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GOAL ANALYSIS REPORT (U)

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F-16 AIRCREW TRAINING DEVELOPMENT PROJECT

Contract No. F02604-79-C8875 ✓

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GOAL ANALYSIS REPORT

DEVELOPMENT REPORT No. 9
MARCH 1981

Prepared in fulfillment of CDRL no. B014

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. 8014. 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.

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F-16 AIRCREW TRAINING
DEVELOPMENT PROJECT REPORTS

Copies of these reports may be obtained by writing the Defense Technical Information Center, Cameron Station, Alexandria, Virginia 22314. All reports were reviewed and updated in March 81.

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EXECUTIVE SUMMARY

Goal analysis is the process of translating instructional goals into observable indicator behaviors which can be taught and measured. In order to develop a list of goals for the F-16 pilot training program, a literature review was conducted and experienced F-4 pilots were interviewed to identify the attributes and attitudes characterizing a successful combat pilot. From these data, a list of eleven major goals was identified. These goals are:

1. A high standard of preparation.
2. Excellent physical fitness.
3. Highly self-reliant.
4. Timely and decisive in actions.
5. Situational awareness during flight.
6. Detailed knowledge of enemy tactics, capabilities, and weaknesses.
7. Highly flexible and resourceful.
8. Foresight.
9. Competitive and aggressive in combat.
10. Maintain composure in combat.
11. Possess a high degree of discipline.

For each goal, indicator behaviors and characteristics to be incorporated into the instructional system to facilitate these goals were identified. This information will be important in the development of the performance measurement system as well as the quality control of the F-16 training project.

GOAL ANALYSIS REPORT

1.0 INTRODUCTION

This report presents the results of the goal analysis performed for the F-16 Aircrew Training Development Project. The report is written in response to CDRL no. B014 of the Statement of Work. The general aims of goal analysis are discussed, and the specific application of goal analysis to the current project is described in detail.

The goal analysis performed during Phase III of this project produced a list of pilot training goals in the form of desired attributes of a combat-ready F-16 pilot. Each goal is accompanied by a list of student behaviors that can be used to indicate attainment of the goal and by a list of characteristics of the F-16 instructional system that will be implemented to facilitate attainment. These lists are preliminary and may be revised somewhat during the course of the project. Provision for this updating is contained in certain project CDRLs, specifically B015.

1.1 The Need for Goal Analysis

A major objective of the F-16 Aircrew Training Development Project is to set up a training program that will produce competent, combat-ready F-16 fighter pilots. This requires that there are means to determine when a pilot meets those qualifications. There are three major areas in which these determinations must be made: psychomotor, cognitive, and affective.

Through a properly applied task analysis, instructional developers can determine all of the performance tasks a pilot must master to be competent and can devise a program to train pilots in those tasks. With a well designed system for evaluating pilot performance, it can be determined whether or not each task has been mastered. This accounts for necessary pilot skills in the psychomotor and cognitive domains.

However, more than technical proficiency is involved in being a competent, combat-ready pilot. Combat performance is also influenced by factors in the affective domain, such as emotion, awareness, and attitude. For instance, some pilots have described unexpected reactions to their first encounter with

hostile aircraft or ground fire--an emotional response. Pilots, furthermore, find that differences in situational awareness can have a very real effect on the outcome of a mission. Finally, it should be expected that the training system will deal with those standard, desirable products of military training: attitudes such as pride and professionalism. Developers are commonly concerned with the skill outcome produced by an instructional system but are less often concerned with these more elusive and difficult to measure affective training goals.

Often when instructional design is based solely on task analysis, some of the very important, yet subtle, attitudes and mental habits that characterize an effective job holder are lost to the analyst. As a result, they are not brought to bear upon the design of the instructional system and its instructional materials. Since attitudes and mental habits of fighter pilots are so closely integrated with the effective employment of their skills, an instructional system to train fighter pilots must attempt to deal with these essential characteristics in some systematic way and incorporate features in the instructional system to promote them. The instilling of these critical, yet intangible factors into the student pilot is the objective of the project goal analysis.

1.2 The Use of Indicator Behaviors

Goal analysis is a process through which a developer can deal with these abstract goals of a training program. The purpose of the goal analysis, as described by Mager (1972), is to state very general and difficult to express goals and translate them into observable indicator behaviors. If a student routinely exhibits most or all of the indicator behaviors for a goal, then it is inferred that the goal has been attained, in somewhat the same way mastery of a skill is inferred by performance.

