LEVEL II

1

F-16 AIRCREW TRAINING DEVELOPMENT PROJECT

Contract No. F02604-79-C0875

See also AD-A099 844

F-16 TRAINING SYSTEM MEDIA REPORT,

DEVELOPMENT REPORT No. 30,

MARCH 1981

Prepared in fulfillment of CDRL no. B037

by

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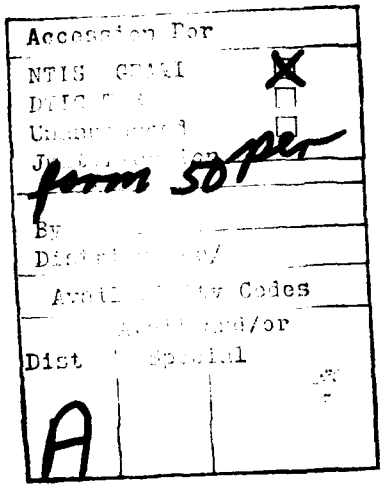
PREFACE

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. B037. 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 [illegible] Final Report, for an overview of the Instructional System Development Project.



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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Schmidt, R.F., Gibbons, A.S., Jacobs, R. & Faust, G.W. Recommendations for the F-16 performance measurement system (F-16 Development Report No. 14). San Diego, Calif.: Courseware, Inc., October 1978, March 1981.

Thompson, E.A., & Gibbons, A.S. Program/system constraints analysis report (F-16 Development Report No. 15). San Diego, Calif.: Courseware, Inc., October 1978, March 1981.

Gibbons, A.S., & Rolnick, S.J. A study of media production and reproduction options for the F-16 project (F-16 Development Report No. 16). San Diego, Calif.: Courseware, Inc., February 1978, March 1981.

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Jacobs, R.S., & Gibbons, A.S. Recommendations for F-16 operational flight trainer (OFT) design improvements (F-16 Development Report No. 22). San Diego, Calif.: Courseware, Inc., October 1978, March 1981.

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Rothstein, L.J., Hibian, J.E., & Mudrick, D. F-16 instructor/ course manager training requirements report (F-16 Development Report No. 25). San Diego, Calif.: Courseware, Inc., October 1978, March 1981.

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Farrow, D.R., & Kearsley, G.P. A user's guide to the F-16 training development reports (F-16 Development Report No. 34). San Diego, Calif.: Courseware, Inc., January 1981, March 1981.

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EXECUTIVE SUMMARY

This document lists the 32 academic media types and 20 simulation media types selected for possible inclusion in the F-16 training program, and provides a detailed description of each in terms of its instructional features, training capability, life cycle costs, hardware and software characteristics, manpower requirements and facilities requirements. This information is presented in the form of matrix tables, which list media characteristics and indicate the extent to which each medium possesses those characteristics.

This historical document was produced not only to document the F-16 media pool, but as a preliminary input to the instructional media selection process. The 52 media could not be selected and assigned in either the cost benefit analysis or media analysis without first characterizing them in terms of the variables listed earlier. Once this process was complete, the media were utilized in the instructional media selection process (see Development Report No. 20, F-16 Media Selection and Utilization Plan Report, and Development Report No. 31, F-16 Training Media Mix) and would have been utilized in a detailed cost benefit analysis, had that requirement not been cancelled by the contracting officer.

CONTENTS

LIST OF TABLES

F-16 TRAINING SYSTEM MEDIA REPORT

1.0 INTRODUCTION

This report addresses two somewhat distinct topics: (1) Proposals to enhance the instructional effectiveness of the F-16 Operational Flight Trainer (OFT), and (2) a detailed description of all potential candidate instructional media for the F-16 training program. These two analyses help provide the background and rationale for selecting and/or modifying instructional media to best meet the needs of the F-16 training program.

The recommendations for design improvements to the F-16 OFT were originally to include a series of evaluations of the Instrument Flight Simulator (IFS), now called the OFT, the Egress Procedures Trainer (EPT), and the Cockpit Procedures Trainer (CPT). Unfortunately, the contractor was not involved in the trainer design process *early enough* to impact the design of the CPT or EPT. Therefore, the contractor was directed to focus analysis and recommendations on the OFT alone. This analysis was published as development report no. 22, "Recommendations for F-16 Operational Flight Trainer (OFT) Design Improvements" and is summarized in Section 2.0 of this report. This summary lists 14 specific recommendations made on the basis of the ISD program design products, preliminary descriptions of the simulator design concept provided by the simulator contractor, and suggestions from the F-16 OTD team and other Tactical Air Command (TAC) agencies involved in simulator design, review, and procurement.

The list of potential candidate training media provided in Section 3.0 was developed through interaction between the contractor and the F-16 OTD team. Each medium is described in terms of its life cycle costs, training capability, hardware characteristics, software characteristics, manpower requirements, and facility requirements. These media became inputs to the media selection process first described in development report no. 24, "F-16 Pilot Media Selections and Syllabi, Volumnes I and II" and later updated in development report no. 31, "F-16 Training Media Mix."

2.0 TRAINING DEVICE STUDY

Development report no. 22, "Recommendations for F-16 OFT Design Improvements", describes the contractor's analysis of the F-16 OFT. The reader is encouraged to consult report no. 22 for a detailed discussion of this topic. For the purpose of this report, the 14 specific modification recommendations are listed below:

1. Grade sheet production: The F-16 OFT should produce carefully structured records of relevant data output in a format readily usable by instructors for debriefing and historical purposes.

2. Define Problem Set-up/Debrief: A capability should be established to perform simulator set-up and/or student debriefings off-line.

3. Mission Status and Look Ahead: A feature should be provided allowing the instructor pilot (IP) to examine the profile of a training mission (past and future) while the mission is being conducted, and determine the progress through the mission to that point while being alerted to the nature and time of occurence of events yet to transpire during the mission.

4. Self-instructional feature: The simulator should incorporate a self-instructional feature for IPs that operates through on-simulator tutorials.

5. Self-instructional feature: It is recommended that a "HELP" function be available to IPs while using the simulator for the purpose of guiding or suggesting instructor actions/ options at points where the instructor recognizes that he does not understand what options are available.

6. Mockup Physical Arrangement: Use either neutral density or matched spectral filtration on the cathode ray tube (CRT) faceplates.

7. Mockup physical arrangement: Tilt the CRTs forward.

8. Instructor displays of student controls: The instructor display of student indicators and controls should show appropriate readings continually rather than as a function of student views.

9. Page format: The following principles are offered as guidelines in the design of F-16 OFT CRT page formats:

   a. The design of a particular page must be made with an understanding of the use an operator will make of the information on the page.

b. Information displays used only occasionally must be encoded in a form that very closely resembles the observer's natural pictorial and verbal language.

c. Where quick acquisition of displayed information is required by the demands of the application, the amount of information on the display must be limited relative to its absolute capacity for presentation.

d. Organize CRT page structure along logical lines.

e. The psychophysical properties of the CRT display should be appropriate to the simulator operating environment.

10 Automatic malfunctions indication: The F-16 simulator should provide the instructor with advance indications of the nature and time of occurrence of automatically inserted malfunctions.

11. Malfunction copies: Simulator designers should establish a list of commonly used terms and denote aircraft system events with mnemonic codes for those terms.

12. Catastrophic malfunction combinations: Logic should be built into the instructor/operator station (IOS) software complement to provide the instructor with warning that emergency combinations will be counterproductive to the objectives of the selected mission.

13. Design for expansion I: A dual-port common data pool memory should service the simulator while simultaneously providing access to important parameters in memory for add-on functions.

14. Design for explantion II: Provide software in the F-16 OFT/WST to interpret and reconstruct missions flown on the Air Combat Maneuvering Range (ACMR) using range tapes produced by Cubic Corporation equipment as input media.

3.0 TRAINING MEDIA CHARACTERISTICS

This section describes each of the potential training media in terms of its instructional features (Section 4.1), training capability (Section 4.2), life cycle costs (Section 4.3), hardware characteristics (Section 4.4), software characteristics (Section 4.5), manpower requirements (Section 4.6), and facilities requirements (Section 4.7). This information is presented in the form of matrix tables which list media characteristics and indicate the extent to which each medium possesses those characteristics.

The following lists of academic and simulation media were selected by the OTD team for use in the F-16 training program. It is anticipated that the reader will be familiar with the simulation training devices, so these are simply listed without explanation. The full range of academic media may be less familiar, however, and are defined below. All media from both lists will be later defined in terms of their instructional features, training capability, life cycle costs, hardware characteristics, software characteristics, manpower requirements, and facilities requirements.

ACADEMIC MEDIA POOL

1. Computer-assisted instruction (CAI) plus lesson guide: An individualized digital computer-based instructional system whereby direct student-computer interface allows the automatic management and display of information to the student, the acceptance, processing and evaluation of student responses, the display of results, and the selection of subsequent learning events, plus a worksheet containing the lesson (segment) identification number and title, an introduction, list of objectives, support information, graphics, practice items, and feedback to provide the student with a written record of all mediated presentations.

2. CAI plus videotape plus lesson guide: CAI plus lesson guide plus color television program stored on a tape cassett which may be operated by the student.

3. CAI plus videotape plus part-task trainer plus lesson guide: CAI plus videotape plus lesson guide plus training hardware designed to provide hands-on practice of a single or limited range of tasks which are cued and prompted by a videotape display.

