choose an alternative.

The analysis of the Pilot/ATO workbooks included 187 lessons. The results of this analysis appear in Appendix E. However, a summary of results appears in Figure 3-6.

3.4 Expert Interview

The information acquisition for the job analysis phase was completed by interviewing the LAMPS operational experts. Two LAMPS operation instructors as well as two LAMPS operation trainees participated in the interviews. A series of predesigned questionnaires were prepared from the specific tasks identified in objectives hierarchies and tape slide analysis. A sample of questionnaires appears in Figure 3-7. The sample questionnaire concerns the problem of a gearbox malfunction. It is classed as an emergency operation. Each question attempts to elicit information about the particular decision.

RADAR OFFSET



EXERCISE: F-11

LESSON: 2

SEGMENT: 2

MEDIA: Workbook

OBJECTIVE

State the procedures for performing a radar approach to a contact.

GENERALITY

The correct procedure for performing a radar approach to a contact is:

1. Find radar target.
2. Determine if a direct or offset approach will be used.
3. Compute estimated time on top.
4. Turn to an inbound course.
5. Radar as desired.
6. Mark on top contact.

INTRODUCTION

When flying a radar approach to a contact the senso will provide headings and distances to fly. You may deceive the contact into thinking that he has not been detected by flying an offset approach. (An offset approach entails flying parallel or perpendicular to the contact's course and then "cutting in" directly to him.) If you believe the contact will submerge before you reach him, a straight in approach is recommended. (It is easier to calculate the estimated time on top flying a straight in approach.)

FIGURE 3-4

RADAR OFFSET

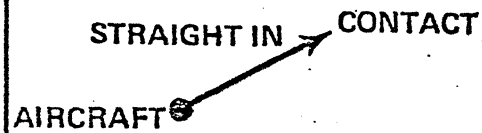
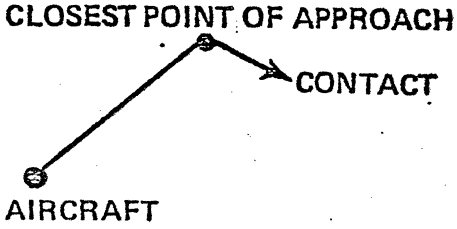
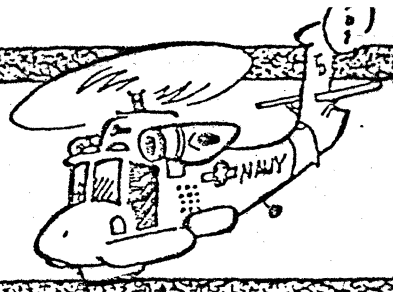
	PROCEDURE	ACTION PERFORMED	IMPORTANT NOTES AND COMMENTS
1	FIND RADAR TARGET	The senso should locate the contact and pass the bearing and range information to the cockpit.	
2	DETERMINE IF A DIRECT OR OFFSET APPROACH WILL BE USED	<u>The ATO will decide if a direct or offset approach will be used.</u> a. A direct approach is flown directly from the aircraft's present position to the surface contact. b. The offset approach is flown to a position abeam the target to one side at the closest point of approach. From this point a direct leg is used.	a. This approach is recommended if you believe you have been detected.  b. If you think you are detected and wish to get closer to the contact prior to starting your direct run, you should use the offset approach. If the contact disappears from the radar during an offset approach, immediately perform a direct approach to the contact. 
3	COMPUTE THE ESTIMATED TIME ON TOP	Determine the distance from the aircraft to the contact and adjust for groundspeed.	Time on top is important in case your contact disappears from the radar screen.

FIGURE 3-4 Continued

IMMEDIATE DITCHING



EXERCISE: F-7

LESSON: 2

SEGMENT: 7

MEDIA: Workbook

OBJECTIVE

State the steps to complete an immediate ditching.

GENERALITY

PILOT	COPILOT
1. Alert crew and passengers, harness locked. 2. Pilot's door - open 3. Transmit distress message 4. After water landing: A. Two engine fail 1. Full up collective 2. Rotor brake - on 3. Abandon aircraft B. Single Eng fail 1. Hold helicopter level ✓2. Either secure eng and rotors (release harness and abandon aircraft or) follow single eng water takeoff procedures.	1. Open copilot's door, harness locked. 2. Jettison all external cargo/ stores and sonobuoys. 3. When rotor stops, abandon aircraft.

INTRODUCTION

In the event of an immediate ditching situation it is critical that all of the people in the aircraft react to it and perform their NATOPS procedures. You will be required to know both the pilot and copilot duties since you will be serving in both functions during your training.

FIGURE 3-5

IMMEDIATE DITCHING (PILOT)

	PROCEDURE	ACTION PERFORMED	IMPORTANT NOTES AND COMMENTS
1	ALERT CREW AND PASSENGERS, HARNESS LOCKED	Let the crew know you are going to ditch over the ICS.	If the Senso is on private, monitoring sonobuoys, you will have to use the call position of the ICS to talk to him.
2	PILOT'S DOOR – OPEN.		If door does not want to open, pull jettison "T" handle.
3	TRANSMIT DISTRESS MESSAGE	Switch to guard and tell them 1) I.D. 2) Position 3) Number of people on board 4) Problem	If time permits, repeat your distress call.
4	AFTER WATER LANDING: A. TWO ENGINE FAIL 1. COLLECTIVE: FULL UP 2. ROTOR BRAKE ON 3. ABANDON AIRCRAFT B. SINGLE ENG FAIL 1. HOLD HELICOPTER LEVEL 2. EITHER SECURE ENG AND ROTORS AND RELEASE HARNESS AND ABANDON AIRCRAFT OR FOLLOW SINGLE ENG WATER TAKEOFF PROCEDURES		1) Do not inflate floatation gear until clear of aircraft 2) Unplug helmet cords before trying to get out of the aircraft 3) WARNING-Do not abandon aircraft before the rotor has stopped turning.

FIGURE 3-5 Continued

OBVIOUS DECISIONS

- External Engine Fire (TS)
- Gear Box Oil Malfunction (TS)
- Determining Restart Feasibility (TS)
- Radar Offset Approach (WB)

HIDDEN DECISIONS

- Combining Gear Box Oil Malfunctions (TS)
- Hydraulic System Malfunction (TS)
- Electrically-Caused Overspeed (TS)
- Loss of Tail Rotor Thrust (TS)
- Loss of Tail Rotor Control (TS)
- Immediate Ditching (WB)

FIGURE 3-6. RESULTS OF INSTRUCTIONAL MATERIAL ANALYSIS

(Q1) WHAT MAY BE DONE WHEN A GEARBOX MALFUNCTION HAPPENS?

(Q2) WHAT ARE THE ADVANTAGES AND DISADVANTAGES INVOLVED IN EACH ALTERNATIVE?

(Q3) IS THERE ANY SITUATION IN WHICH SOME OF THE ALTERNATIVES ARE USELESS? WHICH ONE AND IN WHAT SITUATION?

(Q4) ARE ANY OF THE ALTERNATIVES MORE PREFERABLE IN CERTAIN SITUATIONS? WHICH ONE AND IN WHAT SITUATION?

(Q5) WHAT IS THE CHANCE OF SUCCESS FOR EACH ALTERNATIVE? (GOOD, BAD, NOT LIKELY, ...)

(Q6) IF THE ATTEMPT TO PERFORM AN ALTERNATIVE FAILS, WILL THERE BE A CHANCE TO TRY ANOTHER? HOW?

(Q7) WHAT ARE THE CUES AND ALERTS FOR SUCH A MALFUNCTION?

(Q8) DO ALL CUES EXIST IN CASE OF THIS MALFUNCTION?

(Q9) IS THERE ANY OTHER MALFUNCTION WITH THE SAME CUES?

(Q10) HOW DO YOU RANK THE IMPORTANCE OF SUCH A MALFUNCTION?

(Q11) WHAT WAS THE CRITERIA FOR IMPORTANCE FOR THIS RANKING?

(Q12) RANK THE TASK FOR EACH CRITERION SEPARATELY.

FIGURE 3-7. SAMPLE OF EXPERT INTERVIEW QUESTIONNAIRE

Question Q1 asks for a set of alternative actions which can be taken when a gearbox malfunction occurs. Q2 tries to locate attributes of each alternative which may be used in selection. Since limiting the initial set of alternatives can be a help in rapid decision making, question Q3 probes for situations which allow the deletion of one or more alternatives. Questions Q4 and Q5 request value judgments on relative utility and probability of occurrence respectively. Only a linguistic value judgment is required in this case. Normally, however, numerical judgments are preferred. Q6 is a structural question. It determines if this is a "one shot" decision situation or if it is repetitive in nature. Questions Q7, Q8, and Q9 concern the "cues and alerts" for a gearbox malfunction. These are indicators that a malfunction is either about to happen or has already occurred. Question Q8 deals with completeness. That is, if there is an imminent gearbox malfunction, will <u>all</u> cues and alerts be observable? Question Q9, on the other hand, deals with uniqueness. That is, are there any other malfunctions with exactly the same cues and alerts as a gearbox malfunction? If this situation could occur, there would exist an ambiguity in the recognition of an emergency decision situation. In such cases, it would be beneficial to design a new alert (such as an emergency indicator light) to differentiate between the two ambiguous conditions.

Questions Q10, Q11, and Q12 produced the most valuable information for the selection of decision task areas for further study. Q10 required the participants to rank the gearbox malfunction with respect to other potentially critical areas. The only criteria given was "importance" and it was left to the participant to define this word in his own terms. Immediately after this ranking, the participant was asked to describe the major factors that he considered when thinking about "importance". Both instructors and both students gave the same list of criteria:

(1) Personnel Safety
(2) Mission Effectiveness
(3) Equipment Salvage

This unanimous concensus is, of course, attributable to the fact that all participants were part of the same training program. However, all agreed that not only were these the most important, but also that there were no other major ones.

The last question, Q12, required the ranking of the potential decision areas in terms of each criteria separately. The detailed results of these rankings will be described in the next chapter.

