

Research Note 82-29

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A FORECAST OF ARMY AVIATION TRAINING RESEARCH  
AND DEVELOPMENT REQUIREMENTS FOR THE PERIOD  
1985-2000 VOLUME II: APPENDICES

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) → This research note presents the results of a survey designed to identify U.S. Army aviation system and subsystem acquisitions projected for the time period of 1985 to 2000 which will require behavioral research to support development of new aircrew training methods and equipment. Survey results are presented in questionnaire format, as they were originally obtained, together with information on scoring model weighting, and a complete listing of the bibliographical references.  (Continued)		

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## Item 20 (Continued)

The related technical report (ARI Technical Report TR 565) describes the conduct and results of three tasks: (a) a survey to identify future Army aviation related systems and subsystems; (b) the identification of systems with unique training needs; and (c) the determination of training requirements and the forecasting of behavioral research requirements for the systems with unique training needs.

This research is intended to assist the Army in identifying behavioral research requirements for future Army aviation aircrew training before the new aviation systems and subsystems are introduced. The lead time provided the early initiation of behavioral research programs should aid the development of effective training systems. Requirements for the behavioral research needed to support Army aviation training programs in the time frame 1985 to 2000 are described in this report. This document presents an integrated and future-oriented review of U.S. Army aviation training R&D needs.

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APPENDIX A  
COMPLETED QUESTIONNAIRES

APPENDIX A  
COMPLETED QUESTIONNAIRES

The University of Dayton conducted eleven interview sessions at three Army agencies in this study. A list of agencies involved in each interview session and systems discussed is presented below. The results of all of the interviews, as recorded on the survey instruments at the time of the interviews, are presented in this appendix so that original records are not lost.

Interview Session	Organization	Systems/Subsystems Discussed	Date of Interview
1.	TRADOC, Ft. Rucker	Near-term Scout Helicopter	5/06/80
2.	TRADOC, Ft. Rucker	Attack Helicopter	5/06/80
3.	TRADOC, Ft. Rucker	LHX-Scout SEMA-X	5/06/80
4.	PMO for ASH DARCOM, St. Louis	Near-term Scout Helicopter Advanced Scout Helicopter	5/28/80
5.	PMO for Black Hawk DARCOM, St. Louis	Black Hawk	5/28/80
6.	AVRADCOM, St. Louis	A/C Rocket Subsystems A/C Guns Subsystems Fire Control	5/27/80
7.	AVRADCOM, St. Louis	ADAS, Landing Subsystems	5/27/80
8.	AVRADCOM, St. Louis	LH-X SEMA-X	5/27/80
9.	PMO for AAH, DARCOM, St. Louis	AAH	5/28/80
10. & 11.	AVRADCOM, St. Louis	ADOCs IDSV	5/27-28/80

QUESTIONNAIRE FOR UNIVERSITY OF DAYTON STUDY OF ARMY  
 AVIATION TRAINING R&D REQUIREMENTS  
 (ARMY RESEARCH INSTITUTE FIELD UNIT  
 CONTRACT NO. MDA903-80-C-0229

DATE 6 May 1980

QUESTIONNAIRE NO. 1

RESPONDER'S NAME \_\_\_\_\_

RESPONDER'S ORGANIZATION \_\_\_\_\_

RESPONDER'S TITLE OR POSITION \_\_\_\_\_

The objective of this study is to identify new Army aviation systems and system characteristics which will require behavioral changes necessitating new training techniques.

Question 1 What new systems will be in the U.S. Army aviation inventory for the period of 1985 to 2000 (within your area of cognizance)?

- 1.1 Mast Mounted Sight/FLIR/Laser Designator
- 1.2 Air-to-Air Missile
- 1.3 Advanced Navigation (Doppler, GPS, PLARS)
- 1.4 HUD/Advanced Night Vision
- 1.5 Threat Detector
- 1.6 Advanced Scout Airframe

Question 2 What are the probabilities that each of these new systems will be introduced into Army inventory? (Values of probability are defined as 1.0 = almost certain, 0.8 = highly probable, 0.6 = probable, 0.4 = uncertain, and 0.2 = highly unlikely.)

	<u>New System</u>	<u>Probability</u>
2.1	<u>Sight</u>	<u>0.8 (Laser), 0.9 (MMS), 1.0 (FLIR)</u>
2.2	<u>Missile</u>	<u>0.8</u>
2.3	<u>Navigation</u>	<u>1.0</u>
2.4	<u>Display</u>	<u>0.6 (HUD), 1.0 (Advanced Nav.)</u>
2.5	<u>Threat</u>	<u>0.7</u>

Question 3 What are the scheduled years for introducing each of these new aviation systems?

	<u>New System</u>	<u>Year</u>
3.1	<u>Sight</u>	<u>1985 (IOC)</u>
3.2	<u>Missile</u>	<u>Beyond 1985</u>
3.3	<u>Navigation</u>	<u>1985</u>
3.4	<u>Displays</u>	<u>1990 (HUD) 1985 (Adv. Nav.)</u>
3.5	<u>Threat</u>	<u>1985</u>

Question 4 How extensive will be the use of each of these new systems? (Degrees of use are defined as "a" = more than three thousand items, "b" = one to three thousand items, "c" = three hundred to one thousand items, "d" = one to three hundred items, and "e" = thirty to one hundred items.)

	<u>New System</u>	<u>Degree of Use</u>
4.1	<u>Sight</u>	<u>C</u>
4.2	<u>Missiles</u>	<u>A</u>
4.3	<u>Navigation</u>	<u>C</u>
4.4	<u>Display</u>	<u>C</u>
4.5	<u>Threat</u>	<u>C</u>

Question 5 What are the current systems, if any, to be replaced by each of these systems?

	<u>New Systems</u>	<u>Current Systems</u>
5.1	<u>Sight</u>	<u>Stabilized Monocular</u>
5.2	<u>Missiles</u>	<u>Nothing (A/G)</u>
5.3	<u>Navigation</u>	<u>Nothing</u>
5.4	<u>Displays</u>	<u>Navigation</u>
5.5	<u>Threat</u>	<u>Nothing</u>

The questionnaire responder should answer Questions 6 to 12, on separate sheets, for each of the new systems identified in the answer to Question 1.

New System Mast Mounted Sight/FLIR/Laser

Question 6.1 How much difference will there be between the new system and the current systems which it replaces in terms of physical characteristics? (Degrees of difference are defined as: "a" = radically different; "b" = substantially different; "c" = somewhat different; and "d" = minimal or no difference.)

<u>Component</u>	<u>Degree of Difference</u>
6.1.1 Flight Controls . . . . .	_____
6.1.2 Instruments . . . . .	<u>B</u>
6.1.3 Displays . . . . .	_____
6.1.4 Power Controls . . . . .	_____
6.1.5 Seating Arrangement . . . . .	_____
6.1.6 Visibility . . . . .	_____
6.1.7 Weapon Guidance . . . . .	<u>A</u>
6.1.8 Guns . . . . .	_____
6.1.9 Rockets . . . . .	_____
6.1.10 Laser . . . . .	<u>A</u>
6.1.11 Threat Detection . . . . .	_____
6.1.12 Navigation . . . . .	_____
6.1.13 Communication . . . . .	_____
6.1.14 ECM/EW . . . . .	_____
6.1.15 Other (Specify) . . . . .	_____
6.1.16 Other (Specify) . . . . .	_____

Question 6.2 For the components rated "radically different", what is the nature of the difference?

*Laser: New concept in weapon aiming. Laser designation for other aircraft weapons. Laser designation for artillery.*

Question 6.3 For the components rated "substantially different", what is the nature of the difference?

*Displa - 2 CP - large one for gunner, small one for pilot*

Question 6.4 For the components rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

New System Mast Mounted Sight/FLIR/Laser

Question 7.1 How much performance difference will there be between the new system and the current systems which it replaces? (Degrees of difference are defined in Question 6.1).

	<u>Performance</u>	<u>Degree of Difference</u>
7.1.1	Maneuverability . . . . .	<u>D</u>
7.1.2	Flight Stability . . . . .	<u>D</u>
7.1.3	Control Responsiveness . . . . .	<u>D</u>
7.1.4	Flying Workload . . . . .	<u>B</u>
7.1.5	Flight Safety Characteristics . . . . .	<u>        </u>
7.1.6	Complexity . . . . .	<u>C</u>
7.1.7	Speed . . . . .	<u>        </u>
7.1.8	Target Detection Capabilities . . . . .	<u>A</u>
7.1.9	Weapon Range . . . . .	<u>        </u>
7.1.10	Weapon Accuracy . . . . .	<u>A</u>
7.1.11	Troop Capacity . . . . .	<u>        </u>
7.1.12	Cargo Capacity . . . . .	<u>        </u>
7.1.13	Other (Specify) . . . . .	<u>        </u>
7.1.14	Other (Specify) . . . . .	<u>        </u>

Question 7.2 For the performances rated "radically different", what is the nature of the difference?

*See Question 6.2*

Question 7.3 For the performances rated "substantially different", what is the nature of the difference?

*Pilot workload, new switches, need to monitor*

Question 7.4 For the performances rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

*More tasks than one person (pilot) can do*

New System Mast Mounted Sight/FLIR/Laser

Question 8.1 In terms of cockpit crew operations, how much difference is there between the new system and the current systems which it replaces? (Degrees of difference are defined in Question 6.1).

<u>Operation</u>	<u>Degree of Difference</u>
8.1.1 Basic Flying . . . . .	_____
8.1.2 Instrument Flying . . . . .	_____
8.1.3 Nap of Earth Flying . . . . .	_____
8.1.4 Navigation . . . . .	_____
8.1.5 Communication . . . . .	D
8.1.6 Other (Specify) <i>Terrain Masking</i> . . . . .	A
8.1.7 Other (Specify) . . . . .	_____

Question 8.2 For the operations rated "radically different", what is the nature of the difference?

*Replace "pop-up" with terrain masking. Need to train and practice using MMS to clear terrain without exposing helicopter.*

Question 8.3 For the operations rated "substantially different", what is the nature of the difference?

Question 8.4 For the operations rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

New System Mast Mounted Sight/FLIR/Laser

Question 9.1 In terms of combat operations tasks, how much difference is there between the new system and current systems which it replaces? (Degrees of difference are defined in Question 6.1).

	<u>Operation</u>	<u>Degree of Difference</u>
9.1.1	Target Detection . . . . .	<u>A</u>
9.1.2	Target Attack . . . . .	<u>          </u>
9.1.3	Weapon Aiming and Firing . . .	<u>B</u>
9.1.4	Air-to-Air Combat Flight Maneuvers . . . . .	<u>          </u>
9.1.5	Air-to-Ground Combat Flight Maneuvers . . . . .	<u>          </u>
9.1.6	Multiple Aircraft Operation .	<u>C</u>
9.1.7	Reconnaissance . . . . .	<u>C</u>
9.1.8	Command and Control Informa- tion Processing . . . . .	<u>          </u>
9.1.9	Other (Specify) . . . . .	<u>          </u>
9.1.10	Other (Specify) . . . . .	<u>          </u>

Question 9.2 For the operations rated "radically different", what is the nature of the difference?

*See Question 6.2*

Question 9.3 For the operations rated "substantially different", what is the nature of the difference?

*Multiple aircraft or aircraft/artillery coordination*

Question 9.4 For the operations rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

9.1.6 *See Question 9.3*

9.1.7 *Night use of FLIR*

New System Mast Mounted Sight/FLIR/Laser

Question 10.1 What are the differences in man-machine skill requirements between the new system and the current systems which it replaces? (Degrees of difference are defined in Question 6.1).

<u>Skill Category</u>	<u>Degree of Difference</u>
10.1.1 Monitoring Displays . . . . .	<u>B/C</u>
10.1.2 Tracking Outside Aircraft . .	<u>          </u>
10.1.3 Recognition . . . . .	<u>          </u>
10.1.4 Memory . . . . .	<u>          </u>
10.1.5 Decision-Making . . . . .	<u>C</u>
10.1.6 Physical Responses . . . . .	<u>          </u>
10.1.7 Other (Specify) . . . . .	<u>          </u>
10.1.8 Other (Specify) . . . . .	<u>          </u>

Question 10.2 For the skills rated "radically different", what is the nature of the difference?

Question 10.3 For the skills rated "substantially different", what is the nature of the difference?

*Displays: for gunner a new set of control/displays*

*Decision: laser set code*

*designate at proper time, don't designate too long*

Question 10.4 For the skills rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

*Displays: pilot displays*

New System Mast Mounted Sight/FLIR/Laser

Question 11.1 What are the differences in crew interaction requirements between the new system and the current systems which it replaces? (Degrees of difference are defined in Question 6.1).

	<u>Interaction Category</u>	<u>Degree of Difference</u>
11.1.1	Verbal Exchange . . . . .	<u>C</u>
11.1.2	Non-Verbal Exchange . . . . .	<u>C</u>
11.1.3	Coordinated Physical Responses . . . . .	<u>        </u>
11.1.4	Other (Specify) . . . . .	<u>        </u>
11.1.5	Other (Specify) . . . . .	<u>        </u>

Question 11.2 For the interactions rated "radically different", what is the nature of the difference?

Question 11.3 For the interactions rated "substantially different", what is the nature of the difference?

Question 11.4 For the interactions rated "somewhat different", is the difference enough to require a change in training methods?

*Non-verbal: symbols on monitor to show targets*

New System Mast Mounted Sight/FLIR/Laser

Question 12.1 In terms of training methods, how much difference will there be between the new system and the current systems it replaces? (Note that this differs from Questions 8.1 and 9.1, by emphasizing training difference instead of system operation differences, i.e., differences in system operation might not always necessitate differences in training methods.)

	<u>Training Areas</u>	<u>Degree of Difference</u>
12.1.1	Basic Flying . . . . .	_____
12.1.2	Instrument Flying . . . . .	_____
12.1.3	Nap of Earth Flying . . . . .	_____
12.1.4	Navigation . . . . .	_____
12.1.5	Communications . . . . .	_____
12.1.6	Target Detection . . . . .	<u>C</u>
12.1.7	Target Attack . . . . .	_____
12.1.8	Weapon Aiming and Firing . .	<u>B</u>
12.1.9	Air-to-Air Combat Flight Maneuvers . . . . .	_____
12.1.10	Air-to-Ground Combat Flight Maneuvers . . . . .	_____
12.1.11	Multiple Aircraft Operations	<u>C</u>
12.1.12	Reconnaissance . . . . .	_____
12.1.13	Command and Control Informa- tion Processing . . . . .	_____
12.1.14	Other (Specify) . . . . .	_____
12.1.15	Other (Specify) . . . . .	_____

Question 12.2 For the training areas rated "radically different", what is the nature of the difference?