4. Interactive part-task trainer plus lesson guide: Lesson guide plus part-task trainer that is wired to a computer to allow realistic responses to student manipulations. Cockpit gauges, for example, respond to student pressure on the throttle.

5. Random access slide plus lesson guide: Lesson guide plus visual slide projection system that allow slides to be presented in any order, rather than following the order in which they are loaded into a cartridge.

6. Motion picture plus lesson guide: Lesson guide plus 16mm or super 8mm color film projection system.

7. Videotape plus lesson guide: See 2 above.

8. Videodisc plus lesson guide: Lesson guide plus color television program stored on a thin plastic disc instead of a tape (as in 2 above), allowing random access, freeze frame, and motion.

9. Tape/Slide plus learning guide: Learning guide plus system for presenting audiovisual information by means of an audio tape and a series of synchronized projected visual slides.

10. Suitcase projector with audio and both still and motion visual plus lesson guide: Lesson guide plus portable desk-top screen for viewing audiovisual film strip loops that include both still slides and limited motion sequences.

11. Workbook plus lesson guide: Lesson guide plus printed booklet which includes lesson identification number and title, introduction, objectives, core idea information, discussion of core idea information, graphics, practice, and feedback.

12. Color workbook plus lesson guide: Lesson guide plus workbook as in 11 above, but with color graphics.

13. Workbook plus slides plus lesson guide: See 5 and 11 above.

14. Workbook plus audio plus lesson guide: See 11 above, plus audio tape recording that may be reviewed by individual student with tape player or presented to a group as in 21, 26 and 30 below.

15. Programmed text plus lesson guide: Lesson guide plus a printed text containing a sequence of small frames of information and requiring a simple written response from the student.

16. Training manual plus lesson guide: Lesson guide plus off-the-shelf technical publication such as F-16 Dash One, operator guide or maintenance manual.

17. Model/Actual equipment plus lesson guide: Lesson guide plus scale model or actual item of operational equipment used for training purposes.

18. CFT plus lesson guide: Lesson guide plus F-16 3-dimensional life-size cockpit mockup with screen for tape/slides located where head-up display would go.

19. CFT plus tape/slide plus lesson guide: See 9 and 18.

20. Lecture plus lesson guide: Lesson guide plus formal, stand-up podium expository presentation to a large class (10 or more).

21. Lecture plus audio and lesson guide: See 14 and 20.

22. Lecture plus visual motion plus lesson guide: See 20, plus 2 (videotape) or 6 (motion picture).

23. Lecture plus model/actual equipment plus lesson guide: See 17 and 20.

24. Lecture plus student response system plus lesson guide: See 20, plus desk-mounted responders that allow all students to respond to instructor questions simultaneously and consequently guide lecture delivery based on real-time student comprehension.

25. Tutorial plus lesson guide: Lesson guide plus one-on-one student-instructor interaction loosely structured around a flexible format of objectives.

26. Tutorial plus audio plus lesson guide: See 21 and 25.

27. Tutorial and visual motion plus lesson guide: See 22 and 25.

28. Tutorial plus model/actual equipment plus lesson guide: See 23 and 25 above.

29. Seminar plus lesson guide: Lesson guide plus informal discussion loosely structured around a firm format of objectives for a small class (2 to 9 students).

30. Seminar plus audio plus lesson guide: See 21 and 29.

31. Seminar plus visual motion and lesson guide: See 22 and 29.

32. Seminar plus model/actual equipment plus lesson guide: See 23 and 29.

SIMULATION MEDIA POOL

1. Panel mockup

2. Cockpit mockup

3. Stick and throttle trainer

4. Stores management system (SMS) trainer

5. Avionics display

6. 2-dimensional isolated system device

7. Radar warning receiver (RWR) trainer

8. Interactive CFT

9. CFT

10. EPT

11. Dynamic system simulator (DSS)

12. Simulation air-to-air combat trainer (SAAC)

13. OFT

14. OFT and night visual system (NVS) trainer

15. OFT and Digital Radar Land Mass System (DRLMS)

16. OFT and electronic warfare trainer

17. Weapons System Trainer (WST)

18. F-16A aircraft

19. F-16B aircraft

20. Advanced Simulator for Pilot Training (ASPT)

4.1 Instructional Features

The instructional features of a training medium are defined by its ability to successfully deliver effective instructional strategies. The seven basic or general instructional strategies are: Remember a fact, remember a procedure, use a procedure, remember a rule, use a rule, remember a concept, and use a concept. Section 4.0 breaks down each starategy into its component elements, while Tables 4.1-1 and 4.1-2 rate the academic and simulation media on their ability to present each of those component elements.

4.1.1 Remember/Facts

This strategy requires the student to recall or recognize an arbitrary or historically determined relationship between objects, symbols, or events. Ideally the media will present:

Table 4.1-1--Instructional features of academic media

ACADEMIC MEDIA

5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	1
5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	2
5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	3
5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	4
5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
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5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	15
5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	16
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INSTRUCTIONAL FEATURES	
USE/CONCEPT	1
REMEMBER/CONCEPT	2
USE/RULE	3
REMEMBER/RULE	4
USE/PROCEDURE	5
REMEMBER/PROCEDURE	6
REMEMBER/FACT	7

1	CAI + Lesson Guide
2	CAI + Videotape + LG
3	CAI + Videotape + Part Task Trainer + LG
4	Interactive Part Task Trainer + LG
5	Random Access Slide + LG
6	Motion Picture + LG
7	Videotape + LG
8	Videodisc + LG
9	Tape Slide + LG
10	Suitcase Projector + LG
11	Workbook + LG
12	Color Workbook + LG
13	Workbook + Slides + LG
14	Workbook + Audio + LG
15	Programmed Text + LG
16	Training Manuals + LG
17	Model/Actual Equipment + LG
18	CFT + LG
19	CFT + Tapeslide + LG
20	Lecture + LG
21	Lecture + Audio + LG
22	Lecture + Visual Motion + LG
23	Lecture + Model/Actual Equipment + LG
24	Lecture + Student Response System + LG
25	Tutorial + LG
26	Tutorial + Audio + LG
27	Tutorial + Visual Motion + LG
28	Tutorial + Model/Actual Equipment + LG
29	Seminar + LG
30	Seminar + Audio + LG
31	Seminar + Visual Motion + LG
32	Seminar + Model/Actual Equipment + LG

SIMULATION MEDIA

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	INSTRUCTIONAL FEATURES
	Panel Mockup	Cockpit Mockup	Stick & Throttle Trainer	SMS Trainer	Avionics Display	2-D Device	RWR Trainer	ICPT	CFT	EPT	DSS	ASPT	SAAC	OFT	OFT + NVS	OFT + DRLMS	OFT + EW	WST	F-16 A Aircraft	F-16 B Aircraft	
	1	1	-	-	-	-	-	-	1	-	-	-		-	-	-	-	-	1		REMEMBER/FACT
	1	1	-	-	-	-	-	-	1	-	-	-		-	-	-	-	-	1		REMEMBER/PROCEDURE
	3	3	3	3	3		3	3	3	3	4	4		4	4	4	4	5	4		USE/PROCEDURE
	1	1	-	-	-	-	-	-	1	-	-	-		-	-	-	-	-	1		REMEMBER/RULE
	3	3	3	3	3		3	3	3	3	3	3		3	3	3	3	3	3		USE/RULE
	1	1	1	1	1		1	1	1	1	-	-		-	-	-	-	5	1		REMEMBER/CONCEPT
	2	2	2	2	2		2	2	2	2	5	5		5	5	5	5	4	2		USE/CONCEPT

Table 4.1-2--Instructional features of simulation media

1. Expected learner outcome: Provides the student with an informal objective telling him what he should be able to do.

2. Fact statement: Provides a statement of the information the learners are required to remember.

3. Remember help: Provides the student with an easy way to remember the fact.

4. Special learning activities: Provides the student practice in remembering the essential information (this is an optional component and should only be included when it will help the learners achieve the objective).

5. Practice section: Provides the student with an opportunity to find out if he can remember the essential information.

6. Feedback: Provides the student with the correct answers for the practice items.

4.1.2 Remember/Procedure

This strategy requires the student to recall or recognize a set of sequential steps designed to accomplish a specific task which needs to be demonstrated in only one way. The media should present the following information:

1. Expected learner outcome: Provides the student with an informal objective telling him what he should be able to do.

2. Procedure statement: Provides a statement of the essential information--the steps in the procedure.

3. Remember help: Provides the student with an easy way to remember the procedure.

4. Special learning activities: Provides the student practice in remembering the essential information. (This is an optional component and should only be included when it will help the learner achieve the response.)

5. Practice section: Provides the student with an opportunity to find out if he can remember the essential information.

6. Feedback: Provides the student with the correct answers for the practice items.

4.1.3 Use/Procedure

This strategy requires the learner to apply a set of sequential steps designed to accomplish a specific task which needs to be demonstrated in only one way. The media should present:

1. Expected learner outcome: Provides the student with an informal objective, telling him exactly what he should be able to do.

2. Procedure statement: Provides the student with the essential informaion needed to meet the objective.

3. Procedure help: Provides the student with a method to make the procedure easier to understand and helps the student avoid common errors in performance.