Consider the following example. One of the goals of the F-16 pilot training program is that "an F-16 pilot should be highly self reliant." The statement of this goal by itself does not make clear what is meant by self reliance, and, therefore, it may not be possible to determine whether or not a student is self reliant. In order to clarify the goal, we have devised a list of behaviors that we feel are indications of the goal:

- Completes assignments on time without being continually reminded.
- Upon completion of assignment, initiates request for next assignment.
- Requests duties with responsibility.
- Can perform in flight lead or single-ship role.

- Takes responsibility for getting work done.

Such a list provides an operational definition of the goal of self reliance as it relates to this project. If we observe most or all of the behaviors almost all of the time, we can be reasonably sure that the students are self reliant. However, the absence of a particular behavior in student performance does not necessarily mean the goal has not been attained. Similarly, we can apply the goal analysis process to other abstract goals in the F-16 training program.

1.3 How Goal Analysis Affects the Design of an Instructional System

Once a developer has identified the indicator behaviors students are to exhibit as evidence of goal attainment, it is necessary to determine how the instructional system should be configured to (1) aid students in the attainment of the goals and (2) allow for the observation of the indicator behaviors.

The result of goal analysis can affect almost every facet of the instructional system, either directly or indirectly. In particular, the analysis greatly affects those parts that may use the goal analysis to generate design specifications for any of the following instructional system components: objective hierarchies, syllabi, student instructional materials (such as workbooks, tapes, slides, users manuals, tests, and performance measures), personnel training materials, the management plan (including personnel selection and training plans, instructional system operating procedures, the system resources plan, scheduling plans, and role descriptions), the program evaluation plan for materials and exercises, and the instructional facilities plan.

For instance, one of the greatest impacts of the goal analysis is in the development of the instructional materials, where both the tone and content can be greatly affected. For example, it was determined during the F-16 project goal analysis that pilots need to be in excellent physical shape to maintain their performance levels in a high "g" environment. From this, it has been decided that whenever a message can be communicated through the material in favor of physical fitness, it will be done. This will impact on illustrations of pilots and other figures, phrasing of the language, and other materials characteristics. In addition, throughout the materials the importance of physical condition will be emphasized in direct language. Students will be reminded that, unlike the aircraft they have previously flown, the F-16 is performance limited by the pilot's abilities, not by the machine's capabilities. These slants in the instructional materials can encourage the goal of physical fitness among the students.

In another example, personnel selection and training require consideration of the project goals. We may determine from the goal analysis that it is important for the instructor pilots in the course to serve as role models for the student pilots. Then, selection and training of instructor pilots should reflect this requirement. Similarly, role descriptions can be developed so that personnel interactions with the students can aid the attainment of the project goals.

The instructional facilities plan will be directly affected by the goal analysis. The design of the learning center can be adapted to help accomplish the training goals in several important ways, such as in the choice of instructional settings and room plans (classrooms, discussion rooms, etc.), as well as the decor (warm vs. austere, etc.). For example, the goal analysis may indicate the desirability for students to be able to study publications outside of scheduled class time. This might require a library of related publications. The learning center design should be adapted accordingly.

We have demonstrated the need for a training program that does more than train the performance measurable tasks related to combat flying and have introduced the goal analysis process as an aid to attaining that end. In addition, we have discussed general areas in which the design of an instructional system can be affected by the results of a goal analysis. The remainder of this document will deal with the goal analysis performed for the F-16 Aircrew Training Development Project.

2.0 THE F-16 PROJECT GOAL ANALYSIS

The steps that were followed during the F-16 goal analysis will be explained in detail in this section. The goal analysis process involved two major tasks: (1) determining the list of desired training goals and (2) deriving a list of indicator behaviors for each goal. Each step is described below. Once the initial goal analysis has been performed, the analysis document is not fully finished. As is the case with the F-16 task list, the F-16 goal list will be periodically reviewed and updated. This will be done in accordance with the provisions of CDRL no. B015.