Question 12.3 For the training areas rated "substantially different", what is the nature of the difference?

Question 12.4 For the training areas rated "somewhat different", what is the nature of the difference?

*Slightly different technique*

New System Air-to-Air Missile

Question 6.1 How much difference will there be between the new system and the current systems which it replaces in terms of physical characteristics? (Degrees of difference are defined as: "a" = radically different; "b" = substantially different; "c" = somewhat different; and "d" = minimal or no difference.)

<u>Component</u>	<u>Degree of Difference</u>
6.1.1 Flight Controls . . . . .	_____
6.1.2 Instruments . . . . .	_____
6.1.3 Displays . . . . .	_____
6.1.4 Power Controls . . . . .	_____
6.1.5 Seating Arrangement . . . . .	_____
6.1.6 Visibility . . . . .	_____
6.1.7 Weapon Guidance . . . . .	_____
6.1.8 Guns . . . . .	A
6.1.9 Rockets . . . . .	A
6.1.10 Laser . . . . .	_____
6.1.11 Threat Detection . . . . .	_____
6.1.12 Navigation . . . . .	_____
6.1.13 Communication . . . . .	_____
6.1.14 ECM/EW . . . . .	_____
6.1.15 Other (Specify) . . . . .	_____
6.1.16 Other (Specify) . . . . .	_____

Question 6.2 For the components rated "radically different", what is the nature of the difference?

*Entirely new concept*

Question 6.3 For the components rated "substantially different", what is the nature of the difference?

Question 6.4 For the components rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

New System Air-to-Air Missile

Question 7.1 How much performance difference will there be between the new system and the current systems which it replaces? (Degrees of difference are defined in Question 6.1).

	<u>Performance</u>	<u>Degree of Difference</u>
7.1.1	Maneuverability . . . . .	_____
7.1.2	Flight Stability . . . . .	_____
7.1.3	Control Responsiveness . . . . .	_____
7.1.4	Flying Workload . . . . .	_____
7.1.5	Flight Safety Characteristics . . . . .	_____
7.1.6	Complexity . . . . .	_____
7.1.7	Speed . . . . .	_____
7.1.8	Target Detection Capabilities . . . . .	_____
7.1.9	Weapon Range . . . . .	<u>    A    </u>
7.1.10	Weapon Accuracy . . . . .	_____
7.1.11	Troop Capacity . . . . .	_____
7.1.12	Cargo Capacity . . . . .	_____
7.1.13	Other (Specify) . . . . .	_____
7.1.14	Other (Specify) . . . . .	_____

Question 7.2 For the performances rated "radically different", what is the nature of the difference?

*No counterpart*

Question 7.3 For the performances rated "substantially different", what is the nature of the difference?

Question 7.4 For the performances rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

New System Air-to-Air Missile

Question 8.1 In terms of cockpit crew operations, how much difference is there between the new system and the current systems which it replaces? (Degrees of difference are defined in Question 6.1).

<u>Operation</u>	<u>Degree of Difference</u>
8.1.1 Basic Flying . . . . .	_____
8.1.2 Instrument Flying . . . . .	_____
8.1.3 Nap of Earth Flying . . . . .	_____
8.1.4 Navigation . . . . .	_____
8.1.5 Communication . . . . .	_____
8.1.6 Other (Specify) <i>Target Detection</i>	<u>A</u>
8.1.7 Other (Specify) . . . . .	_____

Question 8.2 For the operations rated "radically different", what is the nature of the difference?

- Threat Detection*
- Point Helicopter*
- IR Seeker (Tone)*
- FLIR*

Question 8.3 For the operations rated "substantially different", what is the nature of the difference?

Question 8.4 For the operations rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

New System Air-to-Air Missile

Question 9.1 In terms of combat operations tasks, how much difference is there between the new system and current systems which it replaces? (Degrees of difference are defined in Question 6.1).

	<u>Operation</u>	<u>Degree of Difference</u>
9.1.1	Target Detection . . . . .	_____
9.1.2	Target Attack . . . . .	_____
9.1.3	Weapon Aiming and Firing . . .	_____
9.1.4	Air-to-Air Combat Flight Maneuvers . . . . .	<u>    A    </u>
9.1.5	Air-to-Ground Combat Flight Maneuvers . . . . .	_____
9.1.6	Multiple Aircraft Operation .	_____
9.1.7	Reconnaissance . . . . .	_____
9.1.8	Command and Control Informa- tion Processing . . . . .	_____
9.1.9	Other (Specify) . . . . .	_____
9.1.10	Other (Specify) . . . . .	_____

Question 9.2 For the operations rated "radically different", what is the nature of the difference?

*See Question 8.2*

Question 9.3 For the operations rated "substantially different", what is the nature of the difference?

Question 9.4 For the operations rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

New System Air-to-Air Missile

Question 10.1 What are the differences in man-machine skill requirements between the new system and the current systems which it replaces? (Degrees of difference are defined in Question 6.1).

	<u>Skill Category</u>	<u>Degree of Difference</u>
10.1.1	Monitoring Displays . . . . .	_____
10.1.2	Tracking Outside Aircraft . .	<u>D</u>
10.1.3	Recognition . . . . .	<u>D</u>
10.1.4	Memory . . . . .	_____
10.1.5	Decision-Making . . . . .	<u>D</u>
10.1.6	Physical Responses . . . . .	_____
10.1.7	Other (Specify) . . . . .	_____
10.1.8	Other (Specify) . . . . .	_____

Question 10.2 For the skills rated "radically different", what is the nature of the difference?

Question 10.3 For the skills rated "substantially different", what is the nature of the difference?

Question 10.4 For the skills rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

New System Air-to-Air Missile

Question 11.1 What are the differences in crew interaction requirements between the new system and the current systems which it replaces? (Degrees of difference are defined in Question 6.1).

	<u>Interaction Category</u>	<u>Degree of Difference</u>
11.1.1	Verbal Exchange . . . . .	<u>D</u>
11.1.2	Non-Verbal Exchange . . . . .	<u>D</u>
11.1.3	Coordinated Physical Responses . . . . .	<u>D</u>
11.1.4	Other (Specify) . . . . .	<u>          </u>
11.1.5	Other (Specify) . . . . .	<u>          </u>

Question 11.2 For the interactions rated "radically different", what is the nature of the difference?

Question 11.3 For the interactions rated "substantially different", what is the nature of the difference?

Question 11.4 For the interactions rated "somewhat different", is the difference enough to require a change in training methods?

New System Air-to-Air Missile

Question 12.1 In terms of training methods, how much difference will there be between the new system and the current systems it replaces? (Note that this differs from Questions 8.1 and 9.1, by emphasizing training difference instead of system operation differences, i.e., differences in system operation might not always necessitate differences in training methods.)

	<u>Training Areas</u>	<u>Degree of Difference</u>
12.1.1	Basic Flying . . . . .	_____
12.1.2	Instrument Flying . . . . .	_____
12.1.3	Map of Earth Flying . . . . .	_____
12.1.4	Navigation . . . . .	_____
12.1.5	Communications . . . . .	_____
12.1.6	Target Detection . . . . .	_____
12.1.7	Target Attack . . . . .	_____
12.1.8	Weapon Aiming and Firing . . . . .	_____
12.1.9	Air-to-Air Combat Flight Maneuvers . . . . .	_____ <u>C</u>
12.1.10	Air-to-Ground Combat Flight Maneuvers . . . . .	_____
12.1.11	Multiple Aircraft Operations	_____
12.1.12	Reconnaissance . . . . .	_____
12.1.13	Command and Control Informa- tion Processing . . . . .	_____
12.1.14	Other (Specify) . . . . .	_____
12.1.15	Other (Specify) . . . . .	_____

Question 12.2 For the training areas rated "radically different", what is the nature of the difference?

Question 12.3 For the training areas rated "substantially different", what is the nature of the difference?

Question 12.4 For the training areas rated "somewhat different", what is the nature of the difference?

New System Advanced Navigation

Question 6.1 How much difference will there be between the new system and the current systems which it replaces in terms of physical characteristics? (Degrees of difference are defined as: "a" = radically different; "b" = substantially different; "c" = somewhat different; and "d" = minimal or no difference.)

<u>Component</u>	<u>Degree of Difference</u>
6.1.1 Flight Controls . . . . .	_____
6.1.2 Instruments . . . . .	_____
6.1.3 Displays . . . . .	<u>B</u>
6.1.4 Power Controls . . . . .	_____
6.1.5 Seating Arrangement . . . . .	_____
6.1.6 Visibility . . . . .	_____
6.1.7 Weapon Guidance . . . . .	_____
6.1.8 Guns . . . . .	_____
6.1.9 Rockets . . . . .	_____
6.1.10 Laser . . . . .	_____
6.1.11 Threat Detection . . . . .	_____
6.1.12 Navigation . . . . .	<u>B</u>
6.1.13 Communication . . . . .	_____
6.1.14 ECM/EW . . . . .	_____
6.1.15 Other (Specify) . . . . .	_____
6.1.16 Other (Specify) . . . . .	_____

Question 6.2 For the components rated "radically different", what is the nature of the difference?

*Display: moving map for Advanced Scout Helicopter  
digital for Interim Scout Helicopter*

Question 6.3 For the components rated "substantially different", what is the nature of the difference?

*Easier on crew (less workload)*

Question 6.4 For the components rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

New System Advanced Navigation

Question 7.1 How much performance difference will there be between the new system and the current systems which it replaces? (Degrees of difference are defined in Question 6.1).

	<u>Performance</u>	<u>Degree of Difference</u>
7.1.1	Maneuverability . . . . .	_____
7.1.2	Flight Stability . . . . .	_____
7.1.3	Control Responsiveness . . . . .	_____
7.1.4	Flying Workload . . . . .	_____
7.1.5	Flight Safety Characteristics . . . . .	_____
7.1.6	Complexity . . . . .	_____
7.1.7	Speed . . . . .	_____
7.1.8	Target Detection Capabilities . . . . .	_____
7.1.9	Weapon Range . . . . .	_____
7.1.10	Weapon Accuracy . . . . .	_____
7.1.11	Troop Capacity . . . . .	_____
7.1.12	Cargo Capacity . . . . .	_____
7.1.13	Other (Specify) <u>Navigation Aircraft</u>	_____ <u>B</u>
7.1.14	Other (Specify) . . . . .	_____

Question 7.2 For the performances rated "radically different", what is the nature of the difference?

Question 7.3 For the performances rated "substantially different", what is the nature of the difference?

*More accurate*

Question 7.4 For the performances rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

New System Advanced Navigation

Question 8.1 In terms of cockpit crew operations, how much difference is there between the new system and the current systems which it replaces? (Degrees of difference are defined in Question 6.1).

<u>Operation</u>	<u>Degree of Difference</u>
8.1.1 Basic Flying . . . . .	_____
8.1.2 Instrument Flying . . . . .	_____
8.1.3 Nap of Earth Flying . . . . .	B
8.1.4 Navigation . . . . .	B
8.1.5 Communication . . . . .	_____
8.1.6 Other (Specify) . . . . .	_____
8.1.7 Other (Specify) . . . . .	_____

Question 8.2 For the operations rated "radically different", what is the nature of the difference?

Question 8.3 For the operations rated "substantially different", what is the nature of the difference?

*Easier*

Question 8.4 For the operations rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

New System Advanced Navigation

Question 9.1 In terms of combat operations tasks, how much difference is there between the new system and current systems which it replaces? (Degrees of difference are defined in Question 6.1).

	<u>Operation</u>	<u>Degree of Difference</u>
9.1.1	Target Detection . . . . .	<u>D</u>
9.1.2	Target Attack . . . . .	<u>D</u>
9.1.3	Weapon Aiming and Firing . . .	<u>D</u>
9.1.4	Air-to-Air Combat Flight Maneuvers . . . . .	<u>D</u>
9.1.5	Air-to-Ground Combat Flight Maneuvers . . . . .	<u>D</u>
9.1.6	Multiple Aircraft Operation .	<u>D</u>
9.1.7	Reconnaissance . . . . .	<u>D</u>
9.1.8	Command and Control Informa- tion Processing . . . . .	<u>D</u>
9.1.9	Other (Specify) . . . . .	<u>          </u>
9.1.10	Other (Specify) . . . . .	<u>          </u>

Question 9.2 For the operations rated "radically different", what is the nature of the difference?

Question 9.3 For the operations rated "substantially different", what is the nature of the difference?

Question 9.4 For the operations rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

New System Advanced Navigation

Question 10.1 What are the differences in man-machine skill requirements between the new system and the current systems which it replaces? (Degrees of difference are defined in Question 6.1).

	<u>Skill Category</u>	<u>Degree of Difference</u>
10.1.1	Monitoring Displays . . . . .	<u>B</u>
10.1.2	Tracking Outside Aircraft . .	<u>          </u>
10.1.3	Recognition . . . . .	<u>          </u>
10.1.4	Memory . . . . .	<u>          </u>
10.1.5	Decision-Making . . . . .	<u>          </u>
10.1.6	Physical Responses . . . . .	<u>          </u>
10.1.7	Other (Specify) . . . . .	<u>          </u>
10.1.8	Other (Specify) . . . . .	<u>          </u>

Question 10.2 For the skills rated "radically different", what is the nature of the difference?

Question 10.3 For the skills rated "substantially different", what is the nature of the difference?  
*Map/digital display (must train on use of digital display)*

Question 10.4 For the skills rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

New System Advanced Navigation

Question 11.1 What are the differences in crew interaction requirements between the new system and the current systems which it replaces? (Degrees of difference are defined in Question 6.1).

	<u>Interaction Category</u>	<u>Degree of Difference</u>
11.1.1	Verbal Exchange . . . . .	<u>D</u>
11.1.2	Non-Verbal Exchange . . . . .	<u>D</u>
11.1.3	Coordinated Physical Responses . . . . .	<u>D</u>
11.1.4	Other (Specify) . . . . .	<u>          </u>
11.1.5	Other (Specify) . . . . .	<u>          </u>

Question 11.2 For the interactions rated "radically different", what is the nature of the difference?