4. Demonstration: Provides a step-by-step demonstration of the procedure.

5. Demonstration help: Provides clarification of difficult portions of the demonstration.

6. Practice section: Provides the learner the opportunity to find out how well he can perform the procedure.

7. Evaluation section: Provides information on how to conduct and score practice. (Generally, this section is provided for the instructor and may not be included in the media presentation. However, in cases where the student self scores his practice, it may be a necessary component.)

4.1.4 Remember/Rule

This strategy requires the learner to recall or recognize a set of sequential steps, designed to solve any of a class of problems. The following information should be presented:

1. Expected learner outcome: Provides the student with an informal objective, telling him what he should be able to do.

2. Rule statement: Provides a statement of the essential information.

3. Remember help: Provides the student with an easy way to remember the rule.

4. Special learning activities: Provides the student practice in remembering the essential information (This is an optional component and should only be included when it will help the learner achieve the response).

5. Practice section: Provides the student with an opportunity to find out if he can remember the essential information.

6. Feedback: Provides the student with the correct answers for the practice items.

4.1.5 Use/Rule

This strategy requires the learner to apply a set of sequential steps to solve any of a class of problems. The presentation should include:

1. Expected learner outcome: Provides the student with an informal objective, telling him what he should be able to do.

2. Rule statement: Provides a statement of the essential information the student needs in order to meet the objective. In the case of a mathematical rule, this is a statement of the formula to be used.

3. Rule help: Provides the student with information which will make the rule easier to understand and help him to avoid common errors in application.

4. Example section: Provides a variety of problems which show application of the rule.

5. Example help: Provides clarification of the examples.

6. Practice section: Provides the student the opportunity to find out how well he can apply the rule in a number of situations.

7. Feedback: Provides the correct answers for the practice items.

4.1.6 Remember/Concept

This strategy requires the student to recall or recognize characteristics common to a group of elements or members. The mediated presentation should include:

1. Expected learner outcome: Provides the student with an informal objective telling him what he should be able to do.

2. Concept statement: Provides a statement of the information the learner is required to remember--the critical attributes of the concept.

3. Remember help: Provides the student with an easy way to remember the concept characteristics (critical attributes).

4. Special learning activities: Provides the student practice in remembering the essential information. (This is an optional component and should only be included when it will help the learner achieve the response.)

5. Practice section: Provides the student with an opportunity to find out if he can remember the essential information.

6. Feedback: Provides the student with the correct answers for the practice items.

4.1.7 Use/Concept

This strategy requires the student to analyze common characteristics in order to classify or indentify a group of elements or class members. The presentation should include:

1. Expected learner outcome: Provides the student with an informal objective telling him what he should be able to do.

2. Concept statement: Provides a statement of the information needed to meet the objective--the critical attributes of the concept.

3. Definition help: Provides the student with information to make the definition easier to understand while helping the student avoid common errors in classification.

4. Example--nonexample section: Provides the student with a wide variety of examples (of the concept) matched to nonexamples, which appear superficially similar to the elements of the concept, but are not.

5. *Example--nonexample helps:* Provide clarification of the example--nonexamples.

6. Practice section: Provides student with the opportunity to find out how well he can classify members and nonmembers of the concept class in a number of situations.

7. Feedback: Provides the correct answers for the practice items.

4.1.8 Collected Data

Tables 4.1-1 and 4.1-2 present the collected data. The numbers indicate the following interpretations:

5--All the elements of the strategy are presented in a highly effective manner.

4--Most of the elements of the stategy are presented in a very effective manner.

3--At least half of the elements of the strategy are presented in an effective manner.

2--Some of the elements of the strategy are presented in a reasonably effective manner.

1--A few of the elements of the strategy are presented and in a less than effective manner.

4.2 Training Capability

The training capability of an instructional medium is defined by its ability to perform specific training functions, such as displaying stimulus materials, responding to student input, evaluating student responses, and providing feedback to students. Section 4.2 analyses and describes these basic functions, while Tables 4.2-1 and 4.2-2 rate academic and simulation media on their ability to perform these functions.

4.2.1 Academic Media

For each medium an estimation was made of its ability to perform given training functions. These functions include the following for academic media:

4.2.1.1 Display Characteristics: Those features which are an integral part of the media output.

1. Audio-voice: An output of human speech.

2. Audio: An output of nonhuman audible signals (e.g., music, tones, sirens, or buzzers).

3. Tactile: A display which feels the same to the touch as real world equipment (e.g., a knob on the display of a cockpit training panel feels the same to the touch as the same knob on the actual equipment).

4. Kinesthetic: Equipment on the display responds the same way to the touch as real world equipment (e.g., a switch on the display responds exactly like the switch on the aircraft).

5. Visual: The following display characteristics are concerned with the visual display seen by the student.

   a. Text: The display includes printed material.

   b. Pictorial: The display includes photographs.

   c. Diagrams/Drawings: The display includes line art or full art drawings.

   d. Spatial Layout: The display has the exact same dimensions/proportions as the real equipment it depicts.

   e. Motion: The display includes movement.

   f. Color: The display includes color.

ACADEMIC MEDIA

1	CAI + Lesson Guide
2	CAI + Videotape + LG
3	CAI + Videotape + Part Task Trainer + LG
4	Interactive Part Task Trainer + LG
5	Random Access Slide + LG
6	Motion Picture + LG
7	Videotape + LG
8	Videodisc + LG
9	Tape Slide + LG
10	Suitcase Projector + LG
11	Workbook + LG
12	Color Workbook + LG
13	Workbook + Slides + LG
14	Workbook + Audio + LG
15	Programmed Text + LG
16	Training Manuals + LG
17	Model/Actual Equipment + LG
18	CFT + LG
19	CFT + Tapeslide + LG
20	Lecture + LG
21	Lecture + Audio + LG
22	Lecture + Visual Motion + LG
23	Lecture + Model/Actual Equipment + LG
24	Lecture + Student Response System + LG
25	Tutorial + LG
26	Tutorial + Audio + LG
27	Tutorial + Visual Motion + LG
28	Tutorial + Model/Actual Equipment + LG
29	Seminar + LG
30	Seminar + Audio + LG
31	Seminar + Visual Motion + LG
32	Seminar + Model/Actual Equipment + LG

TRAINING CAPABILITIES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
DISPLAY																																
AUDIO-VOICE	2	3	3			3	3	3	3	3				3					3	4	4	4	4	4	4	4	4	4	4	4	4
AUDIO	5	5	5			3	4	5	5	5				5					5		5	4				5	4			5	4	
TACTILE			5														5	5	5			3					5				4
KINESTHETIC			5														5	5	5			3					5				4
VISUAL																																
TEXT		5	5	4	4	2	2	4	4	4	5	5	5	5	5	5	2	2	4	4	4	4	4	4	4	4	4	4	4	4	4	4
PICTORIAL	3	3	3	5	5	2	2	5	5	1	4	4	5	4	4	4	1	1	5	5	5	5	5	5	5	5	5	5	5	5	5	5
DIAGRAMS/DRAWINGS	3	3	3	5	5	2	2	5	5	1	4	4	5	4	4	4	1	1	5	5	5	5	5	5	5	5	5	5	5	5	5	5
SPATIAL LAYOUT																	5	5	5				3					5				4
MOTION	1	5	5			5	5	5		2												5				5					5	
COLOR	5	5	5	4	5	5	5	5	5	5		5	5				4	4	4	5	5	5	5	5	5	5	5	5	5	5	5	5
RESPONSE																																
VERBAL/WRITTEN	5	5	5	1	3	1	1	2	1	1	4	4	4	4	4	1	1	1	1	2	2	2	2	3	5	5	5	5	4	4	4	4
P-T-M	4	4	5	5	1	1	1	1	1	1	2	2	2	2	2	1	5	5	5	1	1	2	3	2	3	1	4	5	2	1	3	4
MANIPULATE			5	5													5	5	5				3					5				4
COVERT																																
EVALUATION																																
INSTRUCTOR																				3	3	3	3	4	5	5	5	5	4	4	4	4
AUTOMATED	5	5	5	5				3		2														2								
PEER																																
STU.SELF SCORED W/KEY	4	4	4	4	3	3	3	3	3	3	4	4	4	4	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
FEEDBACK																																
FREQUENCY																																
IMMED/RESPONSE	5	5	5	5	4	1	1	4	1	1	2	2	2	2	4	1	1	1	1	1	1	1	1	5	5	5	5	5	1	1	1	1
IMMED/ERROR	5	5	5	5	5			3		3					3									1	5	5	5	5				
PERIODIC	5	5	5	5	4	1	1	4	4	4	4	4	4	4	4	3	2	2	2	5	5	5	5	5	5	5	5	5	5	5	5	5
POST-SESSION	5	5	5	5	4	1	1	4	4	4	4	4	4	4	4	3	2	2	2	5	5	5	5	5	5	5	5	5	5	5	5	5
CONTENT																																
CORRECT ANSWER	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
RT/WRONG ELABORATED	5	5	5	5	4	1	1	4	1	1	1	1	1	1	4					2	2	2	2	4	5	5	5	5	3	3	3	3
BRANCH TO NEW DISPLAY	5	5	5	5	4			4		3					3					1	1	1	1	3	5	5	5	5	2	2	2	2
SPECIAL REQS.																																
CREW/TEAM INT.																																
ENVIRONMENT																																