4. RESULTS OF ANALYSIS

4.1 Overview

Analysis of objectives hierarchies, instructional materials, and expert interviews provided the required data for decision task selection. This data can be classified into the following three categories which will be the topics of the remaining sections:

- Candidate Decision Tasks
- Selection Criteria and Analysis
- Recommended Decision Tasks

4.2 Candidate Decision Tasks

Analysis of instructional materials identified the decision task areas and, together with the potential decision task areas detected in objectives hierarchies analysis (and confirmed in expert interviews), produced the list of final Pilot/ATO decision tasks. The list shown in Figure 4-1 contains fifteen decision task areas covering a variety of operational procedures. The list formed the basis for the selection of two major areas for in-depth analysis in the next phase.

4.3 Selection Criteria and Analysis

Two classes of criteria were identified for the final selection of decision tasks. The first class contains the criteria of importance as judged by LAMPS/ASW operational experts. This class includes:

(1) Safety criticality
(2) Time criticality

- FLYING METHOD (OH)
- MISSION SAFETY (II)
- TYPE OF LANDING (II)
- LAND OR WAVE OFF (II)
- ABORT OR CONTINUE THE MISSION (OH)
- DITCHING SITUATION (WB)
- RESTART FEASIBILITY (TS)
- RADAR APPROACH (WB)
- ENGINE QUITS (OH)
- EQUIPMENT MALFUNCTION (OH)
- GEARBOX MALFUNCTION (TS)
- HYDRAULIC SYSTEM MALFUNCTION (TS)
- LOSS OF ROTOR THRUST (TS)
- LOSS OF TAIL CONTROL (TS)
- FIRE (TS)

OH: OBJECTIVE HIERARCHY
II: INSTRUCTOR INTERVIEW
WB: WORK BOOK
TS: TAPE SLIDE

FIGURE 4-1. FINAL CANDIDATE PILOT/ATO DECISION TASKS

(3) Frequency of occurrence
(4) Current decision making effectiveness

The second class consists of the criteria for usefulness of the task to demonstrate the methodology of decision training. The two criteria of this class were:

(1) Tractability
(2) Demonstrability

where tractability is an aggregation of three basic components:

(1) Representativeness
(2) Size
(3) Degree of Abstraction

Since all the criteria were equally important to the object of the task selection, an equal-weight (w=1) utility model was used to make the final selection. A weight of w=-1 was given for "current decision making effectiveness" since this reflects the negative effect of this criteria on the task selection.

The detailed analysis chart for the decision task selection appears in Figure 4-2. The entries of each column are the result of the ranking of the candidate decision tasks by the interview participants with respect to the corresponding criteria. The last column, Mean Ranks, is an indication of priority for selection of each task according to the above criteria and evaluation scheme.

The ranks in each column were obtained as follows. Three participants independently ranked the tasks under safety criticality. Two of these rankings were almost identical and one varied greatly. The ranking

Decision Task	Safety Criticality (w=1)	Time Criticality (w=1)	Frequency of Occurrence (w=1)	Current DM Effectiveness (w=-1)	Tractability (w=1)	Demonstrability (w=1)	Mean Ranks
Flying Method	14	12	9	4	7	8	46
Mission Safety	13	11	8	5	15	15	57
Type of Landing	12	13	1	3	6	7	35
Land or Wave Off	9	10	2	6	4	3	22
Abort or Continue the Mission	11	7	4	9	3	4	35
Ditching Situation	5	8	15	8	1	1	22
Restart Feasibility	7	9	13	7	8	5	35
Radar Approach	15	15	5	1	13	6	53
Engine Quits	1	3	12	13	2	2	7
Equipment Malfunction	10	14	3	2	5	9	39
Gearbox Malfunction	4	4	7	12	10	11	24
Hydraulic System Malfunction	8	5	6	11	11	12	31
Loss of Rotor Thrust	2	1	14	15	9	10	21
Loss of Tail Control	6	6	11	10	12	14	39
Fire	3	2	10	14	14	13	28

(w=weight)

FIGURE 4-2. ANALYSIS OF DECISION TASK SELECTION

which was at variance was disregarded, and the other two were averaged and re-ranked. The three criteria, Time Criticality, Frequency of Occurrence, and Current Decision Making (DM) Effectiveness were ranked by one participant each. The two criteria, Tractability and Demonstrability, were ranked by Perceptronics' analysts before the interviews.

4.4 Conclusions: Recommended Decision Tasks

An additive model with unit weights was used to determine the final composite ranking. The numbers under the Mean Ranks column in Figure 4-2 are a result of adding together the rank values of each of the criteria columns with the exception of Current DM Effectiveness which was subtracted. The final ranking is shown in Figure 4-3. "Engine Quits" was by far the most important with "Loss of Tail Rotor Thrust", "Land or Waveoff", "Ditching Situation", and "Gearbox Malfunction" closely grouped. In this group, Land or Waveoff was chosen since it would provide possible experimentation without danger. Loss of Tail Rotor Thrust and Gearbox Malfunction are technical tasks similar to Engine Quits. Ditching Situations are a direct result of Engine Quits and could benefit from this analysis. Figure 4-4 presents characteristics of the two selected decision tasks and compares and contrasts them. The selected decision tasks for in-depth analysis: Engine Quits and Land or Waveoff, represent a rich environment for application of decision training methodology and specific decision aids.

*1. ENGINE QUITS
2. LOSS OF ROTOR THRUST
*3. LAND OR WAVE OFF
4. DITCH SITUATION
5. GEARBOX MALFUNCTION
6. FIRE
7. HYDRAULIC SYSTEM MALFUNCTION
8. RESTART FEASIBILITY
9. ABORT OR CONTINUE THE MISSION
10. TYPE OF LANDING
11. EQUIPMENT MALFUNCTION
12. LOSS OF TAIL CONTROL
13. FLYING METHODS
14. RADAR APPROACH
15. MISSION SAFETY

*Recommended Decision Tasks

FIGURE 4-3. SELECTION ANALYSIS RESULTS AND RECOMMENDATION

TASK	CHARACTERISTICS
1. ENGINE QUITS	VERY HIGH SAFETY CRITICAL, VERY HIGH TIME CRITICAL, VERY LOW FREQUENCY OF OCCURRENCE, VERY LOW CURRENT DECISION MAKING EFFECTIVENESS, VERY GOOD DECISION TASK REPRESENTATIVE, VERY LARGE PROBLEM SIZE, LOW DEGREE OF ABSTRACTION, VERY HIGH DEGREE OF DEMONSTRABILITY, TECHNICAL
2. LAND OR WAVE OFF	MEDIUM SAFETY CRITICALITY, LOW TIME CRITICALITY, VERY HIGH FREQUENCY OF OCCURRENCE, MEDIUM CURRENT DECISION MAKING EFFECTIVENESS, VERY GOOD DECISION TASK REPRESENTATIVE, SMALL PROBLEM SIZE, MEDIUM DEGREE OF ABSTRACTION, VERY HIGH DEGREE OF DEMONSTRABILITY, OPERATIONAL

FIGURE 4-4. CHARACTERISTICS OF RECOMMENDED DECISION TASKS

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APPENDIX A

ANALYSIS OF OBJECTIVES HIERARCHIES FOR PILOT/ATO

ANALYSIS OF OBJECTIVE HIERARCHIES FOR PILOT/ATO

Structure	Page	Task No.	Decision Type	Keyword	Task Area
┌	2	1.1.7	Type 2	Classify, specify the degree	Contact Classification
└→	47	1.1.7.3	Type 2	Determine Whether	
	3	1.1.1.4	Type 2, Type 2	Determine What, Determine What	Equipments to Carry
	3	1.1.1.5	Type 1	State	Flying Methods
┌	3	1.1.1.6	Type 2	Determine whether	Mission safety
└→	3	1.1.1.6.1	Type 1	State all	
┌	3	1.1.1.6	Type 2	Determine whether	Mission safety
└→	3	1.1.1.6.4	Type 2	Determine whether	
	3	1.1.1.7.1	Type 1	State	Crew Briefing
┌	14	1.1.4.3.1	Type 3	Recognize	Malfunction Recognition
→	16	1.1.4.3.1.1	Type 3	Recognize	
→	16	1.1.4.3.1.1.1	Type 2	Indicate which	
→	16	1.1.4.3.1.1.1.1	Type 1	Describe the components	
└→	17	1.1.4.3.1.1.1.1.2	Type 2	State the likely effect	
┌	14	1.1.4.3.2	Type 3	Recognize	Malfunction Recognition
└→	18	1.1.4.3.2.1.1	Type 2	Indicate which	
┌	14	1.1.4.3.3	Type 3	Recognize	Malfunction Recognition
└→	19	1.1.4.3.3.1.1	Type 2	Indicate which	
┌	14	1.1.4.3.4	Type 3	Recognize	Malfunction Recognition
└→	20	1.1.4.3.4.1.1	Type 2	Indicate which	
┌	14	1.1.4.3.5	Type 3	Recognize	Malfunction Recognition
└→	21	1.1.4.3.5.1.1	Type 2	Indicate which	
┌	14	1.1.4.3.6	Type 3	Recognize	Malfunction Recognition
└→	22	1.1.4.3.6.1.1	Type 2	Indicate Which	
┌	14	1.1.4.3.7	Type 3	Recognize	Malfunction Recognition
└→	23	1.1.4.3.7.1.1	Type 2	Indicate which	
┌	14	1.1.4.3.8	Type 3	Recognize	Malfunction Recognition
└→	24	1.1.4.3.8.1.1	Type 2	Indicate which	
┌	14	1.1.4.3.9	Type 3	Recognize	Malfunction Recognition
└→	25	1.1.4.3.9.1.1	Type 2	Indicate which	