Question 11.3 For the interactions rated "substantially different", what is the nature of the difference?

Question 11.4 For the interactions rated "somewhat different", is the difference enough to require a change in training methods?

New System Advanced Navigation

Question 12.1 In terms of training methods, how much difference will there be between the new system and the current systems it replaces? (Note that this differs from Questions 8.1 and 9.1, by emphasizing training difference instead of system operation differences, i.e., differences in system operation might not always necessitate differences in training methods.)

	<u>Training Areas</u>	<u>Degree of Difference</u>
12.1.1	Basic Flying . . . . .	_____
12.1.2	Instrument Flying . . . . .	_____
12.1.3	Nap of Earth Flying . . . . .	_____
12.1.4	Navigation . . . . .	C _____
12.1.5	Communications . . . . .	_____
12.1.6	Target Detection . . . . .	_____
12.1.7	Target Attack . . . . .	_____
12.1.8	Weapon Aiming and Firing . . . . .	_____
12.1.9	Air-to-Air Combat Flight Maneuvers . . . . .	_____
12.1.10	Air-to-Ground Combat Flight Maneuvers . . . . .	_____
12.1.11	Multiple Aircraft Operations	_____
12.1.12	Reconnaissance . . . . .	_____
12.1.13	Command and Control Informa- tion Processing . . . . .	_____
12.1.14	Other (Specify) . . . . .	_____
12.1.15	Other (Specify) . . . . .	_____

Question 12.2 For the training areas rated "radically different", what is the nature of the difference?

Question 12.3 For the training areas rated "substantially different", what is the nature of the difference?

Question 12.4 For the training areas rated "somewhat different", what is the nature of the difference?

*Must still use maps but must learn an additional system*

New System Threat Detector

Question 6.1 How much difference will there be between the new system and the current systems which it replaces in terms of physical characteristics? (Degrees of difference are defined as: "a" = radically different; "b" = substantially different; "c" = somewhat different; and "d" = minimal or no difference.)

<u>Component</u>	<u>Degree of Difference</u>
6.1.1 Flight Controls . . . . .	_____
6.1.2 Instruments . . . . .	_____
6.1.3 Displays . . . . .	<u>    c    </u>
6.1.4 Power Controls . . . . .	_____
6.1.5 Seating Arrangement . . . . .	_____
6.1.6 Visibility . . . . .	_____
6.1.7 Weapon Guidance . . . . .	_____
6.1.8 Guns . . . . .	_____
6.1.9 Rockets . . . . .	_____
6.1.10 Laser . . . . .	_____
6.1.11 Threat Detection . . . . .	<u>    c    </u>
6.1.12 Navigation . . . . .	_____
6.1.13 Communication . . . . .	_____
6.1.14 ECM/EW . . . . .	_____
6.1.15 Other (Specify) . . . . .	_____
6.1.16 Other (Specify) . . . . .	_____

Question 6.2 For the components rated "radically different", what is the nature of the difference?

Question 6.3 For the components rated "substantially different", what is the nature of the difference?  
*New display (new capability)*  
*Audible alarm*

Question 6.4 For the components rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

New System Threat Detector

Question 7.1 How much performance difference will there be between the new system and the current systems which it replaces? (Degrees of difference are defined in Question 6.1).

	<u>Performance</u>	<u>Degree of Difference</u>
7.1.1	Maneuverability . . . . .	_____
7.1.2	Flight Stability . . . . .	_____
7.1.3	Control Responsiveness . . . . .	_____
7.1.4	Flying Workload . . . . .	_____
7.1.5	Flight Safety Characteristics . . . . .	_____
7.1.6	Complexity . . . . .	_____
7.1.7	Speed . . . . .	_____
7.1.8	Target Detection Capabilities . . . . .	_____ <i>D</i> _____
7.1.9	Weapon Range . . . . .	_____
7.1.10	Weapon Accuracy . . . . .	_____
7.1.11	Troop Capacity . . . . .	_____
7.1.12	Cargo Capacity . . . . .	_____
7.1.13	Other (Specify) . . . . .	_____
7.1.14	Other (Specify) . . . . .	_____

Question 7.2 For the performances rated "radically different", what is the nature of the difference?

Question 7.3 For the performances rated "substantially different", what is the nature of the difference?

Question 7.4 For the performances rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

New System Threat Detector

Question 8.1 In terms of cockpit crew operations, how much difference is there between the new system and the current systems which it replaces? (Degrees of difference are defined in Question 6.1).

<u>Operation</u>	<u>Degree of Difference</u>
8.1.1 Basic Flying . . . . .	_____
8.1.2 Instrument Flying . . . . .	_____
8.1.3 Nap of Earth Flying . . . . .	_____
8.1.4 Navigation . . . . .	_____
8.1.5 Communication . . . . .	_____
8.1.6 Other (Specify) <i>Threat Detection</i> .	_____ <i>C</i> _____
8.1.7 Other (Specify) . . . . .	_____

Question 8.2 For the operations rated "radically different", what is the nature of the difference?

Question 8.3 For the operations rated "substantially different", what is the nature of the difference?

Question 8.4 For the operations rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

*Capability to detect radar*  
*Tactics to use*

New System Threat Detector

Question 9.1 In terms of combat operations tasks, how much difference is there between the new system and current systems which it replaces? (Degrees of difference are defined in Question 6.1).

	<u>Operation</u>	<u>Degree of Difference</u>
9.1.1	Target Detection . . . . .	_____
9.1.2	Target Attack . . . . .	_____
9.1.3	Weapon Aiming and Firing . . .	_____
9.1.4	Air-to-Air Combat Flight Maneuvers . . . . .	_____
9.1.5	Air-to-Ground Combat Flight Maneuvers . . . . .	_____
9.1.6	Multiple Aircraft Operation .	_____
9.1.7	Reconnaissance . . . . .	_____
9.1.8	Command and Control Informa- tion Processing . . . . .	_____
9.1.9	Other (Specify) <i>Threat Detection</i> .	<u>  c  </u>
9.1.10	Other (Specify) . . . . .	_____

Question 9.2 For the operations rated "radically different", what is the nature of the difference?

Question 9.3 For the operations rated "substantially different", what is the nature of the difference?

Question 9.4 For the operations rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

*See Question 8.4*

New System Threat Detector

Question 10.1 What are the differences in man-machine skill requirements between the new system and the current systems which it replaces? (Degrees of difference are defined in Question 6.1).

	<u>Skill Category</u>	<u>Degree of Difference</u>
10.1.1	Monitoring Displays . . . . .	<u>C</u>
10.1.2	Tracking Outside Aircraft . .	<u>          </u>
10.1.3	Recognition . . . . .	<u>          </u>
10.1.4	Memory . . . . .	<u>          </u>
10.1.5	Decision-Making . . . . .	<u>          </u>
10.1.6	Physical Responses . . . . .	<u>          </u>
10.1.7	Other (Specify) . . . . .	<u>          </u>
10.1.8	Other (Specify) . . . . .	<u>          </u>

Question 10.2 For the skills rated "radically different", what is the nature of the difference?

Question 10.3 For the skills rated "substantially different", what is the nature of the difference?

Question 10.4 For the skills rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

*Aural warning*

New System Threat Detector

Question 11.1 What are the differences in crew interaction requirements between the new system and the current systems which it replaces? (Degrees of difference are defined in Question 6.1).

	<u>Interaction Category</u>	<u>Degree of Difference</u>
11.1.1	Verbal Exchange . . . . .	_____
11.1.2	Non-Verbal Exchange . . . . .	_____
11.1.3	Coordinated Physical Responses . . . . .	_____
11.1.4	Other (Specify) . . . . .	_____
11.1.5	Other (Specify) . . . . .	_____

Question 11.2 For the interactions rated "radically different", what is the nature of the difference?

Question 11.3 For the interactions rated "substantially different", what is the nature of the difference?

Question 11.4 For the interactions rated "somewhat different", is the difference enough to require a change in training methods?

New System Threat Detector

Question 12.1 In terms of training methods, how much difference will there be between the new system and the current systems it replaces? (Note that this differs from Questions 8.1 and 9.1, by emphasizing training difference instead of system operation differences, i.e., differences in system operation might not always necessitate differences in training methods.)

	<u>Training Areas</u>	<u>Degree of Difference</u>
12.1.1	Basic Flying . . . . .	_____
12.1.2	Instrument Flying . . . . .	_____
12.1.3	Map of Earth Flying . . . . .	_____
12.1.4	Navigation . . . . .	_____
12.1.5	Communications . . . . .	_____
12.1.6	Target Detection . . . . .	_____
12.1.7	Target Attack . . . . .	_____
12.1.8	Weapon Aiming and Firing . . . . .	_____
12.1.9	Air-to-Air Combat Flight Maneuvers . . . . .	_____
12.1.10	Air-to-Ground Combat Flight Maneuvers . . . . .	_____
12.1.11	Multiple Aircraft Operations . . . . .	_____
12.1.12	Reconnaissance . . . . .	_____
12.1.13	Command and Control Informa- tion Processing . . . . .	_____
12.1.14	Other (Specify) . . . . .	_____
12.1.15	Other (Specify) . . . . .	_____

Question 12.2 For the training areas rated "radically different", what is the nature of the difference?

Question 12.3 For the training areas rated "substantially different", what is the nature of the difference?

Question 12.4 For the training areas rated "somewhat different", what is the nature of the difference?

Question 13 As stated at the beginning of the questionnaire the objective of this study is to identify new Army aviation systems and system characteristics which will require behavioral changes necessitating new training techniques.

Given this objective, is there anything further which you believe will require changes in training as a result of the introduction of new Army aviation systems?

- (a) Scout is integrator of weapons and tactics  
3 Scouts/5 Attack 2 Scouts "normal"  
1 Scout "battle captain"  
Different training?  
Additional training in attack helicopter/weapons artillery
- (b) Observer training - Minimal peacetime authorization  
Questionable capability of recruit
- (c) Pilot workload - 1 pilot  
1 pilot and 1 observer  
2 pilots
- (d) Simulators - Difficult for multiple visual targets, other  
aircraft laser designating, etc.
- (e) Lack of realistic war-game environment - no ranges
- (f) Avionics, laser, FLIR maintenance
- (g) Reduced instrument for training needs
- (h) Scout attrition
- (i) Advanced scout - No decision expected on configuration  
Will require ordinary aircraft check-out  
training

QUESTIONNAIRE FOR UNIVERSITY OF DAYTON STUDY OF ARMY  
 AVIATION TRAINING R&D REQUIREMENTS  
 (ARMY RESEARCH INSTITUTE FIELD UNIT  
 CONTRACT NO. MDA903-80-C-0229

DATE 6 May 1980 QUESTIONNAIRE NO. 1A

RESPONDER'S NAME \_\_\_\_\_

RESPONDER'S ORGANIZATION \_\_\_\_\_

RESPONDER'S TITLE OR POSITION \_\_\_\_\_

The objective of this study is to identify new Army aviation systems and system characteristics which will require behavioral changes necessitating new training techniques.

Question 1 What new systems will be in the U.S. Army aviation inventory for the period of 1985 to 2000 (within your area of cognizance)?

- 1.1 Near Term Scout Helicopter
- 1.2 \_\_\_\_\_
- 1.3 \_\_\_\_\_
- 1.4 \_\_\_\_\_

Question 2 What are the probabilities that each of these new systems will be introduced into Army inventory? (Values of probability are defined as 1.0 = almost certain, 0.8 = highly probable, 0.6 = probable, 0.4 = uncertain, and 0.2 = highly unlikely.)

	<u>New System</u>	<u>Probability</u>
2.1	<u>Near Term Scout Helicopter</u>	<u>1.0</u>
2.2	_____	_____
2.3	_____	_____
2.4	_____	_____

Question 3 What are the scheduled years for introducing each of these new aviation systems?

	<u>New System</u>	<u>Year</u>
3.1	<u>Near Term Scout Helicopter</u>	<u>1985</u>
3.2	<u></u>	<u></u>
3.3	<u></u>	<u></u>
3.4	<u></u>	<u></u>

Question 4 How extensive will be the use of each of these new systems? (Degrees of use are defined as "a" = more than three thousand items, "b" = one to three thousand items, "c" = three hundred to one thousand items, "d" = one to three hundred items, and "e" = thirty to one hundred items.)

	<u>New System</u>	<u>Degree of Use</u>
4.1	<u>Near Term Scout Helicopter</u>	<u>c</u>
4.2	<u></u>	<u></u>
4.3	<u></u>	<u></u>
4.4	<u></u>	<u></u>

Question 5 What are the current systems, if any, to be replaced by each of these systems?

	<u>New Systems</u>	<u>Current Systems</u>
5.1	<u></u>	<u></u>
5.2	<u></u>	<u></u>
5.3	<u></u>	<u></u>
5.4	<u></u>	<u></u>

The questionnaire responder should answer Questions 6 to 12, on separate sheets, for each of the new systems identified in the answer to Question 1.

New System Near Term Scout Helicopter

Question 6.1 How much difference will there be between the new system and the current systems which it replaces in terms of physical characteristics? (Degrees of difference are defined as: "a" = radically different; "b" = substantially different; "c" = somewhat different; and "d" = minimal or no difference.)

<u>Component</u>	<u>Degree of Difference</u>
6.1.1 Flight Controls . . . . .	_____
6.1.2 Instruments . . . . .	<u>B</u>
6.1.3 Displays . . . . .	<u>B</u>
6.1.4 Power Controls . . . . .	_____
6.1.5 Seating Arrangement . . . . .	_____
6.1.6 Visibility . . . . .	_____
6.1.7 Weapon Guidance . . . . .	<u>A</u>
6.1.8 Guns . . . . .	<u>A</u>
6.1.9 Rockets . . . . .	<u>A</u>
6.1.10 Laser . . . . .	<u>A</u>
6.1.11 Threat Detection . . . . .	<u>C</u>
6.1.12 Navigation . . . . .	<u>B</u>
6.1.13 Communication . . . . .	_____
6.1.14 ECM/EW . . . . .	_____
6.1.15 Other (Specify) . . . . .	_____
6.1.16 Other (Specify) . . . . .	_____

Question 6.2 For the components rated "radically different", what is the nature of the difference?