2.1 Determining the Training Goals

The first step in the F-16 goal analysis was to determine desired goals to be effected during the training program. A literature search was performed, and interviews with combat experienced F-4 pilots and weapon systems operators at Luke AFB were conducted. All personnel interviewed were regarded as competent aircrews by their peers. A time constraint limited the number of interviews to seven. Each person interviewed was asked to list what he thought were the attitudes and attributes of a successful combat pilot, plus any characteristics he thought would be directly related to the success of a pilot in the F-16 aircraft in a projected European-type combat environment.

The objective of the literature search and interviews was to compile a list of the characteristics of successful combat fighter pilots. Although the literature search could not be exhaustive due to the time constraint, some useful documents were located. Among these were de Leon (1977), Youngling et al. (1977), and sections of the Delphi studies presented in the USAF Red Baron reports on Vietnam.

The lists of attitudes and attributes gleaned from the interviews and literature were generally consistent. The same or similar terms kept appearing. The list of goals was derived from these lists by the following process. First, the entries were grouped according to major topics such as physical control habits and mental habits. Within each group similar terms were clustered such as "timeliness" and "knows when to act." Representative terms were selected for each cluster and were reviewed by the operational training development (OTD) and contractor team members. After several iterations of this process a final list was distilled. Each entry on the list became the basis for a goal. Then, each goal was worded as a complete statement of purpose. It was decided to phrase each goal as a desired attribute of an F-16 pilot. For example, "An F-16 pilot should maintain situational awareness in flight."

2.2 Deriving Indicator Behaviors

The next step in the process was to produce a list of indicator behaviors for each goal. Indicator behaviors for a goal are outwardly observable signs that the specific goal has been attained.

Ideally, indicator behaviors should be measurable statements expressed in the form of performance objectives, that is, behaviors accompanied by conditions and standards. In reality, this may not be possible. Sometimes an indicator behavior cannot be expressed in specific terms and still remain useful. For example, an indicator behavior for self reliance is that a student "requests duties with responsibility." It is impossible to prescribe a specific set of conditions and standards for this behavior and still have it remain generalizable over the entire training program. Here, subjective instructor judgment will be required to determine the presence or absence of this behavior.

In the attempt to break out the indicator behaviors for a given goal, it sometimes happens that a sufficient list of behaviors cannot be derived. That is, we cannot produce an adequate list of behaviors from which we would be willing to make decisions as to the attainment of a given goal by a student. In such a case it is necessary to determine whether the goal being analyzed is a useful goal. Sometimes a different goal or goals must be substituted for the original goal.

For example, in the F-16 goal analysis, it at first seemed to be a desirable goal for the students to have pride in the country, the Air Force, and their unit. However, very few useful project-related indicator behaviors could be generated for these goals. Eventually, it was decided that this area of pride was not adequately measurable, and the few useful indicator behaviors that existed were included in other goals.

3.0 INCORPORATING THE RESULTS OF THE GOAL ANALYSIS INTO THE DESIGN OF THE F-16 INSTRUCTIONAL SYSTEM

Ultimately, the purpose of conducting a goal analysis is for students to attain the goals identified. This requires that the results of the goal analysis be incorporated into the design of the instructional system. The effects of the goal analysis on the instructional system will be both direct and indirect. In some instances, direct instructional strategies will be implemented to aid students in attaining the goals. In other instances, there will be indirect approaches to goal attainment along the lines of subtle persuasion and image building, which may not be readily apparent to the students.

The application of the goal analysis to the design of the instructional system will take place at three levels: (1) on the level of individual goals, (2) in the design of the performance measurement and quality control systems, and (3) in the evaluation of the completed design of the instructional system.

3.1 Characteristics of the Instructional System for Each Goal

During the goal analysis, for each goal a list of characteristics of the instructional system was derived that would facilitate student attainment of the goal. At the appropriate time in the design process, the designer will consider each characteristic for inclusion in the system. The lists of system characteristics are presented with their respective goals later in this report.

Some characteristics must be accounted for very early in the design process. For example, the recommendation to establish a library of flight and aircraft related publications must be worked into the blueprints of the learning center. Other considerations, such as specific affective emphases to incorporate into instructional segments, will be dealt with at later phases in the project development.