Structure	Page	Task No.	Decision Type	Keyword	Task Area
┌	14	1.1.4.3.10	ΣType 2	State, most likely	Type of Fire
└→	27	1.1.4.3.10.1	Type 1	State	
┌	14	1.1.4.3.10	ΣType 2	State, most likely	Type of Fire
└→	27	1.1.4.3.10.3	Type 1	State	
┌	14	1.1.4.3.10	ΣType 2	State most likely	Type of Fire
├→	27	1.1.4.3.10.5	ΣType 2	State the most likely	
└→	28	1.1.4.3.10.5.2	ΣType 2	State the likely effect	
	29	1.1.4.3.11.1.2	Type 2, Type 2	Determine the urgency, if	Mission Urgency
	29	1.1.4.3.11.3	Type 3	Recognize	Electric Failure Recognition
	31	1.1.4.3.12.1.1	Type 2	Indicate which	Malfunction Recognition
	32	1.1.4.3.12.3.2	ΣType 2	State likely effect	Fuel System Failure
	33	1.1.4.3.13.1.1	Type 2	Indicate which	Tire Blow-out
	34	1.1.4.3.14.1.1	Type 2	Indicate which	Tire Blow-out
	35	1.1.4.3.15.1.1	Type 2	Indicate which	Loss of Tail Rotor Control
┌	38	1.1.6.1	Type 3	Choose an appropriate	ASW Mission Tactic
├→	38	1.1.6.1.1	Type 2	Determine the likely identity	
└→	39	1.1.6.1.1.5	Type 2	Determine the likely identity	
┌	38	1.1.6.1	Type 3	Choose an appropriate	ASW Mission Tactic
├→	38	1.1.6.1.2	Type 1	Determine possible behavior	
└→	40	1.1.6.1.2.1	Type 3	Determine the most likely	
	42	1.1.6.1.2.2.3.1.2.3.4	Type 2	Classify	Sound/Velocity Profile Interpretation
┌	38	1.1.6.1	Type 3	Choose an appropriate	ASW Mission Tactic
├→	38	1.1.6.1.3	Type 1	State	
└→	45	1.1.6.1.3.3	Type 2	Determine the proportion	

Structure	Page	Task No.	Decision Type	Keyword	Task Area
┌	38	1.1.6.1	Type 3	Choose an appropriate	ASE Mission Tactic
├→	38	1.1.6.1.3	Type 1	State	
└→	45	1.1.6.1.3.4	Type 2	Determine the depth	
┌	38	1.1.6.1	Type 3	Choose an appropriate	ASW Mission Tactic
├→	38	1.1.6.1.3	Type 1	State	
└→	45	1.1.6.1.3.5	Type 2	Determine if	
┌	38	1.1.6.2	Type 3	Revise plan	Tactic Revision
└→	38	1.1.6.2.1	Type 2	Determine whether	
┌	38	1.1.6.2	Type 3	Revise plan	Tactic Revision
└→	38	1.1.6.2.2	Type 3	Select an appropriate	
	48	1.1.7.1.1.3	Type 2	Determine if	Pattern Expansion
	48	1.1.7.1.1.4	Type 3	Prescribe an appropriate	Pattern Expansion
	48	1.1.7.1.1.5	Type 2	Determine which	Sonobuoys Monitoring
	49	1.1.7.1.2.4	Type 3	Determine an appropriate	Pattern Expansion
	51	1.1.7.2.2	Type 3	Select an appropriate	MAD Tracking Pattern
	53	1.1.9.6.1	Type 2	State the proper	Refueling
	53	1.1.9.6.2	Type 2	State the proper	Refueling
┌	55	1.1.10.1.1	Type 3	Identify	Engine Malfunction
├→	56	1.1.10.1.1.1	Type 3	Recognize	
└→	57	1.1.10.1.1.1.1.1	ΣType 2	Indicate which accompany	
┌	55	1.1.10.1.1	Type 3	Identify	Engine Malfunction
├→	56	1.1.10.1.1.2	Type 3	Recognize	
└→	58	1.1.10.1.1.2.1.1	ΣType 2	Indicate which	
┌	55	1.1.10.1.1	Type 3	Identify	Engine Malfunction
├→	56	1.1.10.1.1.3	Type 3	Recognize	
└→	59	1.1.10.1.1.3.1.1	ΣType 2	Indicate which	
┌	55	1.1.10.1.1	Type 3	Identify	Engine Malfunction
├→	56	1.1.10.1.1.4	Type 3	Recognize	
└→	60	1.1.10.1.1.4.1.1	ΣType 2	Indicate which	

Structure	Page	Task No.	Decision Type	Keyword	Task Area
┌	55	1.1.10.1.1	Type 3	Identify	Engine Malfunction
├→	56	1.1.10.1.1.5	Type 3	Recognize	
└→	61	1.1.10.1.1.5.1.1	ΣType 2	Indicate which	
┌	55	1.1.10.1.1	Type 3	Identify	Engine Malfunction
├→	56	1.1.10.1.1.6	Type 3	Recognize	
└→	62	1.1.10.1.1.6.1.1	ΣType 2	Indicate which	
┌	55	1.1.10.1.1	Type 3	Identify	Engine Malfunction
├→	56	1.1.10.1.1.7	Type 3	Recognize	
└→	63	1.1.10.1.1.7.1.1	ΣType 2	Indicate which	
	64	1.1.10.1.1.8.2	ΣType 2	State the likely effects	Engine Malfunction
┌	55	1.1.10.1.2	Type 3	Identify	Drive System Malfunction
├→	65	1.1.10.1.2.1	Type 3	Recognize	
└→	66	1.1.10.1.2.1.1.1	ΣType 2	Indicate which	
┌	55	1.1.10.1.2	Type 3	Identify	Drive System Malfunction
├→	65	1.1.10.1.2.2	Type 3	Recognize	
└→	67	1.1.10.1.2.2.1.1	ΣType 2	Indicate which	
┌	55	1.1.10.1.2	Type 3	Identify	Drive System Malfunction
├→	65	1.1.10.1.2.3	Type 3	Recognize	
└→	68	1.1.10.1.2.3.1.1	ΣType 2	Indicate which	
	69	1.1.10.1.2.4.2	ΣType 2	State the likely effect	Transmission Malfunction
┌	55	1.1.10.1.3	Type 3	Identify	Electrical System Malfunction
├→	70	1.1.10.1.3.1	Type 3	Recognize	
└→	71	1.1.10.1.3.1.1.1	ΣType 2	Indicate which	
┌	55	1.1.10.1.3	Type 3	Identify	Electrical System Malfunction
├→	70	1.1.10.1.3.2	Type 3	Recognize	
└→	72	1.1.10.1.3.2.1.1	ΣType 2	Indicate which	
┌	55	1.1.10.1.3	Type 3	Identify	Electrical System Malfunction
├→	70	1.1.10.1.3.3	Type 3	Recognize	
└→	73	1.1.10.1.3.3.1.1	ΣType 2	Indicate which	

Structure	Page	Task No.	Decision Type	Keyword	Task Area
┌	55	1.1.10.1.3	Type 3	Identify	Electrical System Malfunction
→	70	1.1.10.1.3.4	Type 3	Recognize	
└→	74	1.1.10.1.3.4.1.1	ΣType 2	Indicate which	
┌	55	1.1.10.1.4	Type 3	Identify	Fuel System Malfunction
→	75	1.1.10.1.4.1	Type 3	Recognize	
└→	76	1.1.10.1.4.1.1.1	ΣType 2	Indicate which	
┌	55	1.1.10.1.4	Type 3	Identify	Fuel System Malfunction
→	75	1.1.10.1.4.2	Type 3	Recognize	
└→	77	1.1.10.1.4.2.1.1	ΣType 2	Indicate which	
┌	55	1.1.10.1.4	Type 3	Identify	Fuel System Malfunction
→	75	1.1.10.1.4.3	Type 3	Recognize	
└→	78	1.1.10.1.4.3.1.1	ΣType 2	Indicate which	
	79	1.1.10.1.4.4.2	ΣType 2	State the likely effects	Engine Oil System Malfunction
	80	1.1.10.1.4.5.2	ΣType 2	State the likely effect	Transmission Oil System Malfunction
┌	55	1.1.10.1.5	Type 3	Identify	Oil System Malfunction
→	81	1.1.10.1.5.1	Type 3	Recognize	
└→	82	1.1.10.1.5.1.1.1	ΣType 2	Indicate which	
┌	55	1.1.10.1.5	Type 3	Identify	Oil System Malfunction
→	81	1.1.10.1.5.2	Type 3	Recognize	
└→	83	1.1.10.1.5.2.1.1	ΣType 2	Indicate which	
	84	1.1.10.1.5.3.2	ΣType 2	State the likely effect	Main Rotor Malfunction
	85	1.1.10.1.5.4.2	ΣType 2	State the likely effect	Brake System Malfunction
	86	1.1.10.1.5.5.2	ΣType 2	State the likely effect	Blade Track System Malfunction
┌	55	1.1.10.1.6	Type 3	Identify	Flight Controls Malfunction
→	87	1.1.10.1.6.1	Type 3	Recognize	
└→	88	1.1.10.1.6.1.1.1	ΣType 2	Indicate which	
	89	1.1.10.1.6.2.2	ΣType 2	State the likely effect	Hydraulic Power Supply Malfunction

Structure	Page	Task No.	Decision Type	Keyword	Task Area
⌐	55	1.1.10.1.7	Type 3	Identify	Hydraulic System Malfunction
↳	90	1.1.10.1.7.1	ΣType 2	Identify those	
	92	1.1.10.2.1.1	Type 2	Identify whether	Landing Methods
	93	1.1.10.2.2.3	Type 2	Determine the type (known possibilities)	Engine Failure
	95	1.1.11.1.1.3	Type 2	Determine whether	Landing Feasibility
	97	1.1.11.1.2.1.3	Type 2	Determine it	Land or Abort
	98	1.1.11.1.2.2.3	Type 2	Determine if	Land or Abort
	99	1.1.11.1.2.3.3	Type 2	Determine if	Land or Abort
	100	1.1.11.1.2.4.3	Type 2	Determine if	Land or Abort
	101	1.1.11.1.2.5.3	Type 2	Determine if	Land or Abort
	102	1.1.11.1.3.1	Type 2	Determine whether	Land or Abort
	104	1.1.11.1.3.2.3.2	Type 2	Determine if	Engine Failure
	106	1.1.11.2.1.3	Type 2	Determine whether	Landing Feasibility
	107	1.1.11.2.2.5	Type 2	Determine the min...	Flying Method
⌐	107	1.1.11.2.2.6	Type 2	Determine whether	Land or Wave Off
↳	107	1.1.11.2.2.6.1	Type 3	State the criteria	
⌐	107	1.1.11.2.2.7	Type 3	Determine which	Landing Method
↳	107	1.1.11.2.2.7.1	Type 1	State the alternative	
	108	1.1.11.2.2.1.3	Type 2	Determine if	Landing Safety
	109	1.1.11.2.2.2.3	Type 2	Determine if	Landing Safety
	110	1.1.11.2.2.3.6	Type 2	Determine if	Landing Safety
	111	1.1.11.2.2.4.3	Type 2	Determine when	Flying Method
	111	1.1.11.2.2.4.5	Type 2	Determine if	Landing Safety
	112	1.1.11.2.3.1	Type 2	Determine whether	Land or Abort
	112	1.1.11.2.3.2.1	ΣType 2	State the cues	Loss of Tail Control