Question 6.3 For the components rated "substantially different", what is the nature of the difference?

Question 6.4 For the components rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

New System Near Term Scout Helicopter

Question 7.1 How much performance difference will there be between the new system and the current systems which it replaces? (Degrees of difference are defined in Question 6.1).

	<u>Performance</u>	<u>Degree of Difference</u>
7.1.1	Maneuverability . . . . .	<u>D</u>
7.1.2	Flight Stability . . . . .	<u>D</u>
7.1.3	Control Responsiveness . . . . .	<u>D</u>
7.1.4	Flying Workload . . . . .	<u>B</u>
7.1.5	Flight Safety Characteristics . . . . .	<u>    </u>
7.1.6	Complexity . . . . .	<u>C</u>
7.1.7	Speed . . . . .	<u>    </u>
7.1.8	Target Detection Capabilities . . . . .	<u>A</u>
7.1.9	Weapon Range . . . . .	<u>A</u>
7.1.10	Weapon Accuracy . . . . .	<u>A</u>
7.1.11	Troop Capacity . . . . .	<u>    </u>
7.1.12	Cargo Capacity . . . . .	<u>    </u>
7.1.13	Other (Specify) <i>Navigating Aircraft</i>	<u>B</u>
7.1.14	Other (Specify) . . . . .	<u>    </u>

Question 7.2 For the performances rated "radically different", what is the nature of the difference?

Question 7.3 For the performances rated "substantially different", what is the nature of the difference?

Question 7.4 For the performances rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

New System Near Term Scout Helicopter

Question 8.1 In terms of cockpit crew operations, how much difference is there between the new system and the current systems which it replaces? (Degrees of difference are defined in Question 6.1).

<u>Operation</u>	<u>Degree of Difference</u>
8.1.1 Basic Flying . . . . .	_____
8.1.2 Instrument Flying . . . . .	_____
8.1.3 Nap of Earth Flying . . . . .	<u>B</u>
8.1.4 Navigation . . . . .	<u>B</u>
8.1.5 Communication . . . . .	<u>D</u>
8.1.6 Other (Specify) . . . . .	<u>A</u>
8.1.7 Other (Specify) . . . . .	<u>A</u>

Question 8.2 For the operations rated "radically different", what is the nature of the difference?

Question 8.3 For the operations rated "substantially different", what is the nature of the difference?

Question 8.4 For the operations rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

New System Near Term Scout Helicopter

Question 9.1 In terms of combat operations tasks, how much difference is there between the new system and current systems which it replaces? (Degrees of difference are defined in Question 6.1).

	<u>Operation</u>	<u>Degree of Difference</u>
9.1.1	Target Detection . . . . .	<u>A</u>
9.1.2	Target Attack . . . . .	<u>D</u>
9.1.3	Weapon Aiming and Firing . . .	<u>B</u>
9.1.4	Air-to-Air Combat Flight Maneuvers . . . . .	<u>A</u>
9.1.5	Air-to-Ground Combat Flight Maneuvers . . . . .	<u>D</u>
9.1.6	Multiple Aircraft Operation .	<u>C</u>
9.1.7	Reconnaissance . . . . .	<u>C</u>
9.1.8	Command and Control Informa- tion Processing . . . . .	<u>    </u>
9.1.9	Other (Specify) . . . . .	<u>C</u>
9.1.10	Other (Specify) . . . . .	<u>    </u>

Question 9.2 For the operations rated "radically different", what is the nature of the difference?

Question 9.3 For the operations rated "substantially different", what is the nature of the difference?

Question 9.4 For the operations rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

New System Near Term Scout Helicopter

Question 10.1 What are the differences in man-machine skill requirements between the new system and the current systems which it replaces? (Degrees of difference are defined in Question 6.1).

	<u>Skill Category</u>	<u>Degree of Difference</u>
10.1.1	Monitoring Displays . . . . .	<u>B</u>
10.1.2	Tracking Outside Aircraft . . . . .	<u>D</u>
10.1.3	Recognition . . . . .	<u>D</u>
10.1.4	Memory . . . . .	<u>        </u>
10.1.5	Decision-Making . . . . .	<u>C</u>
10.1.6	Physical Responses . . . . .	<u>        </u>
10.1.7	Other (Specify) . . . . .	<u>        </u>
10.1.8	Other (Specify) . . . . .	<u>        </u>

Question 10.2 For the skills rated "radically different", what is the nature of the difference?

Question 10.3 For the skills rated "substantially different", what is the nature of the difference?

Question 10.4 For the skills rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

New System Near Term Scout Helicopter

Question 11.1 What are the differences in crew interaction requirements between the new system and the current systems which it replaces? (Degrees of difference are defined in Question 6.1).

	<u>Interaction Category</u>	<u>Degree of Difference</u>
11.1.1	Verbal Exchange . . . . .	<u>C</u>
11.1.2	Non-Verbal Exchange . . . . .	<u>C</u>
11.1.3	Coordinated Physical Responses . . . . .	<u>D</u>
11.1.4	Other (Specify) . . . . .	<u>          </u>
11.1.5	Other (Specify) . . . . .	<u>          </u>

Question 11.2 For the interactions rated "radically different", what is the nature of the difference?

Question 11.3 For the interactions rated "substantially different", what is the nature of the difference?

Question 11.4 For the interactions rated "somewhat different", is the difference enough to require a change in training methods?

New System: Near Term Scout Helicopter

Question 12.1 In terms of training methods, how much difference will there be between the new system and the current systems it replaces? (Note that this differs from Questions 8.1 and 9.1, by emphasizing training difference instead of system operation differences, i.e., differences in system operation might not always necessitate differences in training methods.)

	<u>Training Areas</u>	<u>Degree of Difference</u>
12.1.1	Basic Flying . . . . .	_____
12.1.2	Instrument Flying . . . . .	_____
12.1.3	Map of Earth Flying . . . . .	_____
12.1.4	Navigation . . . . .	<u>C</u>
12.1.5	Communications . . . . .	_____
12.1.6	Target Detection . . . . .	<u>C</u>
12.1.7	Target Attack . . . . .	_____
12.1.8	Weapon Aiming and Firing . . . . .	<u>B</u>
12.1.9	Air-to-Air Combat Flight Maneuvers . . . . .	<u>C</u>
12.1.10	Air-to-Ground Combat Flight Maneuvers . . . . .	_____
12.1.11	Multiple Aircraft Operations	<u>C</u>
12.1.12	Reconnaissance . . . . .	_____
12.1.13	Command and Control Informa- tion Processing . . . . .	_____
12.1.14	Other (Specify) . . . . .	_____
12.1.15	Other (Specify) . . . . .	_____

Question 12.2 For the training areas rated "radically different", what is the nature of the difference?

Question 12.3 For the training areas rated "substantially different", what is the nature of the difference?

Question 12.4 For the training areas rated "somewhat different", what is the nature of the difference?

Question 13 As stated at the beginning of the questionnaire the objective of this study is to identify new Army aviation systems and system characteristics which will require behavioral changes necessitating new training techniques.

Given this objective, is there anything further which you believe will require changes in training as a result of the introduction of new Army aviation systems?

QUESTIONNAIRE FOR UNIVERSITY OF DAYTON STUDY OF ARMY  
 AVIATION TRAINING R&D REQUIREMENTS  
 (ARMY RESEARCH INSTITUTE FIELD UNIT  
 CONTRACT NO. MDA903-80-C-0229

DATE 7 May 1980

QUESTIONNAIRE NO. 2

RESPONDER'S NAME \_\_\_\_\_

RESPONDER'S ORGANIZATION \_\_\_\_\_

RESPONDER'S TITLE OR POSITION \_\_\_\_\_

The objective of this study is to identify new Army aviation systems and system characteristics which will require behavioral changes necessitating new training techniques.

Question 1 What new systems will be in the U.S. Army aviation inventory for the period of 1985 to 2000 (within your area of cognizance)?

- 1.1 LH-X - Scout (Far Term)
- 1.2 SEMA-X (Special Electronic Mission Aircraft)
- 1.3 UH-60
- 1.4 CH-47C

Question 2 What are the probabilities that each of these new systems will be introduced into Army inventory? (Values of probability are defined as 1.0 = almost certain, 0.8 = highly probable, 0.6 = probable, 0.4 = uncertain, and 0.2 = highly unlikely.)

	<u>New System</u>	<u>Probability</u>
2.1	<u>LH-X - Scout</u>	<u>0.5</u>
2.2	<u>SEMA-X</u>	<u>0.9</u>
2.3	<u>UH-60</u>	<u>1.0</u>
2.4	<u>CH-47D</u>	<u>1.0</u>

Question 3 What are the scheduled years for introducing each of these new aviation systems?

	<u>New System</u>	<u>Year</u>
3.1	<u>LH-X</u>	<u>Late 1990s</u>
3.2	<u>SEMA-X</u>	<u>Late 1990s</u>
3.3	<u>UH-60</u>	<u>In the field</u>
3.4	<u>CH-47 D</u>	<u>In the field</u>

Question 4 How extensive will be the use of each of these new systems? (Degrees of use are defined as "a" = more than three thousand items, "b" = one to three thousand items, "c" = three hundred to one thousand items, "d" = one to three hundred items, and "e" = thirty to one hundred items.)

	<u>New System</u>	<u>Degree of Use</u>
4.1	<u>LH-x</u>	<u>C</u>
4.2	<u>SEMA-X</u>	<u>D</u>
4.3	<u>UH-60</u>	<u>B</u>
4.4	<u>CH-47 D</u>	<u>B</u>

Question 5 What are the current systems, if any, to be replaced by each of these systems?

	<u>New Systems</u>	<u>Current Systems</u> (with Mast Mounted Sight)
5.1	<u>LH-X</u>	<u>OH-58 Augmentation</u>
5.2	<u>SEMA-X</u>	<u>High side of SEM aircraft</u>
5.3	<u>UH-60</u>	<u>Augment UH-1 fleet</u>
5.4	<u>CH-47D</u>	<u>CH-47 A, B, C</u>

The questionnaire responder should answer Questions 6 to 12, on separate sheets, for each of the new systems identified in the answer to Question 1.

New System LH-X

Question 6.1 How much difference will there be between the new system and the current systems which it replaces in terms of physical characteristics? (Degrees of difference are defined as: "a" = radically different; "b" = substantially different; "c" = somewhat different; and "d" = minimal or no difference.)

<u>Component</u>	<u>Degree of Difference</u>
6.1.1 Flight Controls . . . . .	<u>A</u>
6.1.2 Instruments . . . . .	<u>B</u>
6.1.3 Displays . . . . .	<u>B</u>
6.1.4 Power Controls . . . . .	<u>B</u>
6.1.5 Seating Arrangement . . . . .	<u>?</u>
6.1.6 Visibility . . . . .	<u>D</u>
6.1.7 Weapon Guidance . . . . .	<u>N/A</u>
6.1.8 Guns . . . . .	<u>D</u>
6.1.9 Rockets . . . . .	<u>D</u>
6.1.10 Laser . . . . .	<u>N/A</u>
6.1.11 Threat Detection . . . . .	<u>A</u>
6.1.12 Navigation . . . . .	<u>B</u>
6.1.13 Communication . . . . .	<u>B</u>
6.1.14 ECM/EW . . . . .	<u>B</u>
6.1.15 Other (Specify) . . . . .	<u>                    </u>
6.1.16 Other (Specify) . . . . .	<u>                    </u>

Question 6.2 For the components rated "radically different", what is the nature of the difference?

*Flight Controls - Electro-optic, multiplex, digital, EMP hardened, fly-by-wire*

*Threat Detection - New device and technique, optimum maneuvers, primary air-to-air missile*

Question 6.3 For the components rated "substantially different", what is the nature of the difference?

6.1.4 *EMP hardened, full electronic control*

Question 6.4 For the components rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

*Instruments - Multiplex, common function, IX*

*Displays - Multiplex, common function, IX*

*Power Controls - Electrical control, EMP hardened*

New System LH-X

Question 7.1 How much performance difference will there be between the new system and the current systems which it replaces? (Degrees of difference are defined in Question 6.1).

	<u>Performance</u>	<u>Degree of Difference</u>
7.1.1	Maneuverability . . . . .	<u>B</u>
7.1.2	Flight Stability . . . . .	<u>D</u>
7.1.3	Control Responsiveness . . . . .	<u>B</u>
7.1.4	Flying Workload . . . . .	<u>A</u>
7.1.5	Flight Safety Characteristics . . . . .	<u>A</u>
7.1.6	Complexity . . . . .	<u>B</u>
7.1.7	Speed . . . . .	<u>D</u>
7.1.8	Target Detection Capabilities . . . . .	<u>B</u>
7.1.9	Weapon Range . . . . .	<u>A</u>
7.1.10	Weapon Accuracy . . . . .	<u>A</u>
7.1.11	Troop Capacity . . . . .	<u>C</u>
7.1.12	Cargo Capacity . . . . .	<u>N/A</u>
7.1.13	Other (Specify) <u>Survivability</u>	<u>B</u>
7.1.14	Other (Specify) <u>Threat Detection</u>	<u>B</u>

Question 7.2 For the performances rated "radically different", what is the nature of the difference?

- 7.1.1 *More maneuverable*
- 7.1.3 *More responsive*
- 7.1.4 *Unload pilot*
- 7.1.5 *Safer - crashworthy*

Question 7.3 For the performances rated "substantially different", what is the nature of the difference?

- 7.1.6 *More complex or reduced maintenance*
- 7.1.8 *Better target detection in adverse WX*
- 7.1.13 *Criteria for ballistic rounds up to 37 mm except for cockpit hits*

Question 7.4 For the performances rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

New System LH-X

Question 8.1 In terms of cockpit crew operations, how much difference is there between the new system and the current systems which it replaces? (Degrees of difference are defined in Question 6.1).

<u>Operation</u>	<u>Degree of Difference</u>
8.1.1 Basic Flying . . . . .	<u>D</u>
8.1.2 Instrument Flying . . . . .	<u>D</u>
8.1.3 Nap of Earth Flying . . . . .	<u>D</u>
8.1.4 Navigation . . . . .	<u>C</u>
8.1.5 Communication . . . . .	<u>D</u>
8.1.6 Other (Specify) <i>Single Man</i> . . . . .	<u>A</u>
8.1.7 Other (Specify) . . . . .	<u>          </u>

Question 8.2 For the operations rated "radically different", what is the nature of the difference?