The goal analysis performed for the pilot training course has yielded much information to be used in the design of the instructor training course, specifically in the area of role descriptions for instructors. During the course, instructors will be made aware of the goals of the pilot training course as part of their own training in effectively dealing with students. Also, instructors will need training in the ability to make accurate subjective evaluations of student performance in some aspects of the goal analysis. To produce the best instructor training possible, it will be necessary and desirable to conduct a goal analysis specifically for the instructor course.

3.2 The Performance Measurement System

In addition to the duties normally associated with a system for measuring student performance, the performance measurement system for the F-16 instructional system must be designed to record, score, and interpret goal attainment by students. This means that mechanisms must be available to determine (1) whether students are exhibiting goal indicator behaviors, (2) the extent that these behaviors are occurring, and (3) what effect the appearance of indicator behaviors will have on students' progress through the system.

These determinations probably will not appear as a direct grade to be given to the students, as would the determination of psychomotor and cognitive skills. Instead, they will serve as a secondary line of evaluation to be used to supplement the objective measures taken of performances and as an aid in the resolving of difficult student progress questions.

In various forms, the indicator behaviors should appear as points of evaluation on student grade slips to be filled out by the instructor at the end of each equipment exercise. The performance measurement system must also provide for the monitoring of indicator behaviors at other times than the specific points of measurement represented by the grade slips. These times could occur during both scheduled and unscheduled squadron activities. For example, the behavior "requests duties with responsibility" may appear at times when the student is not being graded. Although such behaviors can be monitored, this does not require constant surveillance of students.

Not every indicator behavior is quantifiable to the point where it can be objectively measured and included as part of a student's grade. To the extent that a behavior is measurable, it should be included as part of the grading system. To the extent that a behavior is not directly measurable, caution should be used in placing too much interpretation on individual ratings. Rather, reliance should be placed on repeated measures that give the same indications of student performance. In this way, a cumulative affective profile can be generated for the student as the course progresses. (Further discussion of the role of the goal analysis in the performance measurement system appears in Development Report No. 14, "Recommendations for the F-16 Performance Measurement System".

3.3 The Quality Control System

Just as the goal analysis affects the system for measuring student performance, it also affects the measurement system set up to monitor the performance of the instructional system itself, i.e., the quality control or evaluation system. The quality control system includes the procedures and decision rules for the evaluation of the materials, exercises, and management of the instructional system. The set up of the quality control system will require the manufacturing of questionnaires, tests, and other evaluative tools to gather data on system operation, student attitudes toward the system, and execution of system roles. Data should also be collected to determine whether or not students are attaining the training goals. Therefore, the results of the goal analysis should be used in the design of these tools.

3.4 The Review of the Instructional System Design

The goal analysis will be applied to the design of the instructional system as a filter for the review of the complete system design. Each characteristic or component of the proposed system will be examined in the light of the list of training goals to determine (1) if there is anything that directly or indirectly contradicts the establishment of any goal and (2) if there are any additional design characteristics that will facilitate attainment of any goal and that can be incorporated into the system without disrupting the system design.

4.0 THE F-16 PILOT TRAINING GOALS, INDICATOR BEHAVIORS, AND RELATED INSTRUCTIONAL SYSTEM CHARACTERISTICS

4.1 The List of Goals

This section presents the list of goals for students in the F-16 pilot training program, along with a brief discussion of each goal.

1. An F-16 pilot should maintain high standards of preparation and performance.

The highest levels of performance demand that a pilot be prepared and proficient. Students must set high standards for their own preparation and performance to achieve this flying proficiency status.

2. An F-16 pilot should maintain excellent physical fitness.

Performance in the F-16 will be "man limited" rather than "machine limited." To maintain the effectiveness of pilots in a high "g" environment and fully exploit the performance capabilities of the aircraft, it is necessary that pilots be in excellent physical condition.

3. An F-16 pilot should be highly self reliant.

In the European combat environment scenario, the fighter pilot must be able to perform by himself, with confidence based on his own experience. Self reliance will be important in a single seat, single engine fighter.

4. An F-16 pilot should be decisive and timely in his actions.

Air combat requires split-second decisions. Pilots need to be able to commit to a course of action, and to commit at the proper time.

5. An F-16 pilot should maintain situational awareness in flight.

Situational awareness is the ability to receive and process all relevant data from the external environment. One who has mastered this vital skill is able to create a three-dimensional image of where all the elements in a situation are located and what they are doing.