Structure	Page	Task No.	Decision Type	Keyword	Task Area
	114	1.1.12.1.3.2	Type 2	Determine if	Postflight Inspection
	115	1.1.12.1.3.6.2	Type 2	Determine if	Postflight Inspection
	116	1.1.12.1.3.4.1.2	Type 3	Identify	Tail Wheel Lock Failure
	116	1.1.12.1.3.4.2.1	Type 3	Recognize	Total Electrical Failure
	116	1.1.12.1.3.4.3.1	Type 3	Recognize	Droop Stop Failure
	116	1.1.12.1.3.4.4.1	Type 3	Recognize	Internal Engine Fire
	116	1.1.12.1.3.4.5.1	Type 3	Identify	External Engine Fire
	118	1.1.13.2	ΣType 3	State	Intelligence Gathering
	118	1.1.13.3	ΣType 3	State	Tactics
	118	1.1.13.4	ΣType 3	State	Crew Briefing
	120	1.2.6.3	Type 2	Determine	Tactics
	120	1.2.6.4	Type 3	Determine the appropriate	Tactics
┌	120	1.2.6.5	Type 3, Type 3	Determine, determine	Tactics
└→	120	1.2.6.5.1	Type 3, Type 3, Type 3	Determine, determine, determine	
┌	120	1.2.6.5	Type 3, Type 3	Determine, determine	Tactics
└→	120	1.2.6.5.2	Type 3, Type 3	Determine, determine	
	120	1.2.6.6	ΣType 3	State the appropriate ref's	Tactics
	120	1.2.6.7	Type 3	State	Tactics
	123	1.3.5.4.2	Type 3	Classify	Tactics
	123	1.3.5.4.3	Type 3	Classify	Tactics
	123	1.3.5.4.4	Type 3	Classify	Tactics
┌	128	1.4.6.1.1.2	Type 3	Determine which	Search and Rescue
└→	128	1.4.6.1.1.2.1	Type 1	State	

Structure	Page	Task No.	Decision Type	Keywords	Task Area
	128	1.4.6.1.1.3	Type 2	Determine the best	Search and Rescue
	128	1.4.6.1.1.4	Type 3	State	Search and Rescue
	129	1.4.6.1.3.1.1	Type 3	Identify	Search and Rescue
	129	1.4.6.1.3.3.1.1	Type 3	State the cues	Search and Rescue
⌐	131	1.4.6.2.1.2	Type 3	Determine which	Search and Rescue
↳	131	1.4.6.2.1.2.1	Type 1	State the major	
	132	1.4.6.2.2.2	Type 3	Determine which	Flying Method
	132	1.4.6.2.2.3	Type 1	State the major	Flying Method
	133	1.4.7.1.2.2	Type 2	Determine	Landing Feasibility
	134	1.4.7.2.3.1	Type 2	Determine	Search and Rescue
	135	1.4.7.3.1.1.1.2	Type 3	Locate	Search and Rescue
	136	1.4.7.5.1.1	Type 3	Identify	Doppler Failure
	136	1.4.7.5.2.1	Type 3	Identify	Radar Altimeter Failure
	139	1.5.5.1.6	Type 2	State all appropriate	External Cargo
	140	1.5.5.3.3	Type 2	State all appropriate	External Cargo
	142	1.6.1.1	Type 3	Determine	Internal Cargo
	142	1.6.1.2	Type 3	State	Internal Cargo
	145	1.7.5.5	Type 3	Determine	Gunfire Spotting
	150	1.8.2.2.4	ΣType 2	State likely effects	Lighting System Failure
	152	1.8.2.3.1.2	ΣType 2	State likely effect	Flight Instrument System Failure
	153	1.8.2.3.2.2	ΣType 2	State likely effect	AN/AYK-2 System Failure

Structure	Page	Task No.	Decision Type	Keywords	Task Area
	155	1.8.2.3.4.2	ΣType 2	State likely effects	Standby Compass Failure
	159	1.8.2.3.8.2	ΣType 2	State likely effects	AN/APN-182 System Failure
	160	1.8.2.3.9.2	ΣType 2	State likely effects	AN/ASN-50 System Failure
	163	1.8.2.4.1.4	ΣType 2	State likely effects	Sonobuoy Processing System Failure
	164	1.8.2.4.2.2	ΣType 2	State likely effects	Smoke Maker Dispenser System Failure
	165	1.8.2.4.3.2	ΣType 2	State likely effects	Torpedo Resease System Failure
	166	1.8.2.4.6.2	ΣType 2	State likely effects	Sonobuoy Launcher System Failure
	167	1.8.2.4.7.2	ΣType 2	State likely effects	MAD System Failure
	168	1.8.2.4.8.2	ΣType 2	State likely effects	ALR-54 System Failure
	171	1.8.2.5.2.2	ΣType 2	State likely effects	AN/ARC-159 System Failure
	174	1.8.2.5.5.2	ΣType 2	State likely effects	Juliet 28 System Failure
	182	1.8.5.3.2	ΣType 2	State likely effects	Anti-Ice System Failure

APPENDIX B

ANALYSIS OF OBJECTIVES HIERARCHIES FOR SENSOR OPERATOR

ANALYSIS OF OBJECTIVE HIERARCHY FOR SENSOR OPERATOR

Structure	Page	Task No.	Decision Type	Keyword	Task Area
	3	2.1.1.2	Type 2	Determine if	Daily Inspection
↳	5	2.1.1.2.1	Type 2	Determine if	
	3	2.1.1.2	Type 2	Determine if	Daily Inspection
↳	5	2.1.1.2.2	Type 2	Determine if	
	3	2.1.1.2	Type 2	Determine if	Daily Inspection
↳	5	2.1.1.2.3	Type 2	Determine if	
	3	2.1.1.2	Type 2	Determine if	Daily Inspection
↳	5	2.1.1.2.4	Type 2	Determine if	
	3	2.1.1.2	Type 2	Determine if	Daily Inspection
↳	5	2.1.1.2.5	Type 2	Determine if	
	3	2.1.1.2	Type 2	Determine if	Daily Inspection
↳	5	2.1.1.2.6	Type 2	Determine if	
	3	2.1.1.2	Type 2	Determine if	Daily Inspection
↳	5	2.1.1.2.7	Type 2	Determine if	
	3	2.1.1.2	Type 2	Determine if	Daily Inspection
↳	5	2.1.1.2.8	Type 2	Determine if	
	3	2.1.1.6	Type 2	Determine if	Fuel Acceptability
	6	2.1.2.2	Type 2	Determine if	Turnaround Inspection
↳	8	2.1.2.2.1	Type 2	Determine if	
	6	2.1.2.2	Type 2	Determine if	Turnaround Inspection
↳	8	2.1.2.2.2	Type 2	Determine if	
	6	2.1.2.2	Type 2	Determine if	Turnaround Inspection
↳	8	2.1.2.2.3	Type 2	Determine if	
	6	2.1.2.2	Type 2	Determine if	Turnaround Inspection
↳	8	2.1.2.2.4	Type 2	Determine if	
	6	2.1.2.2	Type 2	Determine if	Turnaround Inspection
↳	8	2.1.2.2.5	Type 2	Determine if	
	6	2.1.2.2	Type 2	Determine if	Turnaround Inspection
↳	8	2.1.2.2.6	Type 2	Determine if	
	6	2.1.2.2	Type 2	Determine if	Turnaround Inspection
↳	8	2.1.2.2.7	Type 2	Determine if	
	6	2.1.2.4	Type 3	Identify	Standard Safety Precaution

Structure	Page	Task No.	Decision Type	Keyword	Task Area
	6	2.1.2.6	Type 2	Determine if	Turnaround Inspection
┌	13	2.2.1.7	Type 2	Classify	Tactics, Target Classification
→	41	2.2.1.7.1	Type 2	Perform all classification functions to identify	
└→	42	2.2.1.7.1.1	Type 2	Classify	
┌	13	2.2.1.7	Type 2	Classify	Target Classification
→	41	2.2.1.7.1	Type 2	Perform all classification functions to identify	
└→	42	2.2.1.7.1.2	Type 3	Identify	
┌	13	2.2.1.7	Type 2	Classify	Target Classification
→	41	2.2.1.7.1	Type 2	Perform all classification functions to identify	
└→	42	2.2.1.7.1.3	Type 3	Identify	
┌	13	2.2.1.7	Type 2	Classify	Target Classification
→	41	2.2.1.7.1	Type 2	Perform all classification functions to identify	
└→	42	2.2.1.7.1.4	Type 3	Identify	
┌	13	2.2.1.7	Type 2	Classify	Target Classification
→	41	2.2.1.7.1	Type 2	Perform all classification functions to identify	
└→	42	2.2.1.7.1.5	Type 3	Identify	
┌	13	2.2.1.7	Type 2	Classify	Target Classification
→	41	2.2.1.7.1	Type 2	Perform all classification functions to identify	
→	42	2.2.1.7.1.6	Type 2	Determine as to	
└→	42	2.2.1.7.1.6.2	Type 2	Determine if	
┌	13	2.2.1.7	Type 2	Classify	Target Classification
→	41	2.2.1.7.2	Type 2	Perform all classification functions to identify	
└→	43	2.2.1.7.2.1	Type 3	Identify	