Table 4.2-1--Training capability of academic media

SIMULATION MEDIA

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	TRAINING CAPABILITIES
Panel Mockup	Cockpit Mockup	Stick & Throttle Trainer	SMS Trainer	Avionics Display	2-D Device	RWR Trainer	ICPT	CFT	EPT	DSS	ASPT	SAAC	OFT	OFT + NVS	OFT + DRLMS	OFT + EW	WST	F-16 A Aircraft	F-16 B Aircraft	
																				PHYSICAL LAYOUT CHARACTERISTICS
5	5	5	3	5		5	5	5	5	4	5		5	5	5	5	5	5	5	CONFORMITY WITH SHAPE
	2						5	5	5	2	5		5	5	5	5	5	5	5	BETWEEN-PANEL SPATIAL RELATIONS
5	5	5	4	4	3	5	5	5	5	3	5		5	5	5	5	5	5	5	WITHIN-PANEL SPATIAL RELATIONS
																				STIMULUS PROPERTIES-INTERIOR
3	3	5	4	4	2	5	4	3	5	3	4		5	5	5	5	5	5	5	FIDELITY OF VISUAL STIMULUS
					1	5	1		4		2		4	4	4	4	4	5	5	FIDELITY OF AUD (NON VOICE) STIM
									2				3	3	3	3	4	5	5	FIDELITY OF KINESTHETIC STIMULUS
2	2	2	2	2	2	2	2	2	2	2	4		4	4	4	4	4	3	3	VOICE STIMULUS CAPABILITY
																				STIMULUS PROPERTIES - EXTERIOR
										1	3			1			4	5	5	FIELD OF VIEW
										1	3			1			4	5	5	PROPORTION OF DISTANT ORJ
										1	3			1			4	5	5	COLORATION & SHADING ORJ
										1	3			1			4	5	5	VISUAL SENSATION-MOTION
										1	3			1			4	5	5	SHAPE OF OBJECTS
										1	3			1			4	5	5	RESOLUTION-DETAIL GIVEN DISTANCE
																				MANIPULATIVE PROPERTIES
2	2	4	4	2		4	4	4	4	3	4		5	5	5	5	5	5	5	FIDELITY OF MANIPULATION
		3	4	3	1	4	3		3	4	4		4	4	4	4	5	5	5	TIMELY MANIP-RESP CONNECTION
																				RESPONSE PROPERTIES
		2	4	3	1	4	1		2	3	4		5	5	5	5	5	5	5	FIDELITY OF INTERIOR RESPONSE
									1	2	3			2			4	5	5	FIDELITY OF EXTERIOR RESPONSE
																				INSTRUCTIONAL FEATURES
5	5	5	5	5	5	5	5	5	4	5	3		4	4	4	4	4	2	3	INSTRUCTOR VIEW OF STUD. DISPLAYS
1	1	1	1	1	1	3	3	1	3	3	4		5	5	5	5	5			STOP ACTION CAPABILITY
					3	5	3						3	3	3	3	4			CANNED DEMO CAPABILITY
2	2	2	4	5	2	5	2	2	2	3	1		1	1	1	1	1	1	5	LIVE DEMO CAPABILITY
2	2	2	2	2	2	2	2	2	3	2	5		5	5	5	5	5	1	1	CONDITIONS RESET CAPABILITY
																				EVALUATION FEATURES
		4	4	1	5		5		1	1	1		1	1	1	1	1	1	1	R/W FEEDBACK
					2		2		1		4		4	4	4	4	4			OUT OF TOLERANCE FEEDBACK
5	5	5	5	5	5	5	5	5	5	5	3		4	4	4	4	4	2	4	INSTRUCTOR FEEDBACK
					2		2						5	5	5	5	5			REPLAY OF STUDENT PERFORMANCE
																				OPPONENT
										1			2	2	1		5	4	4	MANEUVER OPPONENT

Table 4.2-2--Training capability of simulation media

4.2.1.2 Response: The type of student input accepted by the medium.

1. Verbal/written: The student response may be either orally given or handwritten.

2. PTM--The student may respond by pointing (P), touching (T), or marking (M) an item.

3. Manipulate: The student may respond by operating or controlling a device or piece of equipment.

4. Covert: The student's response is undetectable (i.e., he conceives the answer but does not make an observable response). (NOTE: This category of response has proved to be generally impractical, in that there is no method of detecting whether the student's answer is correct or incorrect. Therefore, it has not been used in developing the F-16 training system.)

4.2.1.3 Evaluation: The method of delivering a response to the student on the correctness or incorrectness of his answer.

1. Instructor: A response to the student's answer is given by the instructor.

2. Automated: The response to the student's answer is generated by the medium.

3. Peer: The response to the student's answer is given by a fellow student. (NOTE: This is not generally used).

4.2.1.4 Feedback: The type of response the student receives after answering a test or practice item.

1. Frequency: How often feedback is presented to the student.

   a. Immediate/Response: The student receives feedback immediately after answering a test/practice item.

   b. Immediate/Error: The student receives feedback immediately after answering a test/practice item incorrectly.

   c. Periodic: The student receives feedback after answering a predetermined number of test/practice items.

   d. Post-Session: The student receives feedback after a complete training session.

2. Content: The information provided to the student during feedback.

a. Correct answer: The student is given the right answer after responding to a question incorrectly.

b. Right/Wrong elaborated: The student is given information as to why he answered a question correctly or incorrectly.

c. Branch to new display: The student receives new information based on the correctness or uncorrectness of his answers (e.g., If the student answers correctly the display may branch to a new lesson. If the student answers incorrectly the display may branch to additional practice items or a "HELP" segment).

4.2.1.5 Special Requirements: Unusual needs required by a specific lesson which must be performed by the selected medium.

1. Crew/Team interaction: The need for the medium to allow interaction required between crew members and the flight team.

2. Environment: The need for the medium to present extraordinary conditions which the student needs to respond to (e.g., taking off during unfavorable weather).

3. Motion: The need for the medium to present normal and abnormal movement which require a specific response from the student (e.g., the student may need to make certain responses while an aircraft is banking).

4. Time Variability: The need for the medium to present information in fast or slow motion.

5. Learner control: The need for the student to regulate his own learning by controlling content, sequence, and rate.

Table 4.2-1 presents the collected data for academic media. The numbers indicate the following interpretations:

5--IDEAL: This is the best medium for the objective. Ifs efficiency, effectiveness, and flexibility are outstanding. The scope is adequate for the full range of possible instructional instances and there is a likelihood of positive affect.

4--DESIRABLE: This is a good medium for the objective. It is efficient, effective, and flexible. A broad range of possible instructional instances are available, and there is potential for positive affect.

3--GOOD: This medium will teach the objective adequately. It is reasonably effective, efficient, and flexible. It will provide the most commonly required instructional instance.

2--ADEQUATE: This medium is acceptable, but weak. The scope and flexibility are limited and both effectiveness and efficiency are poor. There may be a strong dependence on secondary media.

1--POOR: This medium should be used as a last resort. Effectiveness, efficiency, scope, and flexibility are poor. There may be almost complete reliance on secondary media and there is a potential for negative affect.

No rating--this medium cannot perform the required training function.

4.2.2 Simulation Media

For each medium an estimation was made of its degree of fidelity and ability to perform given training functions. These estimates of fidelity and training functions include the following:

4.2.2.1 Physical Layout Characteristics: The three categories within this class define the degree of realism with which the cockpit or other training environment is laid out.

1. Conformity with shape: A high rating on this characteristic indicates a training device in which the actual flight equipment is simulated; e.g., round dial with a needle is shown as a round dial and not a digital readout.

2. Between-panel spatial relations: A high rating on this characteristic indicates a training device where the absolute distance between major panels and subpanels is a close approximation of the real equipment.

3. Within-panel spatial relations: A high rating on this characteristic indicates a training device in which the absolute distance between items on an individual panel is a close approximation of the real equipment.

4.2.2.2. Stimulus Properties--Interior: These characteristics define the fidelity with which the control indicators and displays located within the cockpit present information to the student.

1. Fidelity of visual stimulus: This characteristic defines the fidelity of indicators and displays which present information by visual means.

2. Fidelity of audio (nonvoice) stimulus: This characteristic defines the fidelity with which the trainer presents nonvoice audio stimuli such as the AIM-9 Missile Aural Ton

3. Fidelity of kinesthetic stimulus: This characteristic defines the degree to which the "feel" of operating the

trainer's interior controls correspond to the "feel" of operating the controls of the actual equipment.

4. Voice stimulus capability: The presence of this characteristic indicates the student can receive spoken communication from the instructor.

4.2.2.3. Stimulus Properties--Exterior: This class defines the fidelity with which the environment external to the actual aircraft is replicated in the training device.

1. Field of view: A high rating on this characteristic indicates a field of view which is large enough to approximate the field of view of the student in the actual equipment.

2. Proportion of distant objects: A high rating on this characteristic indicates a visual system with enough resolution so that objects at a great apparent distance appear to be in their true proportions and are of the correct apparent size.

3. Coloration and shading of objects: A high rating on this characteristic indicates realistic color and shading so that apparent depth is enhanced.

4. Visual sensation--motion: A high rating on this characteristic indicates a fully dynamic display in which apparent motion is of high fidelity. A lower rating on this would indicate either stop action motion or still visuals.