6. An F-16 pilot should be fully conversant with enemy capabilities, tactics, and strategies, and should devise means of developing new strategies to deal with them and means for exploiting enemy weaknesses.

A detailed knowledge of the enemy is critical to being able to predict threats and act accordingly. Also, knowledge helps to overcome fear of the unknown. (This goal is very close to a directly measurable behavior and therefore is in the realm of the task listing and objective hierarchies. However, there are many system characteristics and directly unobservable behaviors related to this goal that would not normally result from task analysis alone to justify inclusion of this goal here.)

7. An F-16 pilot should be flexible and resourceful.

As the data are monitored in a combat situation, a course of action must be formulated. The pilot must be able to update his plans in response to a rapidly changing environment. In addition, the pilot's actions must be as unpredictable to the enemy as possible.

8. An F-16 pilot should have foresight.

One key to successful performance is the ability to see in advance what is likely to occur. This skill is based largely on the acquiring of a broad base of experience.

9. An F-16 pilot should be competitive and aggressive in combat.

In combat, pilots cannot be passive. They need tenacity, the desire to gain or regain and maintain the offensive, to push to victory.

10. An F-16 pilot should maintain composure in flight.

Crucial to the ability to monitor, plan, and perform in the air is the ability to remain collected, to avoid panic.

11. An F-16 pilot should be disciplined.

Discipline serves as a balance to aggressiveness and as an aid to composure. The ability to follow orders is also the ability to carry out all the required steps of a procedure, in the proper order. In the F-16, there are sophisticated and highly proceduralized flight control and weapons systems that demand extremely proficient use and disciplined study of procedures. Additionally, discipline is critical to the ability to support other aircrews in aerial combat.

4.2 Indicator Behaviors and Characteristics to Incorporate into the Instructional System

In this section each goal will be presented separately, followed by (1) the indicator behaviors for that goal and (2) the characteristics to be designed into the instructional system to facilitate attainment of the goal.

GOAL

An F-16 pilot should maintain high standards of preparation and performance.

- Shows careful attention to details even when he does not think he is being observed.
- Consistently strives to exceed minimum acceptable standards.
- Uses nonscheduled time for further study and training.
- Shows up for appointments on time (e.g., classes, equipment exercises, meetings, interviews).
- Completes assigned work on time.
- Questions instructors for clarification or additional information.
- Seeks answers to questions.
- Frequently "picks the brains" of experienced fighter pilots.
- Studies job-related literature for additional background.
- Is prepared when called upon to perform verbal skills and performance skills.

Characteristics to Incorporate into the Instructional System

- Provide materials and facilities for studying beyond scheduled course time.
- Provide supplemental professional study materials not directly related to the course (e.g., biographies of great aces, tactical books, history of the military).
- Encourage IPs and other experienced pilots to be available to interact with students during unscheduled time.
- Train and encourage IPs to maintain high levels of preparation and performance as examples to their students.
- Clearly announce deadlines, schedules, and expected standards of performance.

- Continually monitor and evaluate student performance; keep student informed of evaluations and individual progress compared to others.
- Make available material on improving work and study habits and material on increasing personal accomplishment (e.g., material on how to remember, how to organize time, how to control attitudes, how to relax).
- Stress the criticality to the pilot of pilot preparation and performance in a single seat, single engine fighter, including the importance of preparation as to how it affects performance.
- Provide advanced instruction for students who complete required instruction early.
- Establish a quiet lounge area and study rooms.
- Recognize and visibly reward high levels of performance.

GOAL

An F-16 pilot should maintain excellent physical fitness.

Indicator Behaviors

- Meets or exceeds Air Force physical fitness standards in accordance with Air Force Regulation 35-11.
- Meets Air Force weight standards in accordance with Air Force Regulation 35-11.
- Exercises (runs, swims, etc.) regularly to maintain a 30-point or higher weekly level of aerobics training.

Characteristics to Incorporate into the Instructional System

- Employ periodic aerobics testing to determine level of physical conditioning.
- Provide facilities, personnel, and programs for individual and team conditioning, and announce them prominently.
- During instruction directly stress the need for physical conditioning to maintain performance capability in a high "g" environment.
- Schedule activities to include specific time allocated for voluntary exercise periods.
- Schedule activities to allow for regular dining periods.
- Portray F-16 pilots as lean and fit in all instruction.
- Encourage commanders and supervisory and instructional personnel to actively support and participate in physical conditioning activities.
- Require squadron flight surgeon's active monitoring of student physical condition throughout training.
- Encourage competition in endurance building activities such as in the number of miles run each week and in times for long distance running.