Structure	Page	Task No.	Decision Type	Keyword	Task Area
┌	13	2.2.1.7	Type 2	Classify	Target Classification
├→	41	2.2.1.7.2	Type 2	Perform all classification functions to identify	
├→	43	2.2.1.7.2.3	Type 2	Report probability	
└→	43	2.2.1.7.2.3.1	Type 2	Determine the Prob.	
┌	13	2.2.1.7	Type 2	Classify	Target Classification
├→	41	2.2.1.7.3	Type 2	Perform all classification functions to identify	
├→	44	2.2.1.7.3.1	Type 2	Classify	
└→	44	2.2.1.7.3.1.3	Type 2	Classify	
	15	2.2.1.1.1.1	Type 2	Determine if	Flight Gear Inspection
┌	15	2.2.1.1.1.2	Type 2	Determine if	Flight Gear Inspection
└→	15	2.2.1.1.1.2.1	Type 2	Determine if	
┌	15	2.2.1.1.1.3	Type 2	Determine if	Flight Gear Inspection
└→	15	2.2.1.1.1.3.1	Type 2	Determine if	
┌	20	2.2.1.2.1	Type 2	Determine if	Mission Safety
└→	20	2.2.1.2.1.1	Type 3	Determine	
┌	20	2.2.1.2.1	Type 2	Determine if	Mission Safety
└→	20	2.2.1.2.1.2	ΣType 3	Determine	
	22	2.2.1.2.3.2.2	Type 2	Determine	Interior Inspection
┌	22	2.2.1.2.3.2.3	Type 2	Determine	SAR Inspection
└→	22	2.2.1.2.3.2.3.1	Type 2	State if	
	24	2.2.1.3.1.1	ΣType 3	Identify each	Prestart Inspection
	24	2.2.1.3.1.2	Type 2	Determine	Prestart Inspection
	30	2.2.1.5.2.2	Type 3	Identify	Radar Operation
	30	2.2.1.5.2.3	Type 3	Determine	Duration Estimation
	30	2.2.1.5.2.4	Type 3	Identify	Elevation & Obstruction
	30	2.2.1.5.2.6	ΣType 3	Determine	Magnetic Bearing
	33	2.2.1.6.2.2	Type 3	State the effects	MAD Operation
	33	2.2.1.6.2.4	Type 3	Determine	RO-32 Recorder Malfunction

Structure	Page	Task No.	Decision Type	Keyword	Task Area
	33	2.2.1.6.2.5	Type 3	Determine	ASQ-81 System Malfunction
	33	2.2.1.6.2.6	Type 3	Identify	Tactics, Initial Contact
	34	2.2.1.6.2.1.1	Type 3	State	ASQ-81 System Operation
	34	2.2.1.6.2.1.3.1	Type 3	Identify	ASQ-81 System Operation
	34	2.2.1.6.2.1.4	Type 3	Identify	ASQ-81 System Operation
	36	2.2.1.6.3.3.1	Type 3	State	LN-66 Radar Operation
	36	2.2.1.6.3.3.2	Type 3	State	LN-66 Radar Operation
	36	2.2.1.6.3.3.3	Type 3	State	LN-66 Radar Operation
	37	2.2.1.6.4.1.1.2	Type 3	State	ASA-26 System Operation
	39	2.2.1.6.5.1	Type 2	State the best	Visual Search
	46	2.2.1.8.1.1	Type 3	Identify	Tactics, Tracking with MAD
	47	2.2.1.8.2.1.1.2	Type 3, Type 3	Determine, select	Tactics, Master Sonobuoy Selection
	47	2.2.1.8.2.1.1.3	Type 3, Type 3	Determine, select	Tactics, Slave Sonobuoy Selection
	47	2.2.1.8.2.1.1.4.1	Type 2	Determine	Percentage of Attenuation
	47	2.2.1.8.2.1.1.4.3	Type 2	Determine	Percentage of Attenuation
	48	2.2.1.8.2.2.1	ΣType 2	Determine	Range of Target
	55	2.2.2.1.2.1	ΣType 2	List all info. pertaining	SAR Mission
	55	2.2.2.1.2.2	ΣType 2	List all info. pertaining	SAR Mission
	55	2.2.2.1.2.3	ΣType 2	List all info. pertaining	SAR Mission
	55	2.2.2.1.2.4	ΣType 2	List all info. pertaining	SAR Mission

Structure	Page	Task No.	Decision Type	Keyword	Task Area
	68	2.2.2.7.4.1.4.1	Type 3	Identify	Survival Hold Release
	70	2.2.2.12.1	ΣType 2	List all info. pertaining	SAR Mission
	70	2.2.2.12.2	ΣType 2	List all info. pertaining	SAR Mission
	70	2.2.2.12.3	ΣType 2	List all info. pertaining	SAR Mission
	72	2.2.3.1.1	ΣType 2	List the info.	SAR Mission
┌	75	2.2.4.8	Type 3	Identify	Vessel Classification
├→	80	2.2.4.8.1	Type 3	Identify	
└→	80	2.2.4.8.1.1	ΣType 2	List the critical...	
┌	75	2.2.4.8	Type 3	Identify	Vessel Classification
├→	80	2.2.4.8.2	Type 3	Identify	
├→	80	2.2.4.8.2.1	Type 3	Identify	
└→	80	2.2.4.8.2.1.1	ΣType 2	List the critical...	
┌	75	2.2.4.8	Type 3	Identify	Vessel Classification
├→	80	2.2.4.8.2	Type 3	Identify	
├→	80	2.2.4.8.2.2	Type 3	Identify	
└→	80	2.2.4.8.2.2.1	ΣType 2	State the critical...	
┌	75	2.2.4.8	Type 3	Identify	Vessel Classification
├→	80	2.2.4.8.3	Type 3	Identify	
├→	80	2.2.4.8.3.1	Type 3	Identify	
└→	80	2.2.4.8.3.1.1	ΣType 2	List the critical...	
┌	75	2.2.4.8	Type 3	Identify	Vessel Classification
├→	80	2.2.4.8.3	Type 3	Identify	
├→	80	2.2.4.8.3.2	Type 3	Identify	
└→	80	2.2.4.8.3.2.1	ΣType 2	List the critical...	
┌	76	2.2.4.6.1	Type 3	Identify	Visual Rig
├→	77	2.2.4.6.1.1	Type 3	Identify	
└→	77	2.2.4.6.1.1.1	Type 2	State rules for deter.	
┌	76	2.2.4.6.1	Type 3	Identify	Visual Rig
├→	77	2.2.4.6.1.2	Type 3	Identify	
└→	77	2.2.4.6.1.2.1	Type 2	Identify	

Structure	Page	Task No.	Decision Type	Keyword	Task Area
┌	76	2.2.4.6.1	Type 3	Identify	Visual Rig
├→	77	2.2.4.6.1.2	Type 3	Identify	
└→	77	2.2.4.6.1.2.2	Type 3	Identify	
┌	76	2.2.4.6.1	Type 3	Identify	Visual Rig
├→	77	2.2.4.6.1.2	Type 3	Identify	
└→	77	2.2.4.6.1.2.3	Type 2	Identify	
┌	76	2.2.4.6.1	Type 3	Identify	Visual Rig
├→	77	2.2.4.6.1.2	Type 3	Identify	
└→	77	2.2.4.6.1.2.4	Type 3	Identify	
┌	76	2.2.4.6.1	Type 3	Identify	Visual Rig
├→	77	2.2.4.6.1.3	Type 3	Identify	
└→	77	2.2.4.6.1.3.1	Type 3	Identify	
┌	76	2.2.4.6.1	Type 3	Identify	
├→	77	2.2.4.6.1.4	Type 3	Identify	
├→	77	2.2.4.6.1.4.2	Type 2	Identify	
└→	77	2.2.4.6.1.4.2.1	ΣType 2	State the critical...	
┌	76	2.2.4.6.1	Type 3	Identify	Visual Rig
├→	77	2.2.4.6.1.4	Type 3	Identify	
├→	77	2.2.4.6.1.4.3	Type 2	Identify	
└→	77	2.2.4.6.1.4.3	Type 2	State rules for identifying	
┌	76	2.2.4.6.1	Type 3	Identify	Visual Rig
├→	77	2.2.4.6.1.4	Type 3	Identify	
└→	77	2.2.4.6.1.4.4	Type 2	Identify	
┌	76	2.2.4.6.1	Type 3	Identify	Visual Rig
├→	77	2.2.4.6.1.4	Type 3	Identify	
└→	77	2.2.4.6.1.4.5	Type 3	Identify	
┌	76	2.2.4.6.1	Type 3	Identify	Visual Rig
└→	77	2.2.4.6.1.5	Type 2	Identify	
┌	76	2.2.4.6.1	Type 3	Identify	Visual Rig
└→	78	2.2.4.6.1.6	Type 2	Identify	
	82	2.2.5.1.2.1	ΣType 2	List the info. pertaining...	Cargo Mission
	82	2.2.5.1.2.2	ΣType 2	List the info. pertaining...	Cargo Mission

Structure	Page	Task No.	Decision Type	Keyword	Task Area
	82	2.2.5.1.2.3	ΣType 2	List the Info. pertaining...	Cargo Mission
	82	2.2.5.1.2.4	ΣType 2	List the Info. pertaining...	Cargo Mission
	89	2.2.7.1.2.1	ΣType 2	List all ... pertaining...	Passenger Transfer Mission
	89	2.2.7.1.2.2	ΣType 2	List...needed by...	Passenger Transfer Mission
	89	2.2.7.1.2.3	ΣType 2	List info... that must...	Passenger Transfer Mission
	89	2.2.7.1.2.4	ΣType 2	List info... that must...	Passenger Transfer Mission
	90	2.2.7.6.2	Type 2	Determine if	Flight Equipment Inspection
	93	2.3.1.1.3.1	Type 2	Determine whether	Ordnance System Inspection
	93	2.3.1.1.3.2	ΣType 3	State	Ordnance System Inspection
	93	2.3.1.1.4	Type 2	Determine	Ordnance System Inspection
	93	2.3.1.2.2	Type 2	Determine	Ordnance System Inspection
	93	2.3.1.3.2	Type 2	Determine if	Ordnance System Inspection