5. Shape of objects: A high rating on this characteristic indicates no matter what the apparent aspect angle of the visual display, the object display will be of the correct proportion.

6. Resolution--detail given distance: A high rating on this characteristic indicates that the relationship between the amount of detail with which an object is displayed and the apparent distance the student is from that object approximates the amount of detail that would be visible from the actual equipment in that same situation.

4.2.2.4 Manipulative Properties: The manipulative properties of a training device define the ways and the fidelity with which a student can interact with the controls of the trainer.

1. Fidelity of manipulation: A high rating on this characteristic indicates trainer control switches that closely approximate the controls of the actual equipment such that they are manipulated in the same manner.

2. Timely manipulation--responds connection: A high rating on this characteristic indicates that the training device responds to student with a time lag which closely approximates the time lag present in actual equipment.

4.2.2.5 Response Properties: This class defines the realism with which the training device responds to student actions.

1. Fidelity of interior response: This characteristic defines the fidelity with which the training device responds to student actions. It differs from class two, above in that it refers to changes in the interior state of the training device which are student-generated as opposed to device-generated.

2. Fidelity of exterior response: This characteristic referes to the fidelity with which changes in the external environment based on student actions are represented.

4.2.2.6 Instructional Features: The list of characteristics which comprise this class is not an exhaustive one, rather, it is a catalog of special instructional features which required significant hardware engineering, but which are necessary for instruction in a reasonable large subset of in-flight tests.

1. Stop action capability: The presence of this characteristic gives the instructor the ability to halt the flow of real time at any point in the training device session, so that the student may study the displays and situation at that critical instant.

2. Canned demo capability: The presence of this characteristic means that the training device possesses the capability of presenting stored scenarios. The higher the rating on this characteristic, the greater the degree of self-stimulation of displays and controls that is possessed by the training device.

3. Live demo capability: The presence of this characteristic indicates that the training device is capabile of being manipulated externally by the instructors such that the student can see the sequence of events and actions in any scenario that the instructor can imagine. A high rating on this characteristic can be likened to the training possibilities that exist in a dual-control aircraft.

4. Conditions reset capability: The presence of this characteristic indicates that the training device has the capacity to store a particular set of parameters, such that upon the command of the instructor, the state of all displays and controls can be returned to that stored state. High ratings on this characteristic indicate either larger numbers of initial conditions which may be stored and/or larger numbers of parameters which are stored within any one set of conditions.

4.2.2.7 Evaluation Features: This class is similar to the preceding one in that the list of characteristics does not exhaust the class, but consists of characteristics whose presence is often desired/required, due to the increase in training efficiency engendered by providing immediate and sufficient feedback to the student, and/or by providing the performance evaluation capabilities which would be lacking without this characteristic.

1. Instructor view of student displays: Ratings on this characteristic define the extent with which the displays available to the student are duplicated for the benefit of the instructor to use in monitoring student performance.

2. Right/Wrong feedback: The presence of this characteristic indicates that the training device has a capability of automatically monitoring student performance and indicating to the student whether that performance is acceptable or unacceptable. No elaboration is provided, merely indication of correct or incorrect behavior.

3. Out of tolerance feedback: The presence of this characteristic indicates that the training device has the capability of automatically monitoring student performance and indicating to him when that performance does not meet with a preset standard. High ratings on this characteristics indicate the increased accuracy with which the training device can present the student with the degree to which he has failed to meet a given standard.

4. Instructor feedback: The presence of this capability indicates that the instructor is present with a student and can monitor his performance such that the human judgement factor is included in the feedback equation.

5. Replay of student performance: The presence of this characterisitc indicates that the training device has the capability of storing a record of the actions taken by the student such that on command it can "replay" those actions in terms of a real time duplication of displays and control movements so that the student may examine an exact record of his own performance.

4.2.2.8 Opponent: This class define the degree to which combat training is possible in a training device. It's characteristics is to define the type and capabilities of opponents which the student can meet in the training device.

1. Maneuvering opponent: The presence of this characteristic indicates that the training device is able to present the student with an opponent who will maneuver in response to the student's own control inputs. The higher the rating in this characteristic, the higher the fidelity with which the maneuvering opponent is simulated.

Table 4.2-2 presents the collected data for simulation media. The numbers indicate the following interpretations:

5--This medium performs the training function extremely well

4--This medium performs the training function very well

3--This medium performs the training function well

2--This medium performs the training function

1--This medium should be used as a last resort

No rating--This medium cannot perform the training function

4.3 Life Cycle Costs

The life cycle costs of a training medium include the hardware, software, and instructional costs of designing, procuring, maintaining, and updating the training medium or device. Section 4.3 describes the categories of costs required for system implementation, while Tables 4.3-1 and 4.3-2 rate both academic and simulation media on their relative costs within each category.

4.3.1 Hardware Costs

1. Design costs: The cost to design a particular piece of hardware. For most media this was not a consideration, since the hardware was designed by the manufacturer. It is a consideration on F-16 specific hardware, however, such as trainers.

2. Procurement costs: The cost of buying a piece of equipment.

3. Facility costs: The cost to house or store equipment. This cost includes special facility requirements, such as air conditioning and controlled humidity, as well as personnel needed to maintain the facility.

4. Update/Replacement costs: The cost to update or replace equipment because of new regulations, equipment updates, or needs.

5. Operating costs: The cost of operating the equipment, such as power requirements, and of operating and maintenance personnel.

4.3.2 Software Costs

1. Design/Testing costs: The initial cost of analyzing and designing the instructional material and testing the prototype materials. This includes manpower requirements as well as draft material and production costs.

ACADEMIC MEDIA

	Academic media	Hardware costs: Design costs	Hardware costs: Procurement costs	Hardware costs: Facility costs	Hardware costs: Update/Replacement costs	Operating costs	Software/Course costs: Design/Testing costs	Software/Course costs: Production costs	Software/Course costs: Revision/Update costs	Software/Course costs: Replacement costs	Software/Course costs: Facility costs	Instructional costs: Manpower costs	Instructional costs: Support materials
1	CAI + Lesson Guide		4	4	4	4	2	3	3	3	4	4	
2	CAI + Videotape + LG		4	4	4	4	2	3	3	3	4	4	
3	CAI + Videotape + Part Task Trainer + LG		4	4	4	4	2	3	3	3	4	4	
4	Interactive Part Task Trainer + LG	5	5	5	5	5	2	3	3	3	4	4	
5	Random Access Slide + LG		3	2	3	2	4	4	4	4	3	2	
6	Motion Picture + LG		3	3	3	2	5	5	5	5	5	3	
7	Videotape + LG		4	3	4	3	5	5	5	5	5	3	
8	Videodisc + LG		4	3	4	3	5	5	5	5	5	3	
9	Tape Slide + LG		3	2	3	2	3	4	4	4	3	2	
10	Suitcase Projector + LG		3	2	3	2	4	4	4	4	3	2	
11	Workbook + LG		1	1	1	1	2	2	2	2	2	2	
12	Color Workbook + LG		1	1	1	1	2	3	3	3	2	2	
13	Workbook + Slides + LG		3	2	3	2	3	3	1	4	3	2	
14	Workbook + Audio + LG		2	2	2	2	2	2	3	3	3	2	
15	Programmed Text + LG		1	1	1	1	2	2	2	2	2	1	
16	Training Manuals + LG		1	1	1	1	2	2	2	2	2	1	
17	Model/Actual Equipment + LG	5	5	5	5	5	2	2	2	2	2	5	
18	CPT + LG	5	5	5	5	5	2	2	2	2	2	5	
19	CPT + Tapeslide + LG	5	5	5	5	5	2	2	2	2	2	5	
20	Lecture + LG		1	1	1	1	1	1	1	1	1	5	5
21	Lecture + Audio + LG		2	2	2	2	2	2	2	2	2	5	5
22	Lecture + Visual Motion + LG		3	3	3	3	5	5	5	5	5	5	5
23	Lecture + Model/Actual Equipment + [illegible]	5	5	5	5	5	2	2	2	2	2	5	5
24	Lecture + Student Response System + [illegible]		4	4	4	4	3	3	2	2	2	5	5
25	Tutorial + LG		1	1	1	1	1	1	1	1	1	5	5
26	Tutorial + Audio + LG		2	2	2	2	2	2	2	2	2	5	5
27	Tutorial + Visual Motion + [illegible]		3	3	3	3	5	5	5	5	5	5	5
28	Tutorial + Model/Actual Equipment + [illegible]	5	5	5	5	5	2	2	2	2	2	5	5
29	Seminar + LG		1	1	1	1	1	1	1	1	1	5	5
30	Seminar + Audio + LG		2	2	2	2	2	2	2	2	2	5	5
31	Seminar + Visual Motion + [illegible]		3	3	3	3	5	5	5	5	5	5	5
32	Seminar + Model/Actual Equipment + [illegible]	5	5	5	5	5	2	2	2	2	2	5	5