*8.1.6 Single man cockpit being considered. Driver for one man cockpit to reduce size, signature, and cost.*

Question 8.3 For the operations rated "substantially different", what is the nature of the difference?

Question 8.4 For the operations rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

*8.1.4 Map display*

New System LH-X

Question 9.1 In terms of combat operations tasks, how much difference is there between the new system and current systems which it replaces? (Degrees of difference are defined in Question 6.1).

	<u>Operation</u>	<u>Degree of Difference</u>
9.1.1	Target Detection . . . . .	<u>A</u>
9.1.2	Target Attack . . . . .	<u>A</u>
9.1.3	Weapon Aiming and Firing . . .	<u>A</u>
9.1.4	Air-to-Air Combat Flight Maneuvers . . . . .	<u>A</u>
9.1.5	Air-to-Ground Combat Flight Maneuvers . . . . .	<u>D</u>
9.1.6	Multiple Aircraft Operation .	<u>D</u>
9.1.7	Reconnaissance . . . . .	<u>D</u>
9.1.8	Command and Control Informa- tion Processing . . . . .	<u>B</u>
9.1.9	Other (Specify) <i>Threat Detection</i> .	<u>A</u>
9.1.10	Other (Specify) . . . . .	<u>        </u>

Question 9.2 For the operations rated "radically different", what is the nature of the difference?

- 9.1.1 Millimeter wave radar
- 9.1.2 Air-to-air or air-to-ground - Airborne Stinger

Question 9.3 For the operations rated "substantially different", what is the nature of the difference?

- 9.1.8 Much command and control automated

Question 9.4 For the operations rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

New System LH-X

Question 10.1 What are the differences in man-machine skill requirements between the new system and the current systems which it replaces? (Degrees of difference are defined in Question 6.1).

	<u>Skill Category</u>	<u>Degree of Difference</u>
10.1.1	Monitoring Displays . . . . .	<u>B</u>
10.1.2	Tracking Outside Aircraft . . . . .	<u>B</u>
10.1.3	Recognition . . . . .	<u>B</u>
10.1.4	Memory . . . . .	<u>B</u>
10.1.5	Decision-Making . . . . .	<u>C</u>
10.1.6	Physical Responses . . . . .	<u>C</u>
10.1.7	Other (Specify) . . . . . <i>WX</i>	<u>A</u>
10.1.8	Other (Specify) . . . . .	<u>    </u>

Question 10.2 For the skills rated "radically different", what is the nature of the difference?

10.1.7 *Icing conditions okay to fly in*

Question 10.3 For the skills rated "substantially different", what is the nature of the difference?

10.1.1 *Pilot will be unloaded*

10.1.2 *PNVS*

10.1.3 *Helmet display or image intensification - adverse WX*

10.1.4 *More centralized, automated, better organized*

Question 10.4 For the skills rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

10.1.5 *Decision same, amount of information much greater*

10.1.6 *Flying skill requirements reduced*

New System LH-X

Question 11.1 What are the differences in crew interaction requirements between the new system and the current systems which it replaces? (Degrees of difference are defined in Question 6.1).

	<u>Interaction Category</u>	<u>Degree of Difference</u>
11.1.1	Verbal Exchange . . . . .	<u>D</u>
11.1.2	Non-Verbal Exchange . . . . .	<u>B</u>
11.1.3	Coordinated Physical Responses . . . . .	<u>D</u>
11.1.4	Other (Specify) . . . . .	<u>          </u>
11.1.5	Other (Specify) . . . . .	<u>          </u>

Question 11.2 For the interactions rated "radically different", what is the nature of the difference?

Question 11.3 For the interactions rated "substantially different", what is the nature of the difference?

*11.1.2 Cue each other on helmet or CRT*

Question 11.4 For the interactions rated "somewhat different", is the difference enough to require a change in training methods?

New System LH-X

Question 12.1 In terms of training methods, how much difference will there be between the new system and the current systems it replaces? (Note that this differs from Questions 8.1 and 9.1, by emphasizing training difference instead of system operation differences, i.e., differences in system operation might not always necessitate differences in training methods.)

	<u>Training Areas</u>	<u>Degree of Difference</u>
12.1.1	Basic Flying . . . . .	<u>C</u>
12.1.2	Instrument Flying . . . . .	<u>B</u>
12.1.3	Nap of Earth Flying . . . . .	<u>D</u>
12.1.4	Navigation . . . . .	<u>C</u>
12.1.5	Communications . . . . .	<u>B</u>
12.1.6	Target Detection . . . . .	<u>B</u>
12.1.7	Target Attack . . . . .	<u>A</u>
12.1.8	Weapon Aiming and Firing . . . . .	<u>A</u>
12.1.9	Air-to-Air Combat Flight Maneuvers . . . . .	<u>A</u>
12.1.10	Air-to-Ground Combat Flight Maneuvers . . . . .	<u>A</u>
12.1.11	Multiple Aircraft Operations	<u>C</u>
12.1.12	Reconnaissance . . . . .	<u>C</u>
12.1.13	Command and Control Informa- tion Processing . . . . .	<u>A</u>
12.1.14	Other (Specify) . . . . .	<u>          </u>
12.1.15	Other (Specify) . . . . .	<u>          </u>

Question 12.2 For the training areas rated "radically different", what is the nature of the difference?

12.1.7 - 12.1.10 *Air-to-air training; air-to-ground suppression*  
12.1.13 *More information preprocessed*

Question 12.3 For the training areas rated "substantially different", what is the nature of the difference?

12.1.2 *Adverse WX*  
12.1.6 *More wave - better, FLIR, Mast Mounted Sight*

Question 12.4 For the training areas rated "somewhat different", what is the nature of the difference?

12.1.2 *Easier, map of earth at night*  
12.1.4 *Map display, PNVIS*

New System LH-X

Question 12.4 (Continued)

- 12.1.5 *Much easier IX*
- 12.1.11 *More information preprocessed*
- 12.1.12 *(No information recorded)*

New System SEMA-A

Question 6.1 How much difference will there be between the new system and the current systems which it replaces in terms of physical characteristics? (Degrees of difference are defined as: "a" = radically different; "b" = substantially different; "c" = somewhat different; and "d" = minimal or no difference.)

<u>Component</u>	<u>Degree of Difference</u>
6.1.1 Flight Controls . . . . .	<u>A</u>
6.1.2 Instruments . . . . .	<u>A</u>
6.1.3 Displays . . . . .	<u>A</u>
6.1.4 Power Controls . . . . .	<u>A</u>
6.1.5 Seating Arrangement . . . . .	<u>D</u>
6.1.6 Visibility . . . . .	<u>D</u>
6.1.7 Weapon Guidance . . . . .	<u>N/A</u>
6.1.8 Guns . . . . .	<u>N/A</u>
6.1.9 Rockets . . . . .	<u>N/A</u>
6.1.10 Laser . . . . .	<u>N/A</u>
6.1.11 Threat Detection . . . . .	<u>B</u>
6.1.12 Navigation . . . . .	<u>A</u>
6.1.13 Communication . . . . .	<u>A</u>
6.1.14 ECM/EW . . . . .	<u>B</u>
6.1.15 Other (Specify) . . . . .	<u>          </u>
6.1.16 Other (Specify) . . . . .	<u>          </u>

Question 6.2 For the components rated "radically different", what is the nature of the difference?

6.1.1 Hover aircraft

6.1.12 Multiplex

6.1.13 Multiplex

Question 6.3 For the components rated "substantially different", what is the nature of the difference?

6.1.11 Maneuver avoidance

Question 6.4 For the components rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

New System SEMA-X

Question 7.1 How much performance difference will there be between the new system and the current systems which it replaces? (Degrees of difference are defined in Question 6.1).

	<u>Performance</u>	<u>Degree of Difference</u>
7.1.1	Maneuverability . . . . .	<u>A</u>
7.1.2	Flight Stability . . . . .	<u>A</u>
7.1.3	Control Responsiveness . . . . .	<u>A</u>
7.1.4	Flying Workload . . . . .	<u>B</u>
7.1.5	Flight Safety Characteristics . . . . .	<u>D</u>
7.1.6	Complexity . . . . .	<u>A</u>
7.1.7	Speed . . . . .	<u>A</u>
7.1.8	Target Detection Capabilities . . . . .	<u>D</u>
7.1.9	Weapon Range . . . . .	<u>N/A</u>
7.1.10	Weapon Accuracy . . . . .	<u>N/A</u>
7.1.11	Troop Capacity . . . . .	<u>N/A</u>
7.1.12	Cargo Capacity . . . . .	<u>N/A</u>
7.1.13	Other (Specify) . . . <i>VSTOL</i> . . . . .	<u>B</u>
7.1.14	Other (Specify) . . . . .	<u>          </u>

Question 7.2 For the performances rated "radically different", what is the nature of the difference?

7.1.1 <i>More maneuverability</i>	7.1.6 <i>More complex</i>
7.1.2 <i>Full authority system</i>	7.1.7 <i>Higher speed (2)</i>
7.1.3 <i>More responsive</i>	

Question 7.3 For the performances rated "substantially different", what is the nature of the difference?

7.1.8 *Technology update*

Question 7.4 For the performances rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

New System SEMA-X

Question 8.1 In terms of cockpit crew operations, how much difference is there between the new system and the current systems which it replaces? (Degrees of difference are defined in Question 6.1).

<u>Operation</u>	<u>Degree of Difference</u>
8.1.1 Basic Flying . . . . .	<u>C</u>
8.1.2 Instrument Flying . . . . .	<u>C</u>
8.1.3 Nap of Earth Flying . . . . .	<u>N/A</u>
8.1.4 Navigation . . . . .	<u>B</u>
8.1.5 Communication . . . . .	<u>C</u>
8.1.6 Other (Specify) . . . . .	<u>          </u>
8.1.7 Other (Specify) . . . . .	<u>          </u>

Question 8.2 For the operations rated "radically different", what is the nature of the difference?

Question 8.3 For the operations rated "substantially different", what is the nature of the difference?

8.1.4 *Multiplex inertial*

Question 8.4 For the operations rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

8.1.1 *Transition training fixed wing training*

New System SEMA-X

Question 9.1 In terms of combat operations tasks, how much difference is there between the new system and current systems which it replaces? (Degrees of difference are defined in Question 6.1).

	<u>Operation</u>	<u>Degree of Difference</u>
9.1.1	Target Detection . . . . .	<u>A</u>
9.1.2	Target Attack . . . . .	<u>N/A</u>
9.1.3	Weapon Aiming and Firing . . .	<u>N/A</u>
9.1.4	Air-to-Air Combat Flight Maneuvers . . . . .	<u>N/A</u>
9.1.5	Air-to-Ground Combat Flight Maneuvers . . . . .	<u>N/A</u>
9.1.6	Multiple Aircraft Operation .	<u>D</u>
9.1.7	Reconnaissance . . . . .	<u>D</u>
9.1.8	Command and Control Informa- tion Processing . . . . .	<u>A</u>
9.1.9	Other (Specify) . . . . .	<u>          </u>
9.1.10	Other (Specify) . . . . .	<u>          </u>

Question 9.2 For the operations rated "radically different", what is the nature of the difference?

*A's are better*

Question 9.3 For the operations rated "substantially different", what is the nature of the difference?

Question 9.4 For the operations rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

New System SEMA-X

Question 10.1 What are the differences in man-machine skill requirements between the new system and the current systems which it replaces? (Degrees of difference are defined in Question 6.1).

	<u>Skill Category</u>	<u>Degree of Difference</u>
10.1.1	Monitoring Displays . . . . .	<u>A</u>
10.1.2	Tracking Outside Aircraft . . . . .	<u>D</u>
10.1.3	Recognition . . . . .	<u>D</u>
10.1.4	Memory . . . . .	<u>D</u>
10.1.5	Decision-Making . . . . .	<u>B</u>
10.1.6	Physical Responses . . . . .	<u>C</u>
10.1.7	Other (Specify) . . . . .	<u>          </u>
10.1.8	Other (Specify) . . . . .	<u>          </u>

Question 10.2 For the skills rated "radically different", what is the nature of the difference?

- 10.1.1 *Easier*
- 10.1.5 *Some off-loading of work tasks*

Question 10.3 For the skills rated "substantially different", what is the nature of the difference?

Question 10.4 For the skills rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

- 10.1.6 *Transition training*

New System SEMA-X

Question 11.1 What are the differences in crew interaction requirements between the new system and the current systems which it replaces? (Degrees of difference are defined in Question 6.1).

	<u>Interaction Category</u>	<u>Degree of Difference</u>
11.1.1	Verbal Exchange . . . . .	<u>D</u>
11.1.2	Non-Verbal Exchange . . . . .	<u>D</u>
11.1.3	Coordinated Physical Responses . . . . .	<u>D</u>
11.1.4	Other (Specify) . . . . .	<u>          </u>
11.1.5	Other (Specify) . . . . .	<u>          </u>

Question 11.2 For the interactions rated "radically different", what is the nature of the difference?

Question 11.3 For the interactions rated "substantially different", what is the nature of the difference?

Question 11.4 For the interactions rated "somewhat different", is the difference enough to require a change in training methods?

New System SEMA-X

Question 12.1 In terms of training methods, how much difference will there be between the new system and the current systems it replaces? (Note that this differs from Questions 8.1 and 9.1, by emphasizing training difference instead of system operation differences, i.e., differences in system operation might not always necessitate differences in training methods.)

	<u>Training Areas</u>	<u>Degree of Difference</u>
12.1.1	Basic Flying . . . . .	<u>B</u>
12.1.2	Instrument Flying . . . . .	<u>D</u>
12.1.3	Nap of Earth Flying . . . . .	<u>N/A</u>
12.1.4	Navigation . . . . .	<u>C</u>
12.1.5	Communications . . . . .	<u>C</u>
12.1.6	Target Detection . . . . .	<u>D</u>
12.1.7	Target Attack . . . . .	<u>N/A</u>
12.1.8	Weapon Aiming and Firing . . . . .	<u>N/A</u>
12.1.9	Air-to-Air Combat Flight Maneuvers . . . . .	<u>A</u>
12.1.10	Air-to-Ground Combat Flight Maneuvers . . . . .	<u>N/A</u>
12.1.11	Multiple Aircraft Operations	<u>D</u>
12.1.12	Reconnaissance . . . . .	<u>D</u>
12.1.13	Command and Control Informa- tion Processing . . . . .	<u>B</u>
12.1.14	Other (Specify) . . . . .	<u>      </u>
12.1.15	Other (Specify) . . . . .	<u>      </u>

Question 12.2 For the training areas rated "radically different", what is the nature of the difference?