GOAL

An F-16 pilot should be highly self reliant.

Indicator Behaviors

- Completes assignments on time without being continually reminded.
- Upon completion of assignment, initiates request for next assignment.
- Requests duties with responsibility.
- Can perform in flight lead or single-ship role.
- Takes responsibility for getting work done.

Characteristics to Incorporate into the Instructional System

- Enable individuals to proceed through the instruction at their own rate as much as possible.
- Prepare and encourage students to assume responsibility (e.g., solo and flight lead) as early as possible.
- Place student in combat training situations during some flight exercises where he is alone and outnumbered, perhaps unexpectedly.
- Provide leadership opportunities during exercises and in classes.
- Directly emphasize single-seat pilot role and its requirement for self reliance.
- Emphasize likely concepts of operations pilots will fly under.
- Require students to be responsible for major portions of their own scheduling and progress management.

GOAL

An F-16 pilot should be decisive and timely in his actions.

Indicator Behaviors

- Quickly produces performance alternatives when required.
- Responds confidently to questions and problems.
- Reacts unhesitatingly when a decision has been made or when an opportunity is observed.

Characteristics to Incorporate into the Instructional System

- Frequently require students to "think quickly on their feet."
- Use instructional segments and gaming that require decisions to be made rapidly and continually.
- Frequently and directly stress the need for decisiveness in combat.
- Recognize and reward appropriate and particularly decisive and timely actions during exercises.

GOAL

An F-16 pilot should maintain situational awareness in flight.

Indicator Behaviors

- During engagement.
 1. Is spatially oriented (with respect to north, south, up, down, geographic reference points, etc.).
 2. Knows his aircraft status and present performance parameters (altitude, airspeed, etc.).
 3. Knows where to look for enemy aircraft from threat calls and after visual sighting is able to keep track of enemy while maneuvering.
 4. Knows where his wingman is and his status.
- After engagement can accurately reconstruct sequence of events.

Characteristics to Incorporate into the Instructional System

- Place emphasis on and extensively drill spatial orientation exercises.
- Whenever possible use three-dimensional diagrams and presentations.
- Provide view from cockpit in addition to ribbon representations.
- Simulate with all available resources (e.g., red flag/ACMI exercises, full mission simulators) actual mission conditions, including information denial and saturation (e.g., degraded communications, multiple threat calls and visual threat indications).
- Provide direct verbal and performance-oriented instruction to train situational awareness mental habit patterns.
- Include a review of situational awareness factors in all debriefs of encounters.

GOAL

An F-16 pilot should be fully conversant with enemy capabilities, tactics, and strategies and should devise means of developing new strategies to deal with them and means for exploiting enemy weaknesses.

Indicator Behaviors

- Identifies enemy aircraft correctly and can state relevant operating capabilities.
- Is familiar with enemy air tactics and strategies.
- Knows enemy missiles (A/A, S/A,), AAA defenses, and concepts of strategic employment.
- Identifies friendly aircraft and can state relevant performance capabilities.
- Demonstrates individual thought on methods of overcoming enemy tactics and exploiting enemy weaknesses.

Characteristics to Incorporate into the Instructional System

- Teach tactics from the beginning of the course.
- Conduct regular intelligence briefings for students by expert outside agencies.
- Maintain current documents on enemy tactics and weapons on hand and available to students.
- Maintain ready access for students to classified threat information.
- Keep training as realistic as possible and related to known and predicted threats.
- Incorporate DACT and red flag experiences in the continuation training plan.
- Stage competitions in visual identification and enemy threat knowledge.
- Encourage experienced pilots to relate combat experiences.

GOAL

An F-16 pilot should be flexible and resourceful.

Indicator Behaviors

- Accepts systems changes even after mastery of the obsolete system (e.g., new radar devices, reduced sortie availability) and applies himself to mastery of new system.
- Given a change in his situation, can adapt plans accordingly and proceed.
- Attempts to prepare himself to perform the same task in more than one way.
- Avoids continued use of predictable, memorized "school solutions" to tactical problems.