Table 4.3-1--Life cycle costs of academic media

SIMULATION MEDIA

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	LIFE CYCLE COSTS
	Panel Mockup	Cockpit Mockup	Stick & Throttle Trainer	SMS Trainer	Avionics Display	2-D Device	RWR Trainer	ICPT	CFT	EPT	DSS	ASPT	SAAC	OFT	OFT + NVS	OFT + DRLMS	OFT + EW	WST	F-16 A Aircraft	F-16 B Aircraft	
																					HARDWARE COSTS
	1	1	2	2	2		2	2	2	3	3	3		3	3	3	3	4	5	5	DESIGN COSTS
	1	1	2	2	2		2	2	2	3	3	3		3	3	3	3	4	5	5	PROCUREMENT COSTS
	1	1	1	1	1		1	1	1	3	3	3		3	3	3	3	4	5	5	FACILITY COSTS
	1	1	2	2	2		2	2	2	3	3	3		3	3	3	3	4	5	5	UPDATE/REPLACEMENT COSTS
	1	1	2	2	2		2	2	2	3	3	3		3	3	3	3	4	5	5	OPERATING COSTS
																					SOFTWARE/COURSEWARE COSTS
			2	2	2		2	2	2	3	3	3		3	3	3	3	4	5	5	DESIGN/TESTING COSTS
			2	2	2		2	2	2	3	3	3		3	3	3	3	4	5	5	PRODUCTION COSTS
			2	2	2		2	2	2	3	3	3		3	3	3	3	4	5	5	REVISION/UPDATE COSTS
			2	2	2		2	2	2	3	3	3		3	3	3	3	4	5	5	REPLACEMENT COSTS
			2	2	2		2	2	2	3	3	3		3	3	3	3	4	5	5	FACILITY COSTS
																					INSTRUCTIONAL COSTS
1	1	2	2	2		2	2	2	3	3	3		3	3	3	3	5	3	3		MANPOWER COSTS
																					SUPPORT MATERIALS

Table 4.3-2--Life cycle costs of simulation media

2. Production costs: The cost to produce the final draft of the instructional materials. This includes manpower requirements as well as material costs.

3. Revision/Update costs: The cost to revise or update final draft material. This includes manpower requirements.

4. Replacement costs: The cost to replace worn or missing materials. The cost includes manpower requirements and material costs.

5. Facility costs: The cost to store instructional materials as well as personnel needed to maintain the facility.

4.3.3. Instructional Costs

1. Manpower costs: The cost for instructional personnel. For example, an instructor is needed to teach in a lecture mode, but is not needed if a student is using a programmed text.

2. Support material costs: The cost of such support materials as chalk, paper, pencils, and blackboards.

3. Tables 4.3-1 and 4.3-2 present the collected data. The numbers indicate the following:

5--The cost is high for this category relative to the other media in consideration.

4--The cost is higher than most media considerations but is noticably less than those media receiving a five.

3--The cost is average relative to the other media considerations.

2--The cost is less than most media considerations but is noticeably higher than those media receiving a one.

1--The cost is low for this category relative to the other media in consideration.

4.4 Hardware Characteristics

The hardware characteristics of an instructional medium are those physical features of the device which place requirements on supplies, services, or the physical plant. These include storage and handling requirements, operational requirements, and maintenance requirements. Section 4.4 lists the categories of requirements, while Tables 4.4-1 and 4.4-2 indicate the specific requirements of each training medium.

ACADEMIC MEDIA

1. CAI + Lesson Guide
2. CAI + Videotape + LG
3. CAI + Videotape + Part Task Trainer + LG
4. Interactive Part Task Trainer + LG
5. Random Access Slide + LG
6. Motion Picture + LG
7. Videotape + LG
8. Videodisc + LG
9. Tape Slide + LG
10. Suitcase Projector + LG
11. Workbook + LG
12. Color Workbook + LG
13. Workbook + Slides + LG
14. Workbook + Audio + LG
15. Programmed Text + LG
16. Training Manuals + LG
17. Model/Actual Equipment + LG
18. CFT + LG
19. CFT + Tapeslide + LG
20. Lecture + LG
21. Lecture + Audio + LG
22. Lecture + Visual Motion + LG
23. Lecture + Model/Actual Equipment + LG
24. Lecture + Student Respons[illegible] + LG
25. Tutorial + LG
26. Tutorial + Audio + LG
27. Tutorial + Visual Motion + LG
28. Tutorial + Model/Actual Equipment + LG
29. Seminar + LG
30. Seminar + Audio + LG
31. Seminar + Visual Motion + LG
32. Seminar + Model/Actual Equipment + LG

HARDWARE CHARACTERISTICS	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
STORAGE HARDWARE REQ.																																
LARGE STORAGE FACILITY	X	X	X	X													X	X	X				X	X				X				X
AIR CONDITIONING 1	X	X	X	X													X						X	X				X				X
CONTROLLED HUMID. 1	X	X	X	X													X						X	X				X				X
DELICATE HANDLING	X	X	X	X													X						X	X				X				X
LIMITED PORTABILITY	X	X	X	X													X	X	X				X	X				X				X
OPERATIONAL REQS.																																
AC POWER	X	X	X	X	X	X	X	X	X	X			X	X			X		X		X	X	X	X		X	X	X		X	X	X
DC POWER														X							X					X				X		
AIR CONDITION, OP. SP. 1	X	X	X	X													X					X		X				X				X
CONTROLLED HUMID, SP. 1	X	X	X	X			X	X									X					X		X				X				X
SPECIAL LIGHTING 2						X			X					X	X							X					X				X	
SPECIAL AUDIO EQUIP. HOOK UPS	X	X	X	X	X	X	X	X	X	X				X			X	X	X	X	X	X	X	X		X				X		
SPEC. VIEW. FACS. 2		X	X		X	X	X	X	X	X			X						X			X					X			X		
110 V POWER	X	X	X	X	X	X	X	X	X	X			X	X			X		X		X	X	X	X		X	X	X		X	X	X
220 V POWER 1	X	X	X	X													X						X	X				X				X
SPECIAL ELEC. WIRING	X	X	X	X													X						X	X				X				X
SPEC. SEATING ARRANGE.					X	X	X	X	X				X									X		X			X			X		
SPEC. ADAPT. FOR USE ADD. EQ.		X	X	X	X				X																							
PORTABLE					X	X	X	X	X	X	X	X	X	X	X	X				X	X	X			X	X	X		X	X	X	
FIXED	X	X	X	X													X	X	X				X	X				X				X
NOISY	X	X	X	X													X						X	X				X				X
SPECIAL VENTING NEEDS	X	X	X	X	X	X	X	X	X	X			X	X			X				X	X	X	X		X	X	X		X	X	X
USABLE BY MORE THAN ONE PERSON	X	X	X	X	X	X	X	X	X											X	X	X	X	X	X	X	X	X	X	X	X	X
STUDENT FAM W. EQUIP. OP.	X	X	X	X	X	X	X	X	X	X			X	X			X							X								
MAINTENANCE REQS.																																
PREVENTATIVE MAINT.	X	X	X		X	X	X	X	X	X			X	X			X				X	X	X			X	X	X		X	X	X
REPLACEMENT MAINT. REQ.	X	X	X	X	X	X	X	X	X	X			X	X			X				X	X	X			X	X	X		X	X	X
SPECIAL MAINT. TOOLS	X	X	X	X													X						X	X				X				X
SPECIALIZED MAINT PERSONNEL	X	X	X	X			X	X									X						X	X				X				X

(Continued)

1. May/may not be needed depending upon type of system and manufacturer's specs
2. May not be necessary if used in connection with a study carrel.

Table 1.1.1 Hardware characteristics of academic media

ACADEMIC MEDIA

No.	Academic Media	MANUFACTURER MAINT. PERSONNEL
1	CAI + Lesson Guide	X
2	CAI + Videotape + LG	X
3	CAI + Videotape + Part Task Trainer + LG	X
4	Interactive Part Task Trainer + LG	X
5	Random Access Slide + LG	
6	Motion Picture + LG	
7	Videotape + LG	
8	Videodisc + LG	
9	Tape Slide + LG	
10	Suitcase Projector + LG	
11	Workbook + LG	
12	Color Workbook + LG	
13	Workbook + Slides + LG	
14	Workbook + Audio + LG	
15	Programmed Text + LG	
16	Training Manuals + LG	
17	Model/Actual Equipment + LG	X
18	CFT + LG	
19	CFT + Tapeslide + LG	
20	Lecture + LG	
21	Lecture + Audio + LG	
22	Lecture + Visual Motion + LG	X
23	Lecture + Model/Actual Equipment + LG	X
24	Lecture + Student Response System + LG	
25	Tutorial + LG	
26	Tutorial + Audio + LG	
27	Tutorial + Visual Motion + LG	
28	Tutorial + Model/Actual Equipment + LG	X
29	Seminar + LG	
30	Seminar + Audio + LG	
31	Seminar + Visual Motion + LG	X
32	Seminar + Model/Actual Equipment + LG	X

(continued from Pg. 29)