12.1.9 Threat detection followed by evasive maneuvers

Question 12.3 For the training areas rated "substantially different", what is the nature of the difference?

12.1.1 Transition

12.1.13 Easier by preprocessing

Question 12.4 For the training areas rated "somewhat different", what is the nature of the difference?

12.1.3 Multiplex overall training easier

Question 13 As stated at the beginning of the questionnaire the objective of this study is to identify new Army aviation systems and system characteristics which will require behavioral changes necessitating new training techniques.

Given this objective, is there anything further which you believe will require changes in training as a result of the introduction of new Army aviation systems?

*Advanced Scout Helicopter ROC describes LH-X*

*LH-X = Far Term Scout*

QUESTIONNAIRE FOR UNIVERSITY OF DAYTON STUDY OF ARMY  
 AVIATION TRAINING R&D REQUIREMENTS  
 (ARMY RESEARCH INSTITUTE FIELD UNIT  
 CONTRACT NO. MDA903-80-C-0229

DATE 28 May 1980

QUESTIONNAIRE NO. 3

RESPONDER'S NAME \_\_\_\_\_

RESPONDER'S ORGANIZATION \_\_\_\_\_

RESPONDER'S TITLE OR POSITION \_\_\_\_\_

The objective of this study is to identify new Army aviation systems and system characteristics which will require behavioral changes necessitating new training techniques.

Question 1 What new systems will be in the U.S. Army aviation inventory for the period of 1985 to 2000 (within your area of cognizance)?

- 1.1 Advanced Scout Helicopter (ASH)
- 1.2 Near Term Scout Helicopter
- 1.3 \_\_\_\_\_
- 1.4 \_\_\_\_\_

Question 2 What are the probabilities that each of these new systems will be introduced into Army inventory? (Values of probability are defined as 1.0 = almost certain, 0.8 = highly probable, 0.6 = probable, 0.4 = uncertain, and 0.2 = highly unlikely.)

<u>New System</u>	<u>Probability</u>
2.1 <u>Advanced Scout Helicopter</u>	<u>0.2 - 0.4</u>
2.2 <u>Near Term Scout Helicopter</u>	<u>0.8</u>
2.3 _____	_____
2.4 _____	_____



New System Advanced Scout Helicopter

Question 6.1 How much difference will there be between the new system and the current systems which it replaces in terms of physical characteristics? (Degrees of difference are defined as: "a" = radically different; "b" = substantially different; "c" = somewhat different; and "d" = minimal or no difference.)

<u>Component</u>	<u>Degree of Difference</u>
6.1.1 Flight Controls . . . . .	<u>A</u>
6.1.2 Instruments . . . . .	<u>A</u>
6.1.3 Displays . . . . .	<u>A</u>
6.1.4 Power Controls . . . . .	<u>C</u>
6.1.5 Seating Arrangement . . . . .	<u>C</u>
6.1.6 Visibility . . . . .	<u>D</u>
6.1.7 Weapon Guidance . . . . .	<u>A</u>
6.1.8 Guns . . . . .	<u>A</u>
6.1.9 Rockets . . . . .	<u>A</u>
6.1.10 Laser . . . . .	<u>A</u>
6.1.11 Threat Detection . . . . .	<u>A</u>
6.1.12 Navigation . . . . .	<u>A</u>
6.1.13 Communication . . . . .	<u>A</u>
6.1.14 ECM/EW . . . . .	<u>A</u>
6.1.15 Other (Specify) . . . . .	<u>          </u>
6.1.16 Other (Specify) . . . . .	<u>          </u>

Question 6.2 For the components rated "radically different", what is the nature of the difference?

6.1.1 *Fiber optics for greater reliability*

6.1.2 - 6.1.3 *Electronic digital systems management, warning indicators*

Question 6.3 For the components rated "substantially different", what is the nature of the difference?  
(continued on attached)

Question 6.4 For the components rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

New System Advanced Scout Helicopter

Question 6.2 (continued)

- 6.1.7 Mast Mounted Sight
- 6.1.9 Air-to-air, air-to-ground, and anti-tank missiles
- 6.1.10 - 6.1.13 Same as Near Term Scout Helicopter but more detection devices such as acoustic sensors, advanced in technology
- 6.1.4 Better jammers, more digital information without voice communication

New System Advanced Scout Helicopter

Question 7.1 How much performance difference will there be between the new system and the current systems which it replaces? (Degrees of difference are defined in Question 6.1).

	<u>Performance</u>	<u>Degree of Difference</u>
7.1.1	Maneuverability . . . . .	<u>B</u>
7.1.2	Flight Stability . . . . .	<u>B</u>
7.1.3	Control Responsiveness . . . . .	<u>B</u>
7.1.4	Flying Workload . . . . .	<u>A</u>
7.1.5	Flight Safety Characteristics . . . . .	<u>B</u>
7.1.6	Complexity . . . . .	<u>B</u>
7.1.7	Speed . . . . .	<u>B</u>
7.1.8	Target Detection Capabilities . . . . .	<u>A</u>
7.1.9	Weapon Range . . . . .	<u>A</u>
7.1.10	Weapon Accuracy . . . . .	<u>A</u>
7.1.11	Troop Capacity . . . . .	<u>N/A</u>
7.1.12	Cargo Capacity . . . . .	<u>N/A</u>
7.1.13	Other (Specify) . . . . .	<u>          </u>
7.1.14	Other (Specify) . . . . .	<u>          </u>

Question 7.2 For the performances rated "radically different", what is the nature of the difference?

- 7.1.4 *Employ of hover-hold and work-saving devices*
- 7.1.8 - 7.1.10 *The range, type and make-up of sensors such as FLIR, acoustic, new generation of sensors*

Question 7.3 For the performances rated "substantially different", what is the nature of the difference?

- 7.1.1 - 7.1.3 *New aircraft, twin engines, built for role, new design parameters*
- 7.1.5 *Crashworthy, survivability, better armament, and fly by light fiber optics*
- 7.1.6 *More black boxes*      7.1.7 *Faster*

Question 7.4 For the performances rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

New System Advanced Scout Helicopter

Question 8.1 In terms of cockpit crew operations, how much difference is there between the new system and the current systems which it replaces? (Degrees of difference are defined in Question 6.1).

<u>Operation</u>	<u>Degree of Difference</u>
8.1.1 Basic Flying . . . . .	<u>D</u>
8.1.2 Instrument Flying . . . . .	<u>C</u>
8.1.3 Nap of Earth Flying . . . . .	<u>B</u>
8.1.4 Navigation . . . . .	<u>B</u>
8.1.5 Communication <sup>(much simpler digitalized devices)</sup> . . . . .	<u>B</u>
8.1.6 Other (Specify) . . . . .	<u>          </u>
8.1.7 Other (Specify) . . . . .	<u>          </u>

Question 8.2 For the operations rated "radically different", what is the nature of the difference?

Question 8.3 For the operations rated "substantially different", what is the nature of the difference?

- 8.1.3 - 8.1.4 *PMD, DOPPLER, IACS, GPS, PLR automatically update positions*
- 8.1.5 *Digital capabilities and data bus*

Question 8.4 For the operations rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

8.1.2 *A lot easier*

New System Advanced Scout Helicopter

Question 9.1 In terms of combat operations tasks, how much difference is there between the new system and current systems which it replaces? (Degrees of difference are defined in Question 6.1).

	<u>Operation</u>	<u>Degree of Difference</u>
9.1.1	Target Detection . . . . .	<u>A</u>
9.1.2	Target Attack . . . . .	<u>A</u>
9.1.3	Weapon Aiming and Firing . . .	<u>A</u>
9.1.4	Air-to-Air Combat Flight Maneuvers . . . . .	<u>A</u>
9.1.5	Air-to-Ground Combat Flight Maneuvers . . . . .	<u>A</u>
9.1.6	Multiple Aircraft Operation .	<u>A</u>
9.1.7	Reconnaissance . . . . .	<u>A</u>
9.1.8	Command and Control Informa- tion Processing . . . . .	<u>A</u>
9.1.9	Other (Specify) . . . . .	<u>          </u>
9.1.10	Other (Specify) . . . . .	<u>          </u>

Question 9.2 For the operations rated "radically different", what is the nature of the difference?

*Due to sensor capabilities, tactical acquisition, cuing, video recording, and use of mast mounted sight, target laser, requires coordination of gunship activities.*

Question 9.3 For the operations rated "substantially different", what is the nature of the difference?

Question 9.4 For the operations rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

New System Advanced Scout Helicopter

Question 10.1 What are the differences in man-machine skill requirements between the new system and the current systems which it replaces? (Degrees of difference are defined in Question 6.1).

<u>Skill Category</u>	<u>Degree of Difference</u>
10.1.1 Monitoring Displays . . . . .	<u>A</u>
10.1.2 Tracking Outside Aircraft . .	<u>A</u>
10.1.3 Recognition . . . . .	<u>C</u>
10.1.4 Memory . . . . .	<u>D</u>
10.1.5 Decision-Making . . . . .	<u>D</u>
10.1.6 Physical Responses . . . . .	<u>D</u>
10.1.7 Other (Specify) . . . . .	<u>          </u>
10.1.8 Other (Specify) . . . . .	<u>          </u>

Question 10.2 For the skills rated "radically different", what is the nature of the difference?

- 10.1.1 Digital electronic devices
- 10.1.2 Pilot night vision system versus night vision goggle

Question 10.3 For the skills rated "substantially different", what is the nature of the difference?

Question 10.4 For the skills rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

- 10.1.3 CRT display

New System Advanced Scout Helicopter

Question 11.1 What are the differences in crew interaction requirements between the new system and the current systems which it replaces? (Degrees of difference are defined in Question 6.1).

	<u>Interaction Category</u>	<u>Degree of Difference</u>
11.1.1	Verbal Exchange . . . . .	<u>D</u>
11.1.2	Non-Verbal Exchange . . . . .	<u>D</u>
11.1.3	Coordinated Physical Responses . . . . .	<u>D</u>
11.1.4	Other (Specify) . . . . .	<u>          </u>
11.1.5	Other (Specify) . . . . .	<u>          </u>

Question 11.2 For the interactions rated "radically different", what is the nature of the difference?

Question 11.3 For the interactions rated "substantially different", what is the nature of the difference?

Question 11.4 For the interactions rated "somewhat different", is the difference enough to require a change in training methods?

New System Advanced Scout Helicopter

Question 12.1 In terms of training methods, how much difference will there be between the new system and the current systems it replaces? (Note that this differs from Questions 8.1 and 9.1, by emphasizing training difference instead of system operation differences, i.e., differences in system operation might not always necessitate differences in training methods.)

	<u>Training Areas</u>	<u>Degree of Difference</u>
12.1.1	Basic Flying . . . . .	<u>A</u>
12.1.2	Instrument Flying . . . . .	<u>C</u>
12.1.3	Nap of Earth Flying . . . . .	<u>C</u>
12.1.4	Navigation . . . . .	<u>C</u>
12.1.5	Communications . . . . .	<u>C</u>
12.1.6	Target Detection . . . . .	<u>A</u>
12.1.7	Target Attack . . . . .	<u>A</u>
12.1.8	Weapon Aiming and Firing . . . . .	<u>A</u>
12.1.9	Air-to-Air Combat Flight Maneuvers . . . . .	<u>A</u>
12.1.10	Air-to-Ground Combat Flight Maneuvers . . . . .	<u>A</u>
12.1.11	Multiple Aircraft Operations	<u>C</u>
12.1.12	Reconnaissance . . . . .	<u>A</u>
12.1.13	Command and Control Informa- tion Processing . . . . .	<u>A</u>
12.1.14	Other (Specify) . . . . .	<u>          </u>
12.1.15	Other (Specify) . . . . .	<u>          </u>

Question 12.2 For the training areas rated "radically different", what is the nature of the difference?

12.1.1 HUD and PNVS

12.1.6 - 12.1.10 Mast mounted system, sensor capabilities, information processing capabilities,

Question 12.3 For the training areas rated "substantially different", what is the nature of the difference?  
(continued on attached)

Question 12.4 For the training areas rated "somewhat different", what is the nature of the difference?

12.1.2 Digital equipment

12.1.3 Aircraft system is much easier to fly

(continued on attached)

New System Advanced Scout Helicopter

Question 12.2 (Continued)

- 12.1.10 *computer, new weapon systems*
- 12.1.12 *Mast mounted system, video recorder*
- 12.1.13 *Better communication and data handling*

Question 12.4 (Continued)

- 12.1.4 *Projected map display, Doppler*
- 12.1.5 *Multifrequency model*
- 12.1.11 *Coordinate gunships*

New System Near Term Scout Helicopter

Question 6.1 How much difference will there be between the new system and the current systems which it replaces in terms of physical characteristics? (Degrees of difference are defined as: "a" = radically different; "b" = substantially different; "c" = somewhat different; and "d" = minimal or no difference.)

<u>Component</u>	<u>Degree of Difference</u>
6.1.1 Flight Controls . . . . .	<u>D</u>
6.1.2 Instruments . . . . .	<u>D</u>
6.1.3 Displays . . . . .	<u>A</u>
6.1.4 Power Controls . . . . .	<u>D</u>
6.1.5 Seating Arrangement . . . . .	<u>D</u>
6.1.6 Visibility . . . . .	<u>D</u>
6.1.7 Weapon Guidance . . . . .	<u>C</u>
6.1.8 Guns . . . . .	<u>C</u>
6.1.9 Rockets . . . . .	<u>C</u>
6.1.10 Laser . . . . .	<u>B</u>
6.1.11 Threat Detection . . . . .	<u>B</u>
6.1.12 Navigation . . . . .	<u>C</u>
6.1.13 Communication . . . . .	<u>C</u>
6.1.14 ECM/EW . . . . .	<u>C</u>
6.1.15 Other (Specify) <i>FLIR (night vision)</i>	<u>C</u>
6.1.16 Other (Specify) <i>FLIR (night TAS)</i>	<u>B</u>

Question 6.2 For the components rated "radically different", what is the nature of the difference?

