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REVIEW OF EXISTING F-16 TASK ANALYSIS.(U)
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F-16 AIRCREW TRAINING DEVELOPMENT PROJECT

Contract No. F02604-79-C8875

REVIEW OF EXISTING F-16 TASK ANALYSIS

DEVELOPMENT REPORT No. 4
MARCH 1981

Prepared in fulfillment of CDRL no. B009

by

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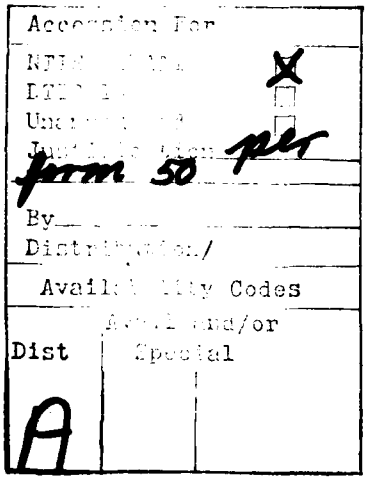
PREFACE

This report was created for the F-16 Aircrew Training Development Project contract no. F02604-79-C8875 for the Tactical Air Command to comply with the requirements of CDRL no. B009. The project entailed the design and development of an instructional system for the F-16 RTU and instructor pilots. During the course of the project, a series of development reports was issued describing processes and products. A list of those reports follows this page. The user is referred to Report No. 34, A Users Guide to the F-16 Training Development Reports, for an overview and explanation of the series, and Report No. 35, F-16 Final Report, for an overview of the Instructional System Development Project.



F-16 AIRCREW TRAINING
DEVELOPMENT PROJECT REPORTS

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EXECUTIVE SUMMARY

A task analysis is a very critical and fundamental component of an ISD project since it ultimately determines what tasks and contents will be included in the training program. The existing task analysis for the F-16 pilot compiled by General Dynamics was analyzed in terms of the specific requirements of the F-16 training program. Five major criteria were used:

1. Appropriate level of detail.

2. Adequacy of coverage of job tasks.

3. The mission orientation (rather than equipment orientation) of the analysis.

4. Appropriate scope of behaviors.

5. Logical consistency of task breakdown.

The level of detail and scope of this existing task analysis were found to be adquate. The coverage of job tasks was found to be inadequate and in need of revision. The mission orientation of the existing analysis was considered to be weak in the areas of tactics, premission planning, and air-to-surface combat. The logical consistency of the analysis was found to be weak and in need for revision in the areas of air maneuvers and system operations.

It was concluded that the existing F-16 task analysis would be helpful as a suggestive tool, but additional analysis is required to provide a solid foundation for the F-16 ISD effort. Areas particularly needing attention are those behaviors associated with cognitive performance (e.g., air-to-air or air-to-surface combat, mission planning, navigation, etc.) as opposed to equipment operation.

CONTENTS

REVIEW OF EXISTING F-16 TASK ANALYSIS

1.0 PURPOSE

A task analysis document is fundamental to a systems approach to the development of job training. It is a tool which is used to optimize the use of training resources by insuring (1) that all necessary content is taught and (2) that no content is taught which is unnecessary. This optimization of the content of training is one of the identifying characteristics of a systems approach.

The purpose of this paper is to review a task analysis produced for the F-16 pilot and to evaluate its potential for use in the F-16 Aircrew Training Development Project as part of, or a supplement to, the final F-16 task analysis.

Since the F-16 task analysis will be used in the context of aircrew training, it should be expected to have certain properties which will facilitate the application of analysis products to the development of instruction and instructional syllabi. The characteristics of task analysis which are useful for those purposes are described in this paper. They constitute the standards against which the existing F-16 task analysis will be evaluated.

2.0 USE OF TASK ANALYSIS IN ISD

Task analysis is the first of two analysis processes used in deriving instructional objectives from job performance requirements. The two analyses first divide the job into terminal or criterion behaviors (task analysis), and then further break down these terminal behaviors into component subtasks, skills and knowledges at lower levels of complexity and job-relatedness (objectives hierarchy analysis). The result of analysis is a set of instructional and performance objectives and the logical relationships between them.

The two analyses have a direct or indirect effect on every other instructional system development (ISD) process. Some subsequent ISD processes use the analyses as a direct input, and

therefore structure and contents are intimately connected with their outcome. In other cases, intermediate events occur between the analyses and a later ISD process but the analyses, having affected the intermediate process, influence the final process as well.