Table 4.1.1--Hardware characteristics of academic media

SIMULATION MEDIA

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	STORAGE/HANDLING REQUIREMENTS
Panel Mockup	Cockpit Mockup	Stick & Throttle Trainer	SMS Trainer	Avionics Display	2-D Device	RWR Trainer	ICPT	CFT	EPT	DSS	ASPT	SAAC	OFT	OFT + NVS	OFT + DRLMS	OFT + EW	WST	F-16 A Aircraft	F-16 B Aircraft	
																				LARGE STORAGE FACILITY
							X		X	X	X		X	X	X	X	X			AIR CONDITIONING
							X		X	X	X		X	X	X	X	X			CONTROLLED HUMIDITY
																				DELICATE HANDLING
							X	X	X	X	X		X	X	X	X	X			LIMITED PORTABILITY
																				OPERATIONAL REQUIREMENTS
		X	X	X		X	X	X	X	X	X		X	X	X	X	X	X	X	AC POWER
																				DC POWER
							X		X	X	X		X	X	X	X	X			AIR CONDITIONED OPERATING SPACE
							X		X	X	X		X	X	X	X	X			CONTROLLED HUMIDITY SPACE
																				SPECIAL LIGHTING
								X	X	X	X		X	X	X	X	X			AUDIO EQUIPMENT/HOOK UPS
																				SPECIAL VIEWING FACILITIES
		X	X	X		X	X	X	X	X	X		X	X	X	X	X			110 V POWER
		X	X	X		X	X	X	X	X	X		X	X	X	X	X			220 V POWER
							X		X	X	X		X	X	X	X	X			SPECIAL WIRING
																				SPECIAL SEATING ARRANGEMENTS
																				SPECIAL ADAPTATION FOR USE & EQUIP. ADD-ON
X	X	X	X	X		X	X	X												PORTABLE
									X	X	X		X	X	X	X	X			FIXED
									X	X	X		X	X	X	X	X	X	X	NOISY
									X	X	X		X	X	X	X	X			SPECIAL VENTING NEEDS
											X						X		X	USEABLE BY 2 OR MORE
																				STUDENT FAM WITH EQUIPMENT OPER
																				MAINTENANCE REQUIREMENTS
		X	X	X		X	X	X	X	X	X		X	X	X	X	X	X	X	PREVENTATIVE MAINTENANCE
									X	X	X		X	X	X	X	X	X	X	REPLACEMENT MAINTENANCE
									X	X	X		X	X	X	X	X	X	X	SPECIAL MAINT. TOOLS
		X	X	X		X	X		X	X	X		X	X	X	X	X	X	X	SPECIALIZED MAINT. PERSONNEL
									X	X	X		X	X	X	X	X	X	X	MANUFACTURER MAINT. PERSONNEL

Table 4.4.-2 -Hardware characteristics of simulation media

4.4.1 Storage/Handling Requirements

1. Large storage facility
2. Air conditioning
3. Controlled humidity
4. Delicate handling
5. Limited portability

4.4.2 Operational Requirements

1. AC power
2. DC power
3. Air conditioned operating space
4. Controlled humidity operating space
5. Special lighting
6. Special audio equipment/audio equipment hookups
7. Special viewing facilities
8. 110v power
9. 220v power
10. Special electrical wiring
11. Special seating arrangements
12. Special aaptation methods for use with additional equipment
13. Portable
14. Fixed
15. Noisy
16. Special venting needs
17. Useable by more than one person at a time
18. Student needs to be familiar with equipment operation

4.4.3 Maintenance Requirements

1. Preventative (regular) maintenence
2. Replacement (regular) of parts
3. Special maintenance tools/equipment
4. Specialized maintenance personnel
5. Manufacturer maintenance personnel

Tables 4.4-1 and 4.4-2 present the collected data. A check-mark indicates that the characteristics are generally required of the hardware used in conjunction with the selected media. Note that in some cases manufacturers specifications may or may not call for the requirement checked (e.g., air conditioned storage). It is imperative that operating manuals be checked for necessary requirements before operating the equipment.

4.5 Software Characteristics

The software characteristics of a training medium are those features of the instructional courseware which place demands on supplies, services, or the physical plant. These include storage and handling requirements, production requirements, and use requirements. Section 4.5 lists the categories of requirements, while Tables 4.5-1 and 4.5-2 indicate the specific requirements of each training medium.

4.5.1 Storage/Handling Requirements

1. Air conditioned storage facility
2. Controlled humidity storage facility
3. Special storage cases

4.5.2 Production Requirements

1. Folding
2. Receiving cases
3. Specified material/or production techniques due to government regulations or the nature of the software delivery system.
4. Printing
5. Photography

ACADEMIC MEDIA

1	CAI + Lesson Guide
2	CAI + Videotape + LG
3	CAI + Videotape + Part Task Trainer + LG
4	Interactive Part Task Trainer + LG
5	Random Access Slide + LG
6	Motion Picture + LG
7	Videotape + LG
8	Videodisc + LG
9	Tape Slide + LG
10	Suitcase Projector + LG
11	Workbook + LG
12	Color Workbook + LG
13	Workbook + Slides + LG
14	Workbook + Audio + LG
15	Programmed Text + LG
16	Training Manuals + LG
17	Model/Actual Equipment + LG
18	CFT + LG
19	CFT + Tapeslide + LG
20	Lecture + LG
21	Lecture + Audio + LG
22	Lecture + Visual Motion + LG
23	Lecture + Model/Actual Equipment + LG
24	Lecture + Student Response System + LG
25	Tutorial + LG
26	Tutorial + Audio + LG
27	Tutorial + Visual Motion + LG
28	Tutorial + Model/Actual Equipment + LG
29	Seminar + LG
30	Seminar + Audio + LG
31	Seminar + Visual Motion + LG
32	Seminar + Model/Actual Equipment + LG

SOFTWARE CHARACTERISTICS	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
STORAGE/HAND. REQS.																																
AIR COND. STOR. FAC.	X	X	X	X		X	X	X														X				X					X	
CONTROL. HUMID. STOR. FAC.	X	X	X	X		X	X	X														X				X					X	
SPECIAL STORAGE CASES	X	X	X	X	X	X	X	X	X	X			X	X					X		X	X				X	X			X	X	
PRODUCTION REQS.																																
BINDING											X	X	X	X	X	X																
VIEWING CASES		X	X		X	X	X	X	X	X			X	X					X		X	X				X	X			X	X	
SPEC. PRINT/PROD. TECH.									X	X			X						X													
PRINTING											X	X	X	X	X	X																
PHOTOGRAPHY					X				X	X			X						X													
STUDIO PROD. TECH/EQUIP		X	X			X	X	X														X				X					X	
SPEC. DEV. PERSONNEL	X	X	X	X		X	X	X														X				X					X	
SPEC. REVISION REQS.		X	X	X	X	X	X	X	X	X			X	X					X			X	X			X	X			X	X	
PHOTO/DEVELOPING EQUIP					X	X			X	X			X						X				X				X				X	
MASTER COPY	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X		X	X				X	X			X	X	
MULT. COPIES FOR USE											X	X	X	X	X	X	X															
EASY TO CHG/REVISE	X										X	X			X	X	X	X		X			X		X			X	X		X	
USE REQUIREMENTS																																
NEEDS HARDWARE FOR USE	X	X	X	X	X	X	X	X	X	X			X	X			X	X	X		X	X	X	X		X	X	X		X	X	X
USED IN STUDY CARREL	X	X	X		X	X	X	X	X	X			X	X																		
USED IN SPECIFIC AREA	X	X	X	X	X	X	X	X	X	X			X	X			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
NEED A MONITOR FOR USE	X	X	X	X	X	X	X	X	X	X			X	X			X	X	X					X								

Table 1.5-1--Software characteristics of academic media

SIMULATION MEDIA

1 Label Mockup	2 Cockpit Mockup	3 Stick & Throttle Trainer	4 SMS Trainer	5 Avionics Display	6 2-D Device	7 RSA Trainer	8 ICP	9 CFT	10 EPI	11 DSE	12 ACCT	13 SAAC	14 OFT	15 OFT + NWS	16 OFT + PRIMS	17 OFT + FS	18 WST	19 F-16 A Aircraft	20 F-16 B Aircraft	SOFTWARE CHARACTERISTICS
																				STORAGE/HANDLING REQUIREMENTS
							X		X	X	X		X	X	X	X	X			AIR CONDITIONED STORAGE FACILITY
							X		X	X	X		X	X	X	X	X			CONTROLLED HUMIDITY STORAGE FACILITY
																				SPECIAL STORAGE CASES
																				PRODUCTION REQUIREMENTS
																				BINDING
																				VIEWING CASES
																				SPECIAL PRODUCTION TECHNIQUES
																				PRINTING
								X												PHOTOGRAPHY
								X												STUDIO PRODUCTION
																				SPECIALIZED DEVELOPMENT
																				PERSONNEL
																				SPECIAL REVISION REQUIREMENTS
								X												PHOTOGRAPHY/DEVELOPING EQUIPMENT
								X												MASTER COPY
								X												MULTIPLE COPIES FOR USE
X	X							X												EASY TO CHANGE/REVISE
																				USE REQUIREMENTS
																				NEEDS HARDWARE FOR USE
																				USED IN STUDY CARREL
							X	X	X	X	X		X	X	X	X	X	X	X	USED IN SPECIFIC AREA
									X	X	X		X	X	X	X	X	X	X	NEED MONITOR FOR USE

Table 4.5-2--Software characteristics of simulation media

6. Studio production techniques/equipment

7. Specialized development personnel

8. Special revision requirements

9. Photography/Developing equipment

10. Master copy

11. Multiple copies for use

12. Easy to change/revise

4.5.3 Use Requirements

1. Needs hardware for use

2. Used in study carrels

3. Must be used in a specific area such as a Learning Center.

4. Needs a monitor when used (to repair/adjust equipment or answer possible questions)

Tables 4.5-1 an 4.5-2 present the collected data. A check-mark indicates that the requirement is generally associated with the software used in conjunction with the selected medium.