APPENDIX C

ANALYSIS OF PILOT/ATO TAPE SLIDES

PILOT/ATO (TS)

Analysis of PILOT/ATO Tape Slides

Task No.	Task Name	Slide No.	Old Slide No.	NA/ND DM/DE	Hidden/ Obvious	Type	Keyword
	Fuel System Malfunction Detection	F-1.5.1	SF-1.7.1	NA			
1.1.10.1.4.1.1.1	Boost Pump Malfunction	F-1.5.2	SF-1.7.3	DE			identify
1.1.10.1.4.2.1.1	Transfer Pump Malfunction	F-1.5.3	SF-1.7.4	ND			state
1.1.10.1.4.3.1.1	Compressor Malfunction	F-1.5.4	SF-1.7.5	ND			
1.1.4.3.12.1.1	Bypass Filter Malfunction	F-1.5.5	SF-1.7.6	ND			state
1.1.10.1.4.4.1.1	Emergency Pump Malfunction	F-1.5.6	SF-1.7.7	DM	obvious	Type 2	whether or
1.1.12.1.3.4.5.1	External Engine Fire	F-1.5.7*	SF-1.7.8	DE			identify
1.1.12.1.3.4.4.1	Internal Engine Fire	F-1.5.8	SF-1.7.9	DE			identify
	Internal Aircraft Fire	F-1.5.10*	SF-1.7.11	ND			identify
	Oil System Malfunction Detection	F-1.4.1	SF-1.5.2	NA			
1.1.10.1.5.2.1.1	Gear Box Oil Malfunction	F-1.4.2*	SF-1.5.3	DM	obvious	Type 2	identify
1.1.10.1.5.3.1.1	Engine Oil Malfunction	F-1.4.3	SF-1.5.4	DE			identify
1.1.10.1.2.3.1.1	Intermediate Gear Box Oil Malfunction	F-1.4.4	SF-1.5.5	ND			state
1.1.10.1.5.2.1.1	Combining Gear Box Oil Malfunction	F-1.4.5*	SF-1.5.7	DM	hidden	Type 2	identify
1.1.10.1.5.1.2	Speed Decreaser	F-1.4.6	SF-1.5.7	DE			identify
	Hydraulic System Malfunction Detection	F-3.5.1	SF-2.5.1	NA			
1.1.10.1.7.1	Hydraulic System Malfunction	F-3.5.2*	SF-2.5.3	DM	hidden		identify
	ASE Malfunction Detection	F-3.3.1	SF-2.3.1	NA			

Task No.	Task Name	Slide No.	Old Slide No.	NA/ND DM/DE	Hidden/ Obvious	Type	Keyword
1.1.4.3.1.1.1	ASE Malfunction	F-3.3.2	SF-2.3.3	DE			identify
	Landing Gear Failure to Lower	F-3.3.3	SF-2.3.5	DE			identify
1.1.4.3.14.1.1	Tire Blowout	F-3.3.4	SF-2.3.6	ND			state
1.1.12.1.3.6.2	Postflight Inspection	F-4.2.4	PE-3A.1.4	ND			name
1.1.12.1.3.4.3.1	Droop Stops Failure	F-4.1.1	PF-3.1.1	DE			identify
	Engine Malfunction Detection	F-5.3.1	SF-4.3.2	NA			
1.1.10.1.1.1.1	Engine Flameout	F-5.3.2*	SF-4.3.3	DE			identify
1.1.10.1.1.2.1.1	Throttle-Caused Power Oscillation	F-5.3.3*	SF-4.3.4	DE			identify
1.1.10.1.1.4.1.1	Partial Power Loss	F-5.3.4	SF-4.3.6	DE			identify
1.1.10.1.1.5.1.1	Compressor Stall	F-5.3.5*	SF-4.3.7	DE			identify
1.1.10.1.1.6.1.1	Electrically-Caused Overspeed	F-5.3.6*	SF-4.3.8	DM	hidden	Type 2	identify
1.1.10.1.1.7.1.1	Loss of Nf Signal	F-5.3.7	SF-4.3.9	DE			identify
	Flight Control Malfunction Detection	F-5.2.1	SF-4.2	NA			
1.1.4.3.9.1.1	Loss of Tail Rotor Thrust	F-5.2.2*	SF-4.2.3	DM	hidden	Type 2	identify
1.1.4.3.15.1.1	Loss of Tail Rotor Control	F-5.2.3*	SF-4.2.4	DM	hidden	Type 2	identify
	Elec'l System Malfunction Detection	F-7.3.1	SF-5.3.1	NA			
1.1.4.3.11.1.1.1	Generator Malfunction	F-7.3.2*	SF-5.3.3	DE			identify
1.1.4.3.11.4.1.1	Converter Malfunction	F-7.3.3	SF-5.3.5	DE			identify
1.1.4.3.11.3.1.1	Total Electrical Failure	F-7.3.4*	SF-5.3.6	DE			identify
	26-Volt AC Transformer Failure	F-7.3.5	SF-5.3.7	DE			identify

Task No.	Task Name	Slide No.	Old Slide No.	NA/ND DM/DE	Hidden/ Obvious	Type	Keyword
1.1.4.3.3.1.1	Torque Gauge Malfunction	F-7.3.6	SF-5.3.10	DE			identify
1.1.12.1.3.4.2.1	Shutdown with Total Electrical Failure	F-7.3.7	SF-5.3.11	ND			state
1.1.4.3.8.1.1	Dual Engine Failure	F-7.2.1	SF-5.2.1	ND			state
1.1.4.3.7.1.1	Single Engine Failure	F-7.2.2*	SF-5.2.2	DE			identify
	Electrical Fire Detection	F-7.2.4	SF-5.2.6	DE			identify
1.1.10.2.3.1	Determining Restart Feasibility	F-7.1.2*	SF-5.1.2	DM	obvious	Type 2	decide whether
1.1.4.3.4.1.1	Decaying Nr/Nf	F-9.2.1	SE-7.2.1	DE			identify
1.4.6.1.3.3.1.1	Settling with Power	F-9.2.2	SU-1.1.1	ND			define, name, state
1.4.6.1.3.1.1	Power Settling	F-9.2.3	SU-1.1.3	DE			identify
1.4.6.1.3.2.1.1	Blade Stall	F-11.1.1*	SF-8.1.1	DE			identify
1.1.12.1.3.4.1.2	Locked Tailwheel	F-11.1.2		ND			state

PILOT/ATO (TS)

Slide No.	Notes
F-1.5.7	Measure of criticality of a mission is considered by the pilot. This information is used to decide whether to continue the mission or to abort.
F-1.5.10	Identify cues and alerts for cabin fire by fumes, visible smoke, and/or fire.
F-1.4.2	The cues and symptoms are given and the pilot must decide whether or not there is a gearbox malfunction. Phrases such as "the first indication of malfunction in the oil system will probably be the transmission oil pressure caution light" are used. As it is indicated in the tape slide, this is a "no ask from ground" procedure.
F-1.4.5	Possible symptoms for a combining gearbox oil malfunction are discussed. The pilot must identify the malfunction. Phrases such as "a complete break in the oil line will probably cause these indications (1) the combining gear box caution light will illuminate, (2)..." are used.
F-3.5.2	Phrases such as "the hydraulic pressure caution light in the caution light panel will probably be your first indication of a malfunctioning, but remember a caution light could be accompanied by a sudden burst of flight in the event of a massive break in the line" are used.
F-5.3.2	The reaction speed is critical. The previously made decision is communicated to the pilot for execution via manuals and gauges.
F-5.3.3	Determine whether it is throttle-caused oscillation or engine-caused oscillation. The procedure to test and determine is given.
F-5.3.5	Symptoms are given but the procedure to obtain a diagnosis through the use of those symptoms is not mentioned.
F-5.3.6	Phrases such as "on the other hand, if the aircraft is on the descent or on deck, faulty electrical input to the fuel control will probably result in rotor overspeed. The symptoms for electrically caused rotor overspeed are: (1) NFNR for ..., (2)..." are used.

Slide No.	Notes
F-5.2.2	As symptoms, phrases such as "... depending upon flight condition, aerodynamic coupling may produce right roll and pitch down. The rate of yaw will depend upon the amount of torque applied to the ..." are used. It may be critical bacause it is said that "loss of tail rotor thrust demands immediate action". It may cause total loss of control which, in turn, may cause landing on the nose. Also there are phrases such as "(1) begin a 70 Ng minimum power descent or autorotation depending upon the intensity of the vibration".
F-5.2.3	Some alternatives are given for yaw controlling the aircraft with loss of tail rotor control, but the criteria for choosing any one of them is not mentioned.
F-7.3.2	The pilot must figure out how much gas is left without the use of working instruments (due to lack of generator).
F-7.3.4	Same as F-7.3.2
F-7.2.2	Phrases are used such as "the first indication of engine failure will probably be the sound of the engine unwinding. This will be followed by ...".
F-7.1.2	Whether or not to attempt a restart is investigated. Phrases are used such as "the ultimate decision as to whether or not a restart should be attempted rests with the pilot in command. In making this decision he must rely on his knowledge of NATOPS, his good judgement and his personal experience. There are no hard and fast rules of attempting to restart after an engine is flamed or has been secured in flight. But there are some general guidelines which can be followed. An engine restart should be attempted under the following conditions: (1)..., (2)..., (3)... Remember, do not attempt to restart if the engine is in flame because of an internal or external fire".
F-7.11.1.1	Critical. Requires rapid identification and correction action.