For instance, the media selection process will select media that are most appropriate for individual objectives. The sequencing process will take individual objectives and place them in an order which promotes mastery through a smooth progression of learning steps. Training Support Requirements Analysis will determine the costs for the development and implementation of instruction for a specified set of objectives and the costs for running and maintaining the instructional system which is the environment for achieving the objectives. Lesson specification writing will produce for each objective the instructional strategy to be used and will establish the critical content of the instruction for each. All of the above emphasize the integral part which objectives, the products of analysis, play in ISD processes. For this reason ISD models stress the importance of conducting an analysis that yields the best possible set of instructional objectives.

3.0 VARIETIES OF ANALYSIS

Because ISD is yet in its infancy compared with other disciplines such as medicine or engineering, the lack of universally accepted guidelines and evaluation criteria for analysis practices and products is not surprising. There are presently several varieties of analysis named "task analysis" by their authors, and each appears to satisfy the needs of a particular training work design, or environment design requirement. One variety, for instance, designed for use in maintenance training, focuses on the equipment being maintained and its manipulations. A second type is used in designing environments for complex man-machine interactions. It is centered on analysis of manipulations of equipment. Still other varieties of task analysis are used for assignment of tasks to jobs and the broad spectrum analysis of training requirements over several jobs. The type of task analysis outlined in this report has been found useful in training for jobs which involve a mixture of equipment manipulations skills and complex decision-making skills. At least one study of instructionally useful analysis methods (task and otherwise) has been made (Gibbons, 1977). A great diversity exists between methods in terms of procedures, purposes, product characteristics, and theoretical/practical rationales; and the field of instructional psychology must expend a great deal of effort to produce a broad-range rationale for using and evaluating analyses.

The requirements of aircrew training in general, and F-16 aircrew training specifically, favor a certain variety of analysis which has proven itself to be appropriate in the past. It will be used as the basis to evaluate the existing F-16 task analysis and make recommendations concerning its use.

The specific requirements of the F-16 project have been taken into account in stating the criteria against which the existing task analysis will be evaluated: the criteria which will also be used for the F-16 task analysis final product evaluation. Pilots act in a mission-directed and complex decision-making environment, working at times with other team members. The analysis must emphasize those elements of the task so that they may give rise to the appropriate training. The criteria for evaluating the existing task analysis are presented below, followed by a summary of the recommendations resulting from a study of that analysis.

4.0 CRITERIA

The following are considered the most important characteristics of a task analysis suitable for use in F-16 training development:

CRITERION 1: Appropriate Level of Detail (Depth)

To be useful in the process of instructional development, a task analysis must drive to a sufficient level of detail.

No adequate terminology has been invented for expressing the differences between levels of a task analysis, and the exact point at which the tasks being identified are serviceable as terminal behavior evaluation points in a training program. For these tasks, the specification of conditions and standards defines a specific behavior and testing setting which is not so inclusive that it is impossible to evaluate at one testing session and not so small that the evaluation is of relatively little consequence in terms of time expended in evaluation and importance of the behavior. More simply stated, this criterion emphasizes the need to identify tasks which can be used to fill practical evaluation needs. It should be agreeable to most judgments that the behavior "perform a takeoff" is too inclusive as an evaluation event, since there are several varieties of takeoff and no indication of which is to be evaluated. Moreover no meaningful, measurable conditions, and standards can be written for the task. The analysis must go at least one more level in depth to provide tasks that can be sufficiently evaluated. "Perform a crosswind takeoff" on the other hand, is a behavior that is observable and practical to evaluate and represents a sufficient depth level for the task analysis. To complete the example, it should be demonstrated that the next level of analysis would produce tasks such as "crab into wind after takeoff to maintain runway alignment." This task is at a level of detail beyond what is practical to evaluate as an isolated entity. It will be evaluated, but only within the context of evaluating several other closely related behaviors in the same sequence. Therefore, it is at a greater depth than is necessary.

A task analysis which goes beyond the required level of detail contains much information which will be useful to the instructional developer later in the development process, though a high degree of detail is not absolutely necessary for analysis to proceed and satisfy its main purpose of identifying all job tasks down to the level of being significant and capable of being evaluated.