4.6 Manpower Requirements

The manpower requirements of a training medium are those personnel who must operate or maintain either the training device itself or its component courseware. These categories include instructors, learning center personnel, training device support personnel, and instructional materials maintenance personnel. Section 4.6 lists these requirements, while Tables 4.6-1 and 4.6-2 indicate the specific requirements of each training medium.

4.6.1 Instructors

1. Flight instructors

2. Academic instructors

3. Simulator instructors

4. Trainer instructors

5. Learning center instructors

ACADEMIC MEDIA

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
CAI + Lesson Guide																																
CAI + Videotape + LG																																
CAI + Videotape + Part Task Trainer + LG																																
Interactive Part Task Trainer + LG				X														X	X													
Random Access Slide + LG					X	X	X	X	X	X	X	X	X	X	X	X																
Motion Picture + LG					X	X	X	X	X	X	X	X	X	X	X	X																
Videotape + LG					X	X	X	X	X	X	X	X	X	X	X	X																
Videodisc + LG					X	X	X	X	X	X	X	X	X	X	X	X																
Tape Slide + LG					X	X	X	X	X	X	X	X	X	X	X	X																
Suitcase Projector + LG					X	X	X	X	X	X	X	X	X	X	X	X																
Workbook + LG					X	X	X	X	X	X	X	X	X	X	X	X																
Color Workbook + LG					X	X	X	X	X	X	X	X	X	X	X	X																
Workbook + Slides + LG					X	X	X	X	X	X	X	X	X	X	X	X																
Workbook + Audio + LG					X	X	X	X	X	X	X	X	X	X	X	X																
Programmed Text + LG					X	X	X	X	X	X	X	X	X	X	X	X																
Training Manuals + LG					X	X	X	X	X	X	X	X	X	X	X	X																
Model/Actual Equipment + LG																	X			X	X	X	X	X	X	X	X	X	X	X	X	X
CFT + LG																		X														
CFT + Tapeslide + LG																		X	X													
Lecture + LG																				X												
Lecture + Audio + LG																				X	X											
Lecture + Visual Motion + LG																				X	X	X										
Lecture + Model/Actual Equipment + LG																				X	X	X	X									
Lecture + Student Response System + LG																				X	X	X	X	X								
Tutorial + LG																									X							
Tutorial + Audio + LG																									X	X						
Tutorial + Visual Motion + LG																									X	X	X					
Tutorial + Model/Actual Equipment + LG																									X	X	X	X				
Seminar + LG																													X			
Seminar + Audio + LG																													X	X		
Seminar + Visual Motion + LG																															X	X
Seminar + Model/Actual Equipment + LG																															X	X
MANPOWER																																
REQUIREMENTS																																
INSTRUCTORS																																
FLIGHT																																
ACADEMIC																	X			X	X	X	X	X	X	X	X	X	X	X	X	X
SIMULATOR																																
TRAINER				X														X	X													
LEARNING CENTER	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X															
LEARNING CENTER																																
OPERATOR	X	X				X	X	X	X	X	X	X	X	X	X	X	X															
SUPERVISOR	X	X				X	X	X	X	X	X	X	X	X	X	X	X															
COMPUTER FACILITY																																
PROGRAMMER	X	X	X																													
OPERATOR	X	X	X																													
MANAGER	X	X	X																													
TRAINING DEVICE																																
OPERATOR																																
MANAGER				X														X	X													
MAINTENANCE				X														X	X													
LESSON UPDATE																																
DESIGNER	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
SME	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
MEDIA SPECIALIST		X	X		X	X	X	X	X	X	X	X	X	X	X	X	X			X		X	X			X	X	X	X	X	X	
PRODUCTION SPECIALIST		X	X		X	X	X	X	X	X	X	X	X	X	X	X	X			X		X	X			X	X	X	X	X	X	
COMPUTER PROGRAMMER	X	X	X																													

Table 4.6-1--Personnel requirements of academic media

SIMULATION MEDIA	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	MANPOWER REQUIREMENTS
	Panel Mockup	Cockpit Mockup	Stick & Throttle Trainer	SMS Trainer	Avionics Display	2-D Device	RWR Trainer	ICPT	CPT	EPT	DSS	ASPT	SAAC	OFT	OFT + NVS	OFT + DPLYS	OFT + EW	WST	F-16 A Aircraft	F-16 B Aircraft	INSTRUCTORS
																			X	X	FLIGHT
	X	X	X	X	X		X		X												ACADEMIC
											X	X		X	X	X	X	X			SIMULATOR
								X		X											TRAINER
																					LEARNING CENTER
																					LEARNING CENTER
																					OPERATOR
																					SUPERVISOR
																					COMPUTER FACILITY
																					PROGRAMMER
																					OPERATOR
																					MANAGER
									X	X	X		X	X	X	X	X				TRAINING DEVICE
							X	X	X	X	X		X	X	X	X	X				OPERATOR
							X	X	X	X	X		X	X	X	X	X				MANAGER
							X	X	X	X	X		X	X	X	X	X				MAINTENANCE
																					LESSON UPDATE
																					DESIGNER
																					SME
								X													MEDIA SPECIALIST
								X													PRODUCTION SPECIALIST
																					COMPUTER SPECIALIST

Table 4.6-2--Personnel requirements of media academic

4.6.2 Learning Center Personnel

1. Learning center operator
2. Learning center supervisor

4.6.3 Computer Support Personnel

1. Computer programmer
2. Computer operator
3. Computer manager

4.6.4 Training Device Support Personnel

1. Training device operator
2. Training device manager
3. Training device maintenance personnel

4.6.5 Instructional Materials Maintenance Personnel

1. Instructional designers
2. Subject matter experts
3. Media specialists
4. Production specialists

Tables 4.6-1 and 4.6-2 present the collected data. A checkmark indicates that the manpower requirement is generally associated with the selected medium.

4.7 Facilities Requirements

The facilities requirements of a training medium are those rooms or buildings required to house either the device itself, or the device and its support personnel. These facilities include the learning center, classrooms, training device facilities, the computer facility, and the production and reproduction facility. Section 4.7 lists these categories of facilities, while Tables 4.7-1 and 4.7-2 indicate the specific requirements of each training medium.

1. Learning center
2. Classrooms
3. Training device facility

ACADEMIC MEDIA

FACILITIES REQUIREMENTS	1 CAI + Lesson Guide	2 CAI + Videotape + LG	3 CAI + Videotape + Part Task Trainer + LG	4 Interactive Part Task Trainer + LG	5 Random Access Slide + LG	6 Motion Picture + LG	7 Videotape + LG	8 Videodisc + LG	9 Tape Slide + LG	10 Suitcase Projector + LG	11 Workbook + LG	12 Color Workbook + LG	13 Workbook + Slides + LG	14 Workbook + Audio + LG	15 Programmed Text + LG	16 Training Manuals + LG
LEARNING CENTER	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X
CLASSROOMS																
TRAINING DEVICE				X												
COMPUTER	X	X	X													
LESSON DEVELOPMENT	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
PRODUCTION/REPRO.		X	X		X	X	X	X	X	X	X	X	X	X	X	

FACILITIES REQUIREMENTS	17 Model/Actual Equipment + LG	18 CFT + LG	19 CFT + Tapeslide + LG	20 Lecture + LG	21 Lecture + Audio + LG	22 Lecture + Visual Motion + LG	23 Lecture + Model/Actual Equipment + LG	24 Lecture + Student Response System + LG	25 Tutorial + LG	26 Tutorial + Audio + LG	27 Tutorial + Visual Motion + LG	28 Tutorial + Model/Actual Equipment + LG	29 Seminar + LG	30 Seminar + Audio + LG	31 Seminar + Visual Motion + LG	32 Seminar + Model/Actual Equipment + LG
LEARNING CENTER																
CLASSROOMS	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
TRAINING DEVICE																
COMPUTER																
LESSON DEVELOPMENT	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
PRODUCTION/REPRO.			X		X	X				X	X			X	X	

Table 4.7-1--Facilities requirements of academic media

SIMULATION MEDIA

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
	Panel Mockup	Cockpit Mockup	Stick & Throttle Trainer	SMS Trainer	Avionics Display	2-D Device	RWR Trainer	ICPT	CFT	EPT	DSS	ASPT	SAAC	OFT	OFT + NVS	OFT + DRLMS	OFT + EW	WST	T-16 A Aircraft	F-16 B Aircraft
FACILITIES REQUIREMENTS / LEARNING CENTER																				
CLASSROOMS	X	X	X	X	X		X		X											
TRAINING DEVICE								X		X	X	X		X	X	X	X	X		
COMPUTER									X											
LESSON DEVELOPMENT									X											
PRODUCTION/REPRODUCTION																				

Table 4.7-2--Facilities requirements of simulation media

4.6.2 Learning Center Personnel

1. Learning center operator
2. Learning center supervisor

4.6.3 Computer Support Personnel

1. Computer programmer
2. Computer operator
3. Computer manager

4.6.4 Training Device Support Personnel

1. Training device operator
2. Training device manager
3. Training device maintenance personnel

4.6.5 Instructional Materials Maintenance Personnel

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4.7 Facilities Requirements

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1. Learning center
2. Classrooms
3. Training device facility

4. Computer facility

5. Lesson development facility

6. Production/Reproduction facility