6.1.3 *Feature of CRT, tracker, cuing, laser*

Question 6.3 For the components rated "substantially different", what is the nature of the difference?

6.1.10 *New application for range designation and target location*

6.1.11 *Mast mounted sight, FLIR, LLTV, laser*

6.1.16 *FLIR on night target acquisition*

Question 6.4 For the components rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

6.1.7 - 6.1.9 *Air-to-air missile and fire and forget*

6.1.12 & 6.1.14 *Mast mounted sight*

6.1.13 *Better radio communication equipment*

6.1.15 *FLIR night vision*

New System Near Term Scout Helicopter

Question 7.1 How much performance difference will there be between the new system and the current systems which it replaces? (Degrees of difference are defined in Question 6.1).

	<u>Performance</u>	<u>Degree of Difference</u>
7.1.1	Maneuverability . . . . .	<u>D</u>
7.1.2	Flight Stability . . . . .	<u>D</u>
7.1.3	Control Responsiveness . . . . .	<u>D</u>
7.1.4	Flying Workload . . . . .	<u>B(1-pilot)</u> <u>C(2-pilot)</u>
7.1.5	Flight Safety Characteristics . . . . .	<u>D</u>
7.1.6	Complexity . . . . .	<u>C</u>
7.1.7	Speed . . . . .	<u>D</u>
7.1.8	Target Detection Capabilities . . . . .	<u>B</u>
7.1.9	Weapon Range . . . . .	<u>B</u>
7.1.10	Weapon Accuracy . . . . .	<u>B</u>
7.1.11	Troop Capacity . . . . .	<u>N/A</u>
7.1.12	Cargo Capacity . . . . .	<u>N/A</u>
7.1.13	Other (Specify) . . . . .	_____
7.1.14	Other (Specify) . . . . .	_____

Question 7.2 For the performances rated "radically different", what is the nature of the difference?

Question 7.3 For the performances rated "substantially different", what is the nature of the difference?

- 7.1.4 Increase workload because of additional capabilities under different conditions
- 7.1.8 Use of TV and FLIR systems allowing target picture enlargement
- 7.1.9 - 7.1.10 New capabilities

Question 7.4 For the performances rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

- 7.1.6 More missions

New System Near Term Scout Helicopter

Question 8.1 In terms of cockpit crew operations, how much difference is there between the new system and the current systems which it replaces? (Degrees of difference are defined in Question 6.1).

<u>Operation</u>	<u>Degree of Difference</u>
8.1.1 Basic Flying . . . . .	<u>D</u>
8.1.2 Instrument Flying . . . . .	<u>D</u>
8.1.3 Nap of Earth Flying . . . . .	<u>D</u>
8.1.4 Navigation . . . . .	<u>C</u>
8.1.5 Communication . . . . .	<u>C</u>
8.1.6 Other (Specify) . . . . .	<u>          </u>
8.1.7 Other (Specify) . . . . .	<u>          </u>

Question 8.2 For the operations rated "radically different", what is the nature of the difference?

Question 8.3 For the operations rated "substantially different", what is the nature of the difference?

Question 8.4 For the operations rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

- 8.1.4 Projected map display and DOPPLER
- 8.1.5 Better communication to NOE and multifunction radios

New System Near Term Scout Helicopter

Question 9.1 In terms of combat operations tasks, how much difference is there between the new system and current systems which it replaces? (Degrees of difference are defined in Question 6.1).

	<u>Operation</u>	<u>Degree of Difference</u>
9.1.1	Target Detection . . . . .	<u>A</u>
9.1.2	Target Attack . . . . .	<u>A</u>
9.1.3	Weapon Aiming and Firing . . . . .	<u>A</u>
9.1.4	Air-to-Air Combat Flight Maneuvers . . . . .	<u>A</u>
9.1.5	Air-to-Ground Combat Flight Maneuvers . . . . .	<u>A</u>
9.1.6	Multiple Aircraft Operation . . . . .	<u>B</u>
9.1.7	Reconnaissance . . . . .	<u>B</u>
9.1.8	Command and Control Informa- tion Processing . . . . .	<u>B</u>
9.1.9	Other (Specify) . . . . .	<u>    </u>
9.1.10	Other (Specify) . . . . .	<u>    </u>

Question 9.2 For the operations rated "radically different", what is the nature of the difference?

- 9.1.1 - 9.1.3 *New systems allow helicopters to hop behind bridges and buildings. New capabilities of using CRT.*
- 9.1.4 *New tactics - self defense and protecting attack helicopters*
- 9.1.5 *Employ air-to-ground defense suppression weapons*

Question 9.3 For the operations rated "substantially different", what is the nature of the difference?

- 9.1.6 *A function of tactics and mission scenarios*
- 9.1.7 *Mast mounted sight and video recording systems*
- 9.1.8 *Provide greater location accuracy to ground commanders. This presents more workload for scout helicopter.*

Question 9.4 For the operations rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

New System Near Term Scout Helicopter

Question 10.1 What are the differences in man-machine skill requirements between the new system and the current systems which it replaces? (Degrees of difference are defined in Question 6.1).

	<u>Skill Category</u>	<u>Degree of Difference</u>
10.1.1	Monitoring Displays . . . . .	<u>B(Pilot)</u> <u>A(Observer)</u>
10.1.2	Tracking Outside Aircraft . . . . .	<u>D</u>
10.1.3	Recognition . . . . .	<u>C</u>
10.1.4	Memory . . . . .	<u>B</u>
10.1.5	Decision-Making . . . . .	<u>C(Pilot)</u> <u>B(Observer)</u>
10.1.6	Physical Responses . . . . .	<u>C</u>
10.1.7	Other (Specify) . . . . .	<u>                    </u>
10.1.8	Other (Specify) . . . . .	<u>                    </u>

Question 10.2 For the skills rated "radically different", what is the nature of the difference?

10.1.1 *CRT inputs and outputs are new*

Question 10.3 For the skills rated "substantially different", what is the nature of the difference?

10.1.4 *More demand on observer (intelligent and bright persons required)*

10.1.5 *Systems have a marked impact on observer's workload*

Question 10.4 For the skills rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

10.1.3 *Using CRT display instead of binoculars*

10.1.6 *Due to new electronic devices*

New System Near Term Scout Helicopter

Question 11.1 What are the differences in crew interaction requirements between the new system and the current systems which it replaces? (Degrees of difference are defined in Question 6.1).

	<u>Interaction Category</u>	<u>Degree of Difference</u>
11.1.1	Verbal Exchange . . . . .	<u>B</u>
11.1.2	Non-Verbal Exchange . . . . .	<u>D</u>
11.1.3	Coordinated Physical Responses . . . . .	<u>D</u>
11.1.4	Other (Specify) . . . . .	<u>          </u>
11.1.5	Other (Specify) . . . . .	<u>          </u>

Question 11.2 For the interactions rated "radically different", what is the nature of the difference?

Question 11.3 For the interactions rated "substantially different", what is the nature of the difference?

11.1.1 Mast mounted sight (pilot works from two field references - CRT and visual).

Question 11.4 For the interactions rated "somewhat different", is the difference enough to require a change in training methods?

New System Near Term Scout Helicopter

Question 12.1 In terms of training methods, how much difference will there be between the new system and the current systems it replaces? (Note that this differs from Questions 8.1 and 9.1, by emphasizing training difference instead of system operation differences, i.e., differences in system operation might not always necessitate differences in training methods.)

	<u>Training Areas</u>	<u>Degree of Difference</u>
12.1.1	Basic Flying . . . . .	<u>D</u>
12.1.2	Instrument Flying . . . . .	<u>C</u>
12.1.3	Map of Earth Flying . . . . .	<u>C</u>
12.1.4	Navigation . . . . .	<u>C</u>
12.1.5	Communications . . . . .	<u>C</u>
12.1.6	Target Detection . . . . .	<u>B</u>
12.1.7	Target Attack . . . . .	<u>B</u>
12.1.8	Weapon Aiming and Firing . .	<u>B</u>
12.1.9	Air-to-Air Combat Flight Maneuvers . . . . .	<u>A</u>
12.1.10	Air-to-Ground Combat Flight Maneuvers . . . . .	<u>A</u>
12.1.11	Multiple Aircraft Operations	<u>C</u>
12.1.12	Reconnaissance . . . . .	<u>B</u>
12.1.13	Command and Control Informa- tion Processing . . . . .	<u>C</u>
12.1.14	Other (Specify) . . . . .	<u>        </u>
12.1.15	Other (Specify) . . . . .	<u>        </u>

Question 12.2 For the training areas rated "radically different", what is the nature of the difference?

*12.1.9 - 12.1.10 New concept and tactics, Mast Mounted Sight*

Question 12.3 For the training areas rated "substantially different", what is the nature of the difference?

*12.1.6 - 12.1.8 Mast Mounted Sight and air-to-air capabilities*

*12.1.12 Mast Mounted Sight*

Question 12.4 For the training areas rated "somewhat different", what is the nature of the difference?

*12.1.2 - 12.1.4 DOPPLER and projected map display*

*12.1.5 More secure and multi-function radios*

*(continued on attached)*

New System Near Term Scout Helicopter

Question 12.4 (Continued)

- 12.1.11 *Coordinate gunships and relief of aircraft on station*
- 12.1.13 *Due to the nature of avionics installed in the aircraft (better equipment, more secure)*

Question 13 As stated at the beginning of the questionnaire the objective of this study is to identify new Army aviation systems and system characteristics which will require behavioral changes necessitating new training techniques.

Given this objective, is there anything further which you believe will require changes in training as a result of the introduction of new Army aviation systems?

1. *Need to emphasize man-machine interface and crew coordination issues.*
2. *Target acquisition, target designation, air-to-air combat are new missions.*
3. *Observers require the same type of training as pilots.*
4. *Maintenance aspects have to be addressed. Will need higher skill level and better trained personnel.*
5. *Crew needs to deal with electronic displays and advisory devices, coordinate night battle conditions.*
6. *Need to discriminate against color and voice symbology in Advanced Scout Helicopter.*

QUESTIONNAIRE FOR UNIVERSITY OF DAYTON STUDY OF ARMY  
 AVIATION TRAINING R&D REQUIREMENTS  
 (ARMY RESEARCH INSTITUTE FIELD UNIT  
 CONTRACT NO. MDA903-80-C-0229

DATE 28 May 1980

QUESTIONNAIRE NO. 4

RESPONDER'S NAME \_\_\_\_\_

RESPONDER'S ORGANIZATION \_\_\_\_\_

RESPONDER'S TITLE OR POSITION \_\_\_\_\_

The objective of this study is to identify new Army aviation systems and system characteristics which will require behavioral changes necessitating new training techniques.

Question 1 What new systems will be in the U.S. Army aviation inventory for the period of 1985 to 2000 (within your area of cognizance)?

- 1.1 Black Hawk (SOTAS, Hellfire, GPS)
- 1.2 Black Hawk with SOTAS
- 1.3 Black Hawk with Hellfire Missile
- 1.4 Black Hawk with GPS

Question 2 What are the probabilities that each of these new systems will be introduced into Army inventory? (Values of probability are defined as 1.0 = almost certain, 0.8 = highly probable, 0.6 = probable, 0.4 = uncertain, and 0.2 = highly unlikely.)

	<u>New System</u>	<u>Probability</u>
2.1	<u>Black Hawk</u>	<u>1.0</u>
2.2	<u>Black Hawk with SOTAS</u>	<u>1.0</u>
2.3	<u>Black Hawk with Hellfire Missile</u>	<u>1.0</u>
2.4	<u>Black Hawk with GPS</u>	<u>1.0</u>

Question 3 What are the scheduled years for introducing each of these new aviation systems?

	<u>New System</u>	<u>Year</u>
3.1	<u>Black Hawk</u>	<u>1979</u>
3.2	<u>Black Hawk with SOTAS</u>	<u>?</u>
3.3	<u>Black Hawk with Hellfire Missile</u>	<u>?</u>
3.4	<u>Black Hawk with GPS</u>	<u>1985</u>

Question 4 How extensive will be the use of each of these new systems? (Degrees of use are defined as "a" = more than three thousand items, "b" = one to three thousand items, "c" = three hundred to one thousand items, "d" = one to three hundred items, and "e" = thirty to one hundred items.)

	<u>New System</u>	<u>Degree of Use</u>
4.1	<u>Black Hawk</u>	<u>B (but are not all funded)</u>
4.2	<u>Black Hawk with SOTAS</u>	<u>D or E</u>
4.3	<u>Black Hawk with Hellfire Missile</u>	<u>?</u>
4.4	<u>Black Hawk with GPS</u>	<u>? (mainly for medical evacuation aircraft)</u>

Question 5 What are the current systems, if any, to be replaced by each of these systems?

	<u>New Systems</u>	<u>Current Systems</u>
5.1	<u>Black Hawk</u>	<u>(maintain a ratio of UH-1 15BH/23UH-1)</u>
5.2	<u>Black Hawk with SOTAS</u>	<u>new</u>
5.3	<u>Black Hawk with Hellfire Missile</u>	<u>new</u>
5.4	<u>Black Hawk with GPS</u>	<u>existing navigation system</u>

The questionnaire responder should answer Questions 6 to 12, on separate sheets, for each of the new systems identified in the answer to Question 1.

New System Black Hawk (SOTAS, Hellfire Missile, GPS)

Question 6.1 How much difference will there be between the new system and the current systems which it replaces in terms of physical characteristics? (Degrees of difference are defined as: "a" = radically different; "b" = substantially different; "c" = somewhat different; and "d" = minimal or no difference.)

<u>Component</u>	<u>Degree of Difference</u>
6.1.1 Flight Controls . . . . .	<u>B</u>
6.1.2 Instruments . . . . .	<u>B</u>
6.1.3 Displays . . . . .	<u>B</u>
6.1.4 Power Controls . . . . .	<u>B</u>
6.1.5 Seating Arrangement . . . . .	<u>D</u>
6.1.6 Visibility . . . . .	<u>C</u>
6.1.7 Weapon Guidance . . . . .	<u>B</u>
6.1.8 Guns . . . . .	<u>B</u>
6.1.9 Rockets . . . . .	<u>B</u>
6.1.10 Laser . . . . .	<u>B</u>
6.1.11 Threat Detection . . . . .	<u>B</u>
6.1.12 Navigation . . . . .	<u>B</u>
6.1.13 Communication . . . . .	<u>B</u>
6.1.14 ECM/EW . . . . .	<u>B</u>
6.1.15 Other (Specify) <i>Tilt Rotor (SB-15)</i>	<u>B</u>
6.1.16 Other (Specify) <i>Advanced Blade Concept</i>	<u>B</u>

Question 6.2 For the components rated "radically different", what is the nature of the difference?