CRITERION 2: Adequate Coverage of Job Tasks (Range)

An adequate task analysis will cover all of the performances which are part of competent job behavior. In aircrew training this means that an adequate task analysis will include not only strictly pilot-initiated behaviors but coordination between the pilot and other crew members and individuals within the aircraft (for two seat aircraft), on the ground, and in other aircraft. The F-16 task analysis must also cover the complete spectrum of job performances including both expected and unexpected conditions such as emergencies or degraded system performance conditions. It will contain behaviors carried out under all relevant conditions which cause differences in job performance, including weather, day/night, VFR/IFR, etc. Finally, the task analysis must be complete and specify all procedures to be performed. Tasks may not be omitted because they are seldom performed or because they are difficult to analyze.

CRITERION 3: Mission-Orientation

In some types analysis procedures, characteristics of configurations of the equipment to be manipulated during performance are used as one of the main logical dimensions of the task analysis. For jobs which involve the operation of equipment exclusively, this form of task analysis is sufficient. The F-16 pilot job, however, is not of this type. Much of the F-16 pilot's critically important behavior takes place independent of the equipment or before equipment is manipulated. The F-16 task analysis must then emphasize the mission orientation of the pilot's behavior rather than the equipment orientation.

In doing this the task analysis for F-16 pilots will include not only those overt and observable performances which are necessary for adequate job performance, but all decision-making and other complex cognitive behaviors which are part of the job performance as well. Complex behaviors of this type represent the core of the air-to-air combat for F-16 pilots. Very often such behaviors are poorly represented in task analyses. The F-16 task analysis must identify complex decision-making, mission-oriented behaviors so that these may lead to the writing of appropriate instructional objectives later.

CRITERION 4: Job Scope Limitation

An instructionally useful task analysis will limit its contents to those behaviors which are job and job-related behaviors.

CRITERION 5: Logically Consistent Organization

Task analysis is one part of a process which is an objective means for determining training requirements and also a means of bypassing more traditional methods of curriculum design which draw upon subjective feelings of what course content ought to be. In this sense, the strength of task analysis is the logic which is used in breaking tasks down or analyzing them into subtasks. Once the logic has been defined that states the allowable type of task/subtask relationship (i.e., subordinate, superordinate, coordinate), the task analysis should insure that they are preserved and that the set of allowable logical relationships is not violated.

5.0 RECOMMENDATIONS

This section of the report makes recommendations for the use of the existing F-16 task analysis in the training development effort.

The level of detail or depth of the existing task analysis is adequate for the purposes of the F-16 project. The existing task analysis goes in virtually every case to a lower level of detail than is required by the criterion. This additional detail will be useful in future stages of the project.

The range of the existing F-16 task analysis is not adequate. The final task analysis will have to include tasks performed by the F-16 pilot that are not included in the existing task listing. The within-crew tasks performed by the pilot (e.g., pilot to crew chief communications) were included in the existing task analysis. Formation operations were not specified pending USAF development. When those procedures are determined, they will need to be determined for the final version of the analysis.

The mission orientation of the existing F-16 task analysis is not adequate. The tactical employment sections of the analysis, though they deal with the most critical of all pilot behaviors, are lacking in detail and completeness. Premission planning for air-to-surface combat, and performance of air-to-air combat are very short and incomplete. A more careful and detailed analysis of these areas of pilot tasks will lay the groundwork for a more mission-oriented training program.

The decision orientation of the existing analysis is also in need of upgrading. The F-16 final task analysis must add greater proportional weight to the decision processes of the pilot, especially those decision processes during air combat maneuvering.

The scope of the presently existing F-16 task analysis appears to be appropriate. All tasks included in the existing

analysis are F-16 pilot job tasks. Care will be exercised to see that any omitted tasks are inserted in the final version.

The pattern of logic in the presently existing F-16 task analysis is in some areas mixed. Questions must be asked in the areas of basic air maneuvers and systems operations to see if they should stand independently, or if they do not more appropriately belong within one of the divisions of the task analysis which will occur naturally as analysis proceeds. Doing this will perhaps identify differences in training requirements which would not be apparent in an analysis with less logical consistency.

In summary, it is the conclusion of this review that the existing F-16 task analysis will be useful as a suggestive tool and as a source of information in those areas which are well analyzed. It will serve as a beginning point for analysis in some of those areas from which the completeness of the analysis can be determined. In those areas which are inadequately covered, original analysis work will be needed. Areas particularly needing this attention are the areas heavily loaded with non-machinery related behaviors such as those requiring heavy cognitive performance (e.g., air-to-air combat, air-to-surface mission planning, navigation, etc.). Those areas seen as needing review and additions are also extensive. Therefore, it is estimated at this time that virtually all of the existing task analysis must undergo thorough reworking and restructuring.

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