APPENDIX D

ANALYSIS OF CREWMAN TAPE SLIDES

CREW (TS)

Analysis of Crewman Tape Slides

Task Name	Old Slide No.	NA/ND	Keyword
Planned Ditching	CRF-1.3.4	ND	state
Search & Rescue Equipment	CRF-1.5.5/6	ND	name, state
Crewman Safety Belt	CRF-1.6.3	ND	describe, name
Aircraft Handling #1	PF-3.2.1	ND	state
Aircraft Handling #2	PF-3.2.2	ND	state
Aircraft Movement Safety Rules	PF-3.2.4	ND	state
Signature Cards	PF-2.1.3	ND	demonstrate
Immediate Ditching Procedure	CRF-1.3.3	ND	state
Bailout Procedure	CRF-1.3.5	ND	state
Total Electrical Failure	CRF-1.3.7	ND	identify
Internal & External Engine Fire	CRF-1.3.9	ND	state
Hand Pressure Signals	CRH-1.3.3	ND	state
Cabin and/or Electrical Fire	CRF-1.3.11	ND	state
Hung Droop Stop	CRF-1.3.14	ND	state
Cargo Transfer Safety Precaution	CRH-1.4.1	ND	state
Cargo Rigging Safety Precaution	CRH-1.4.5	ND	state
Normal Hoisting Operations	CRH-1.3.7	ND	state
Connect/Disconnect Refueling Hose	CRH-2.1.4	ND	state
Passenger Survival Gear	CRH-2.1.4	ND	name
Swimmer's Equipment	CRW-1.2.1	ND	identify, state
Required Flight Gear	CRF-1.6.7	ND	name
Regaining Lost UHF Communication	SE-4.9.2	ND	name
LAMPS Frequency Circuits	SE-4.9.3	ND	name
Aircraft Positioning During HIFR	CRH-2.1.2	ND	state

Task Name	Old Slide No.	NA/ND	Keyword
Sonobuoy Loading Safety	OR-2.1.8	ND	state
Inspecting JAU-1B CAD	OR-1.1.5	ND	state
Inspecting Sonobuoy Launch Container	OR-1.1.3	ND	name
Major Preflight Inspection Areas	PF-3A.2.7	ND	name
Radar Interpretation - Land Mass	NA-2.1.1*	ND	name
Radar Interpretation - Heavy Weather Contact	NA-2.1.2*	ND	name
Radar Interpretation - Surface Contact	NA-2.1.3*	ND	name
Radar Interpretation - Airborne Contacts	NA-2.1.4*	ND	name
Sound Velocity	AC-1.2.11	ND	describe

CREW (TS)

Slide No.	Notes
NA-2.1.1	This slide prepares the crewmen for distinguishing between a target and a land mass which itself is a classification and, therefore, a decision task. Only the attributes (features of a land mass on radar (one of the two classes) is listed and the crewman is supposed to classify the object as a land mass if he identifies those attributes.
NA-2.1.2	"Name three radar display characteristics of heavy weather" is the objective of this course. These characteristics (features) are listed.
NA-2.1.3	The three radar display characteristics of surface contact are listed.
NA-2.1.4	The three radar display characteristics of an airborne contact are listed. One of them (fast movement) is mentioned to be the distinguishing characteristics between airborne contact and surface contact.

APPENDIX E

ANALYSIS OF PILOT/ATO WORK BOOK

PILOT/ATO (WB)

Analysis of PILOT/ATO Workbooks

Task No.	Task Name	Section No.	Old Section No.	NA/ND DM/DE	Hidden/ Obvious	Type	Keyword
1.1.10.1.2.4.1.3	Transmission System	F-1.8.1	SF-1.10.1	ND			describe
1.1.10.1.2.4.1.2	"	F-1.8.2		ND			"
1.1.10.1.2.4.3	"	F-1.8.3		ND			"
1.1.10.1.2.4.2	"	F-1.8.4		ND			"
1.1.10.1.2.4.1	"	F-1.8.5		ND			"
1.1.10.1.2.4.1.1	"	F-1.8.6		ND			"
	Fire Detection and Extinguishing System	F-1.7.1	SF-1.9.1	ND			describe
1.1.4.3.10.6.1.2	"	F-1.7.2		ND			"
1.1.4.3.10.6.3	"	F-1.7.3		ND			"
1.1.4.3.10.6.4	"	F-1.7.4		ND			"
1.1.4.3.10.6.2	"	F-1.7.5		ND			"
1.1.4.3.10.6.1	"	F-1.7.6		ND			"
1.1.4.3.10.6.1.1	"	F-1.7.7		ND			"
1.1.4.3.12.4.1.3	Fuel System Operation	F-1.6.1	SF-1.8.1	ND			describe
1.1.4.3.12.4.1.2	"	F-1.6.2		ND			"
1.1.4.3.12.4.3	"	F-1.6.3		ND			"
1.1.4.3.12.4.4	"	F-1.6.4		ND			"
	"	F-1.6.5		ND			"
1.1.4.3.12.4.1	"	F-1.6.6		ND			"
1.1.4.3.12.4.1.1	"	F-1.6.7		ND			"
	Fuel Control Divider Setting	F-1.5.9	SF-1.7.10	ND			state
1.1.10.1.6.6	Flight Control System	F-1.3.1	SF-1.4.1	ND			describe
1.1.12.1.3.2	Disengage Rotor Envelope	F-1.2.7	SF-1.3.7	DE			determine if

Task No.	Task Name	Section No.	Old Section No.	NA/ND DM/DE	Hidden/ Obvious	Type	Keyword
	Airspeed	F-1.2.6	SF-1.3.6	DE			calculate
1.1.10.2.1.3	Density	F-1.2.5	SF-1.3.5	DE			determine
1.1.10.2.1.3	Torque	F-1.2.4	SF-1.3.4	DE			determine
	Endurance	F-1.2.3*	SF-1.3.3	DE			determine
1.1.2.1.1	Gross Weight	F-1.2.2	SF-1.3.2	DE			calculate
1.1.2.1	Single Engine Airspeed	F-1.2.1	SF-1.3.1	DE			determine
1.1.11.2.1.1	VMC Recovery to Land	F-1.1.4*	SF-1.1.4	ND			state
	Land Recovery	F-1.1.3	SF-1.1.3	ND			state
1.1.4.2.1.1	Normal Take-Off	F-1.1.2	SF-1.1.2	ND			state
1.1.4.2.1.7.1	Taxi Procedure	F-1.1.1	SF-1.1.1	ND			state
	Airframe System	F-3.11.1	SF-2.11.1	ND			describe
1.1.10.6.3.1.2	"	F-3.11.2		ND			"
1.1.10.1.6.3.3	"	F-3.11.3		ND			"
1.1.10.1.6.3.2	"	F-3.11.4		ND			"
1.1.10.1.6.3.1	"	F-3.11.5		ND			"
1.1.10.1.6.3.1.1	"	F-3.11.6		ND			"
1.1.10.1.6.3.1	Rotor System Operation	F-3.10.1	SF-2.10.1	ND			describe
1.1.10.1.6.3.1.2	"	F-3.10.2		ND			"
1.1.10.1.6.3.3	"	F-3.10.3		ND			"
1.1.10.1.6.3.2	Rotor System Operation	F-3.10.4		ND			describe
1.1.10.1.6.3.1	"	F-3.10.5		"			"
1.1.10.1.6.3.1.1	"	F-3.10.6		"			"
1.1.10.1.6.4.1.2	Wheel Brakes System	F-3.9.1	SF-3.9.1	ND			describe
	"	F-3.9.2		"			"

Task No.	Task Name	Section No.	Old Section No.	NA/ND DM/DE	Hidden/ Obvious	Type	Keyword
1.1.10.1.6.4.3	Wheel Brakes System	F-3.9.3		ND			describe
1.1.10.1.6.4.3	"	F-3.9.4		"			"
1.1.10.1.6.4.2	"	F-3.9.5		"			"
1.1.10.1.6.4.1	"	F-3.9.6		"			"
1.1.10.1.6.4.1.1	"	F-3.9.7		"			"
	Blade Track System	F-3.8.1	SF-2.8.1	ND			describe
	"	F-3.8.2		"			"
1.1.10.1.6.9.4	"	F-3.8.3		"			"
	"	F-3.8.4		"			"
1.1.10.1.6.9.1	Blade Track System	F-3.8.5		ND			describe
1.1.10.1.6.9.1.1	"	F-3.8.6		"			"
1.1.10.1.7.2.1.3	Hydraulic System	F-3.6.1	SF-2.6.1	ND			describe
1.1.10.1.7.2.1.2	"	F-3.6.2		"			"
1.1.10.1.7.2.3	"	F-3.6.3		"			"
1.1.10.1.7.2.4	"	F.3.6.4		"			"
1.1.10.1.7.2.2	"	F-3.6.5		"			"
1.1.10.1.7.2.1	"	F-3.6.6		"			"
1.1.10.1.7.2.1.1	"	F-3.6.7		"			"
1.1.4.3.1.1.1.1.2	ASE System	F-3.4.1	SF-2.4.1	ND			describe
1.1.4.3.1.1.1.1.3	"	F-3.4.2		"			"
1.1.4.3.1.1.1.4	"	F-3.4.3		"			"
1.1.4.3.1.1.1.1.2	"	F-3.4.4		"			"
1.1.4.3.1.1.1.1.1	"	F-3.4.5		"			"
1.1.4.3.1.1.1.1.1.1	"	F-3.4.6		"			"
1.1.3.2.4	Battery Start	F-3.2.1	SF-2.2.1	ND			state

Task No.	Task Name	Section No.	Old Section No.	NA/ND DM/DE	Hidden/ Obvious	Type	Keyword
	Precision Approach	F-3.1.1	SF-2.1.3	ND			state
	Normal Approach	F-3.1.2	SF-2.1.4	ND			state
	Rustlick	F-4.2.3	PF-3A.1.3	ND			state
1.1.12.1.1.2	Vids Fill-Out	F-4.2.2	PF-3A.1.2	ND			Fill out
1.1.12.1.1.1	Yellow Sheet	F-4.2.1	PF-3A.1.1	ND			list
1.8.2.3.8.1.1	Navigation System	F-5.8.7		ND			describe
1.8.2.3.8.1	"	F-5.8.6		"			"
1.8.2.3.8.2	"	F-5.8.5		"			"
1.8.2.3.8.4	"	F-5.8.4		"			"
1.8.2.3.8.3	"	F-5.8.3		"			"
1.8.2.3.8.1.2	"	F-5.8.2		"			"
1.8.2.3.8.1.3	"	F-5.8.1	SF-4.6.1	"			"
1.8.2.3.1.1.1	Pitot Airspeed System	F-5.7.7		ND			describe
1.8.2.3.1.1	"	F.5.7.6		"			"
1.8.2.3.1.2	"	F.5.7.5		"			"
1.8.2.3.1.3	"	F.5.7.4		"			"
1.8.2.3.1.3	"	F.5.7.3		"			"
1.8.2.3.1.1.2	"	F-5.7.2		"			"
1.8.2.3.1.1.3	"	F-5.7.1	SF-4.7.1	"			"
1.1.10.1.1.8.1.1	Power Plant System	F-5.4.7		NA			
1.1.10.1.1.8.1	"	F-5.4.6		"			
1.1.10.1.1.8.2	"	F-5.4.5		"			
1.1.10.1.1.8.4	"	F-5.4.4		"			
1.1.10.1.1.8.3	"	F-5.4.3		"			
1.1.10.1.1.8.1.2	"	F-5.4.2		"			
1.1.10.1.1.8.1.3	"	F-5.4.1	SF-4.5.1	"			