Characteristics to Incorporate into the Instructional System

- Remind students directly through adequately exemplified instruction that problems often have several "best" solutions.
- Provide a wide variety of conditions during training.
- Directly stress the need for unpredictability in combat.
- Penalize continued use of the same solution on similar problems even though solutions are acceptable.
- Place students in simulated conditions requiring quick thinking and adaptability.
- Carefully outline safety limits and operational limits of the F-16 and its pilot and discuss solutions to problems which exist near these limits.

GOAL

An F-16 pilot should have foresight.

Indicator Behaviors

- Correctly anticipates necessary actions during operations and positions himself to be ready to act.
- Tends to double check, and follows up on others' duties where he suspects trouble could occur (e.g., aircraft equipment, fuel supply, maintenance).
- Is knowledgeable in aircraft system functions to the degree of being able to respond in uncommon situations (e.g., degrade progressions, reactions of aircraft at edge of operating envelope).
- Has advance plans and anticipates events.

Characteristics to Incorporate into the Instructional System

- Provide exercises requiring careful advanced planning.
- Provide direct instruction on efficient planning practices.
- Require students to be thoroughly familiar with basic aircraft system structure, operations, interactions of systems, and operation of aircraft at edge of operating envelope.
- Make available to students the expertise of thoroughly experienced pilots.
- Provide accounts of real-life decision making situations requiring foresight.
- Practice tactics (offensive and defensive) with the same team as much as possible.
- Keep problems as realistic as possible; where possible introduce subtle variables that must be anticipated.

GOAL

An F-16 pilot should be competitive and aggressive in combat.

Indicator Behaviors

- Wants to win; dissatisfied with losing or tying.
- Requests training time with the most skilled opponents (students and instructors).
- Seeks new challenges and competition.
- Is alert to opportunity and takes it when possible.

Characteristics to Incorporate into the Instructional System

- Incorporate individual and team competitions within the instructional system.
- Provide incentives and recognition for "winning" and exemplary performance.
- Allow mission demands to expand to meet student capabilities.
- Provide combat simulation games in student lounge.
- Mediate some instruction in gaming form (against computer, against other students, etc.).
- Never portray the enemy humorously or sympathetically.

GOAL

An F-16 pilot should maintain composure in flight.

Indicator Behaviors

- Controls temper.
- Performance does not degrade significantly under stress:
 1. Maintains communications discipline.
 2. Continues to follow procedures.
 3. Maintains appropriate timing and pace.
 4. Does not freeze.
 5. Does not overreact.

Characteristics to Incorporate into the Instructional System

- Impose graduated levels of stress where possible, increasing stress as skill and tolerance increase.
- Introduce unexpected stress in critical situations.
- Directly instruct importance of composure in combat.
- Make available case histories on effects of maintaining composure under pressure.
- Train students in stress-reduction techniques.

GOAL

An F-16 pilot should be disciplined.

Indicator Behaviors

- Follows orders.
- Completes assignments well and on time.
- Maintains appropriate flight position in formation.
- Responds quickly and properly in radio communication.
- Responds quickly and accurately to commands from flight lead.
- Is knowledgeable of rules and regulations pertaining to flying aircraft.
- Observes regulations.

Characteristics to Incorporate into the Instructional System

- Keep students informed as to what is expected of them (the objectives) and measure performance according to the objectives.
- Train students thoroughly in appropriate regulations governing flight in aircraft.
- Directly instruct on the need for discipline in combat; for self discipline in single-seat aircraft.
- Allow opportunities for students and instructional system personnel to "blow off steam" at each other in sporting or other competitive events.

5.0 CONCLUSIONS

This goal analysis effort has been one of the first attempts to apply goal analysis directly to an Air Force training development program. Much useful information has been derived, and much has been learned about goal analysis as a process, including some ideas for other methods of generating goals and indicator behaviors in the future. (For example, as the task listing is developed, affective goals can often be identified for individual tasks. The approach we employed here--the generation of a list of goals independent of the task listing--seemed to best fit the intent of the Statement of Work.)

The implementation of the goal analysis results into the overall design of the instructional system is a major area of concern in the F-16 aircrew training project; procedures are currently being developed to ensure that this process is carried out as effectively as possible.

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