Task No.	Task Name	Section No.	Old Section No.	NA/ND DM/DE	Hidden/ Obvious	Type	Keyword
1.1.11.2.3.2.1	Recovery w/ loss of Tail Rotor Control	F-5.1.5*	SF-7.1.2	DE			state
1.1.10.2.2.2.1	Running Autorotation Landing	F-5.1.3	SF-4.1.3	ND			state
1.1.10.2.2.1.1	Fuel Flare Autorotation Landing	F-5.1.2	SF-4.1.2	ND			state
1.1.10.2.1.4	Emergency RPM Control Approach	F-5.1.1*	SF-4.1.1	DE			state
	Communications System	F-7.7.6		ND			describe
1.8.2.5.5.1	"	F-7.7.5		"			"
1.8.2.5.5.2	"	F-7.7.4		"			"
1.8.2.5.5.3	"	F-7.7.3		"			"
1.8.2.5.5.1.2	"	F-7.7.2		"			"
1.8.2.5.5.1.3	"	F-7.7.1	SF-5.6.1	"			"
	Caution Lights System	F-7.6.6		ND			describe
1.8.2.5.5.1	"	F-7.6.5		"			"
1.8.2.5.5.2	"	F-7.6.4		"			"
1.8.2.5.5.3	"	F-7.6.3		"			"
1.8.2.5.5.1.2	"	F-7.6.2		"			"
	"	F-7.6.1	SF-4.16.1	"			"
1.8.2.2.1	Lighting System	F-7.5.5		ND			describe
1.8.2.2.4	"	F-7.5.4		"			"
1.8.2.2.5	"	F-7.5.3		"			"
1.8.2.2.2	"	F-7.5.2		"			"
1.8.2.2.3	"	F-7.5.1	SF-5.5.1	"			"

Task No.	Task Name	Section No.	Old Section No.	NA/ND DM/DE	Hidden/ Obvious	Type	Keyword
1.1.4.3.11.5.1.1	Electrical System	F-7.4.7		ND			describe
1.1.4.3.11.5.1	"	F-7.4.6		"			"
1.1.4.3.11.5.2	"	F-7.4.5		"			"
1.1.4.3.11.5.4	"	F-7.4.4		"			"
1.1.4.3.11.5.3	"	F-7.4.3		"			"
1.1.4.3.11.5.1.2	"	F-7.4.2		"			"
1.1.4.3.11.5.1.3	"	F-7.4.1	SF-5.4.1	"			"
1.1.10.2.4.1	Ditching Station	F-7.2.8*	SF-5.2.11	DE			state
1.1.10.2.4	Immediate Ditching	F-7.2.7*	SF-5.2.10	DM	hidden	Type 2	state
1.1.10.2.4.1	Controlled Ditching	F-7.2.6	SF-5.2.9	ND			state
1.1.10.2.6	Water Takeoff	F-7.2.5	SF-5.2.7	ND			state
1.1.4.3.10.5	Internal A/C Fire Likelihood	F-7.2.3	SF-5.2.3	ND			state
1.1.11.1.3.2.3.3	Single Engine Recovery	F-7.1.6	SF-5.1.6	ND			state
1.1.11.1.3.2.3.1	Jettisoning	F-7.1.3	SF-5.1.3	ND			state
1.1.10.2.3.2	Secured Engine Restart	F-7.1.1	SF-5.1.1	ND			state
1.8.2.4.2.1.1	Weapons Systems	F-9.8.7		NA			
1.8.2.4.2.1	"	F-9.8.6		"			
1.8.2.4.2.2	"	F-9.8.5		"			
1.8.2.4.2.4	"	F-9.8.4		"			
1.8.2.4.2.3	"	F-9.8.3		"			
1.8.2.4.2.1.2	"	F-9.8.2		"			
1.8.2.4.2.1.3	Weapons System	F-9.8.1		NA			
1.8.2.4.2.1.1	Electrical Release System	F-9.7.7		ND			describe

Task No.	Task Name	Section No.	Old Section No.	NA/ND DM/DE	Hidden/ Obvious	Type	Keyword
1.8.2.4.2.1	Electrical Release System	F-9.7.6		ND			describe
1.8.2.4.2.1	"	F-9.7.5		"			"
1.8.2.4.2.4	"	F-9.7.4		"			"
1.8.2.4.2.3	"	F-9.7.3		"			"
1.8.2.4.2.1.2	"	F-9.7.2		"			"
1.8.2.4.2.1.3	"	F-9.7.1	SF-7.10.1	"			"
	Sonobuoy System	F-9.6.3		ND			describe
	"	F-9.6.2		"			"
	"	F-9.6.1	SF-5.9.1	"			"
1.8.2.4.8.1.1	ALR-54 System	F-9.5.7		ND			describe
1.8.2.4.8.1	"	F-9.5.6		"			"
1.8.2.4.8.2	"	F-9.5.5		"			"
1.8.2.4.8.4	"	F-9.5.4		"			"
1.8.2.4.8.3	"	F-9.5.3		"			"
1.8.2.4.8.1.2	"	F-9.5.2		"			"
1.8.2.4.8.1.3	"	F-9.5.1	SF-7.4.1	"			"
1.8.2.4.7.1.1	MAD System	F-9.4.7		ND			describe
1.8.2.4.7.1	"	F-9.4.6		"			"
1.8.2.4.7.2	"	F-9.4.5		"			"
1.8.2.4.7.4	"	F-9.4.4		"			"
1.8.2.4.7.3	"	F-9.4.3		"			"
1.8.2.4.7.1.2	"	F-9.4.2		"			"
1.8.2.4.7.1.3	"	F-9.4.1	SF-7.3.1	"			"
1.1.6.1.3.6	MAD Use	F-9.3.5*	SE-1.4.4	NA			

Task No.	Task Name	Section No.	Old Section No.	NA/ND DM/DE	Hidden/ Obvious	Type	Keyword
	MAD Pattern Strengths	F-9.3.4	SE-1.2.8	NA			
	MAD Localization	F-9.3.3*	SE-1.2.7	NA			
	MAD Procedures	F-9.3.1	SE-1.2.5	ND			state
1.1.4.2.3.1	Max. Gross Weight Takeoff	F-9.1.1	SF-7.1.1	ND			state
	LN66 HP Radar System	F-11.5.3		ND			describe
1.8.2.3.7.1	"	F-11.5.2		"			"
1.8.2.3.7.2	"	F-11.5.1	SF-4.12.1	"			"
1.8.4.2.1.1	Cargo Hook System	F-11.4.6		ND			describe
1.8.4.2.1	"	F-11.4.5		"			"
1.8.4.3	"	F-11.4.4		"			"
1.8.4.2.2	"	F-11.4.3		"			"
1.8.4.2.1.2	"	F-11.4.2		"			"
1.8.4.2.1.3	"	F-11.4.1	SF-8.4.1	"			"
1.8.5.3.1.1	Environmental System	F-11.3.7		ND			describe
1.8.5.3.1	"	F-11.3.6		"			"
1.8.5.3.2	"	F-11.3.5		"			"
1.8.5.3.4	"	F-11.3.4		"			"
1.8.5.3.3	"	F-11.3.3		"			"
1.8.5.3.1.2	"	F-11.3.2		"			"
1.8.5.3.1.3	"	F-11.3.1	SF-8.3.1	"			"
	Radar Offset Approach	F-11.2.2*	SE-4.8.3	DM	obvious	Type 2	state

PILOT/ATO (WB)

Section No.	Notes
F-1.2.3	There is a hidden decision making task inside the whole task "determine the required fuel reserve"; however, the procedure for its calculation is given "10% of fuel on board or 20 minutes of flight time, whichever is longer".
F-1.1.4	There are two hidden decision making tasks inside the whole task: (1) "Determine destination weather", and (2) "Determine traffic pattern", neither of which possesses a procedure. However, both are said to be "asked from the tower". Therefore, they are non-decision tasks with respect to the pilot.
F-5.1.5	The procedure is given in the form of "If (condition), then (action)", which is the translation of a table look up. This is a means of communicating a decision previously made to a decision executer.
F-5.1.1	There is a hidden decision "determine type of landing to be made"; however, the procedure to perform this determination is also given.
F-7.2.8	This task can be considered as a decision execution task. Since the decision as to "should an immediate ditching, planned ditching, or none be performed" has previously been made for all possible states of nature, the result of this decision is now being communicated to the pilot for execution.
F-7.2.7	Item B-2 of the procedure says, "Either secure engine and rotors (release harness and abandon aircraft) or follow single engine water takeoff procedure". However, it has not been suggested how to decide between these two alternatives. Therefore, this remains as a decision task to be performed by the pilot.
F-9.3.5	This task is potentially a very good technical and also critical (in terms of the objective of the mission) decision task. The course materials are not found in the workbook pack. (It might be classified.)
F-9.3.3	It is a potential decision task; however,the corresponding course material is not found in the workbook pack. (It might be classified.)
F-11.2.2	The item 2 of the procedure: "Determine if a direct or offset approach will be used" is a decision task. In the description of this item, it is said that "The ATO will decide if a direct or offset approach will be used". No completely specified criteria for this selection has been given.