Question 6.3 For the components rated "substantially different", what is the nature of the difference?

6.1.1 - 6.1.4 *Less weight, more reliable, state-of-art improvement*

6.1.6 *Improve small display panel (continued on attached)*

Question 6.4 For the components rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

New System Black Hawk (SOTAS, Hellfire Missile, GPS)

Question 6.3 (Continued)

6.1.7 - 6.1.14 *New technology*

6.1.15 *Tilt rotor*

6.1.16 *More flexible, low speed and fixed wing and ability to hop like helicopters*

New System Black Hawk (SOTAS, Hellfire Missile, GPS)

Question 7.1 How much performance difference will there be between the new system and the current systems which it replaces? (Degrees of difference are defined in Question 6.1).

	<u>Performance</u>	<u>Degree of Difference</u>
7.1.1	Maneuverability . . . . .	<u>B</u>
7.1.2	Flight Stability . . . . .	<u>B</u>
7.1.3	Control Responsiveness . . . . .	<u>B</u>
7.1.4	Flying Workload . . . . .	<u>B</u>
7.1.5	Flight Safety Characteristics . . . . .	<u>D</u>
7.1.6	Complexity . . . . .	<u>B</u>
7.1.7	Speed . . . . .	<u>B</u>
7.1.8	Target Detection Capabilities . . . . .	<u>B</u>
7.1.9	Weapon Range . . . . .	<u>B</u>
7.1.10	Weapon Accuracy . . . . .	<u>B</u>
7.1.11	Troop Capacity . . . . .	<u>D</u>
7.1.12	Cargo Capacity . . . . .	<u>C</u>
7.1.13	Other (Specify) . . . . .	<u>          </u>
7.1.14	Other (Specify) . . . . .	<u>          </u>

Question 7.2 For the performances rated "radically different", what is the nature of the difference?

Question 7.3 For the performances rated "substantially different", what is the nature of the difference?

7.1.1 - 7.1.3 *Less weight, friction-free, state-of-art*

7.1.4 *50 percent reduction in workload (but will introduce additional functions for DOPPLER and GPS capabilities)  
(continued on attached)*

Question 7.4 For the performances rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

7.1.12 *Dimensions are the same, but can carry more weight*

New System Black Hawk (SOTAS, Hellfire Missile, GPS)

Question 7.3 (Continued)

- 7.1.6 *More complex*
- 7.1.7 *Higher speed*
- 7.1.8 *Digital display*
- 7.1.9 *Use of rockets*
- 7.1.10 *New sighting device and laser ranging*

New System Black Hawk (SOTAS, Hellfire Missile, GPS)

Question 8.1 In terms of cockpit crew operations, how much difference is there between the new system and the current systems which it replaces? (Degrees of difference are defined in Question 6.1).

<u>Operation</u>	<u>Degree of Difference</u>
8.1.1 Basic Flying . . . . .	<u>B</u>
8.1.2 Instrument Flying . . . . .	<u>B</u>
8.1.3 Nap of Earth Flying . . . . .	<u>D</u>
8.1.4 Navigation . . . . .	<u>B</u>
8.1.5 Communication . . . . .	<u>D</u>
8.1.6 Other (Specify) . . . . .	<u>          </u>
8.1.7 Other (Specify) . . . . .	<u>          </u>

Question 8.2 For the operations rated "radically different", what is the nature of the difference?

Question 8.3 For the operations rated "substantially different", what is the nature of the difference?

- 8.1.1 *Functions are the same but characteristics are different due to side arm for stick control*
- 8.1.2 *Use of CRT, digital readouts, and automatic for IFR (Instrument Flight Rules)*
- 8.1.4 *Simplified by GPS and DOPPLER*

Question 8.4 For the operations rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

New System Black Hawk (SOTAS, Hellfire Missile, GPS)

Question 9.1 In terms of combat operations tasks, how much difference is there between the new system and current systems which it replaces? (Degrees of difference are defined in Question 6.1).

	<u>Operation</u>	<u>Degree of Difference</u>
9.1.1	Target Detection . . . . .	<u>B</u>
9.1.2	Target Attack . . . . .	<u>B</u>
9.1.3	Weapon Aiming and Firing . . .	<u>B</u>
9.1.4	Air-to-Air Combat Flight Maneuvers . . . . .	<u>D</u>
9.1.5	Air-to-Ground Combat Flight Maneuvers . . . . .	<u>C</u>
9.1.6	Multiple Aircraft Operation .	<u>B</u>
9.1.7	Reconnaissance . . . . .	<u>B</u>
9.1.8	Command and Control Informa- tion Processing . . . . .	<u>B</u>
9.1.9	Other (Specify) . . . . .	<u>          </u>
9.1.10	Other (Specify) . . . . .	<u>          </u>

Question 9.2 For the operations rated "radically different", what is the nature of the difference?

Question 9.3 For the operations rated "substantially different", what is the nature of the difference?

9.1.1 - 9.1.2 Army digital aircraft systems

9.1.3 HUD (better sighting and tracking equipment)

9.1.6 Improve rendezvous capability when operating with other aircraft because of GPS

9.1.7 SOTAS and GPS      9.1.8 SOTAS

Question 9.4 For the operations rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

9.1.5 Different equipment, more maneuver

New System Black Hawk (SOTAS, Hellfire Missile, GPS)

Question 10.1 What are the differences in man-machine skill requirements between the new system and the current systems which it replaces? (Degrees of difference are defined in Question 6.1).

	<u>Skill Category</u>	<u>Degree of Difference</u>
10.1.1	Monitoring Displays . . . . .	<u>B</u>
10.1.2	Tracking Outside Aircraft . . . . .	<u>D</u>
10.1.3	Recognition . . . . .	<u>C</u>
10.1.4	Memory . . . . .	<u>D</u>
10.1.5	Decision-Making . . . . .	<u>D</u>
10.1.6	Physical Responses . . . . .	<u>B</u>
10.1.7	Other (Specify) . . . . .	_____
10.1.8	Other (Specify) . . . . .	_____

Question 10.2 For the skills rated "radically different", what is the nature of the difference?

Question 10.3 For the skills rated "substantially different", what is the nature of the difference?

10.1.1 Digital and CRT equipment

10.1.6 Side arm control (fire with one hand, other hand and feet are free)

Question 10.4 For the skills rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

10.1.3 Use of sensors (FLIR, IR)

New System Black Hawk (SOTAS, Hellfire, GPS)

Question 11.1 What are the differences in crew interaction requirements between the new system and the current systems which it replaces? (Degrees of difference are defined in Question 6.1).

	<u>Interaction Category</u>	<u>Degree of Difference</u>
11.1.1	Verbal Exchange . . . . .	<u>D</u>
11.1.2	Non-Verbal Exchange . . . . .	<u>B</u>
11.1.3	Coordinated Physical Responses . . . . .	<u>D</u>
11.1.4	Other (Specify) . . . . .	<u>          </u>
11.1.5	Other (Specify) . . . . .	<u>          </u>

Question 11.2 For the interactions rated "radically different", what is the nature of the difference?

Question 11.3 For the interactions rated "substantially different", what is the nature of the difference?

11.1.2 During air-to-air engagement

Question 11.4 For the interactions rated "somewhat different", is the difference enough to require a change in training methods?

New System Black Hawk (SOTAS, Hellfire Missile, GPS)

Question 12.1 In terms of training methods, how much difference will there be between the new system and the current systems it replaces? (Note that this differs from Questions 8.1 and 9.1, by emphasizing training difference instead of system operation differences, i.e., differences in system operation might not always necessitate differences in training methods.)

	<u>Training Areas</u>	<u>Degree of Difference</u>
12.1.1	Basic Flying . . . . .	<u>D</u>
12.1.2	Instrument Flying . . . . .	<u>C</u>
12.1.3	Nap of Earth Flying . . . . .	<u>D</u>
12.1.4	Navigation . . . . .	<u>D</u>
12.1.5	Communications . . . . .	<u>D</u>
12.1.6	Target Detection . . . . .	<u>B</u>
12.1.7	Target Attack . . . . .	<u>B</u>
12.1.8	Weapon Aiming and Firing . .	<u>B</u>
12.1.9	Air-to-Air Combat Flight Maneuvers . . . . .	<u>B</u>
12.1.10	Air-to-Ground Combat Flight Maneuvers . . . . .	<u>B</u>
12.1.11	Multiple Aircraft Operations	<u>B</u>
12.1.12	Reconnaissance . . . . .	<u>B</u>
12.1.13	Command and Control Informa- tion Processing . . . . .	<u>B</u>
12.1.14	Other (Specify) . . . . .	<u>      </u>
12.1.15	Other (Specify) . . . . .	<u>      </u>

Question 12.2 For the training areas rated "radically different", what is the nature of the difference?

Question 12.3 For the training areas rated "substantially different", what is the nature of the difference?  
 12.1.6 - 12.1.11 Better equipment (more training required to understand systems which provide information to support these tasks)

Question 12.4 For the training areas rated "somewhat different", what is the nature of the difference?  
 12.1.2 Basic knowledge of instrument systems

Question 13 As stated at the beginning of the questionnaire the objective of this study is to identify new Army aviation systems and system characteristics which will require behavioral changes necessitating new training techniques.

Given this objective, is there anything further which you believe will require changes in training as a result of the introduction of new Army aviation systems?

*A lot of training required to teach people systems in the aircraft. The training has to be more complete and more information provided. More aircraft systems in Black Hawk than UH-1 plus the addition of large amount of digital systems.*

QUESTIONNAIRE FOR UNIVERSITY OF DAYTON STUDY OF ARMY  
 AVIATION TRAINING R&D REQUIREMENTS  
 (ARMY RESEARCH INSTITUTE FIELD UNIT  
 CONTRACT NO. MDA903-80-C-0229

DATE 27 May 1980

QUESTIONNAIRE NO. 5

RESPONDER'S NAME \_\_\_\_\_

RESPONDER'S ORGANIZATION \_\_\_\_\_

RESPONDER'S TITLE OR POSITION \_\_\_\_\_

The objective of this study is to identify new Army aviation systems and system characteristics which will require behavioral changes necessitating new training techniques.

Question 1 What new systems will be in the U.S. Army aviation inventory for the period of 1985 to 2000 (within your area of cognizance)?

- 1.1 Aircraft Rocket Systems
- 1.2 Aircraft Guns (20mm, 30mm)
- 1.3 Fire Control (Mast Mounted Sight, FLIR)
- 1.4 \_\_\_\_\_

Question 2 What are the probabilities that each of these new systems will be introduced into Army inventory? (Values of probability are defined as 1.0 = almost certain, 0.8 = highly probable, 0.6 = probable, 0.4 = uncertain, and 0.2 = highly unlikely.)

<u>New System</u>	<u>Probability</u>
2.1 <u>Aircraft Rocket Systems</u>	<u>0.75 (see attached)</u>
2.2 <u>Aircraft Guns</u>	<u>0.60</u>
2.3 <u>Fire Control</u>	<u>0.70</u>
2.4 _____	_____

Question 2 (Continued)

*Aircraft Rocket Systems include:*

- a. Multiple purpose submunition with  $p = 1.0$*
- b. Lightweight launcher with  $p = 1.0$*
- c. Rocket motor development with  $p = 1.0$*
- d. Smoke screen warhead with  $p = 0.5$*
- e. Illumination warhead with  $p = 0.5$*

*IOC for a, b, and c is 1983.*

*IOC for d, e is 1985.*



QUESTION 5 (Continued)

*Multiple purpose submunition is completely new.*

*Lightweight launcher replaces M200 and M158.*

*Rocket motor replaced MK40.*

*Smoke screen warhead replaces M262.*

*Illumination warhead replaces M157.*

New System Aircraft Rocket Systems

Question 6.1 How much difference will there be between the new system and the current systems which it replaces in terms of physical characteristics? (Degrees of difference are defined as: "a" = radically different; "b" = substantially different; "c" = somewhat different; and "d" = minimal or no difference.)

<u>Component</u>	<u>Degree of Difference</u>
6.1.1 Flight Controls . . . . .	_____
6.1.2 Instruments . . . . .	_____
6.1.3 Displays . . . . .	<u>D</u>
6.1.4 Power Controls . . . . .	_____
6.1.5 Seating Arrangement . . . . .	_____
6.1.6 Visibility . . . . .	_____
6.1.7 Weapon Guidance . . . . .	<u>N/A</u>
6.1.8 Guns . . . . .	<u>D</u>
6.1.9 Rockets . . . . .	<u>C</u>
6.1.10 Laser . . . . .	<u>D</u>
6.1.11 Threat Detection . . . . .	_____
6.1.12 Navigation . . . . .	_____
6.1.13 Communication . . . . .	_____
6.1.14 ECM/EW . . . . .	_____
6.1.15 Other (Specify) . . . . .	_____
6.1.16 Other (Specify) . . . . .	_____

Question 6.2 For the components rated "radically different", what is the nature of the difference?

Question 6.3 For the components rated "substantially different", what is the nature of the difference?

Question 6.4 For the components rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

6.1.9 *More accurate and longer range*

New System Aircraft Rocket Systems

Question 7.1 How much performance difference will there be between the new system and the current systems which it replaces? (Degrees of difference are defined in Question 6.1).

	<u>Performance</u>	<u>Degree of Difference</u>
7.1.1	Maneuverability . . . . .	_____
7.1.2	Flight Stability . . . . .	_____
7.1.3	Control Responsiveness . . . . .	_____
7.1.4	Flying Workload . . . . .	_____
7.1.5	Flight Safety Characteristics . . . . .	_____
7.1.6	Complexity . . . . .	_____
7.1.7	Speed . . . . .	_____
7.1.8	Target Detection Capabilities . . . . .	_____
7.1.9	Weapon Range . . . . .	<u>B</u> _____
7.1.10	Weapon Accuracy . . . . .	<u>B</u> _____
7.1.11	Troop Capacity . . . . .	_____
7.1.12	Cargo Capacity . . . . .	_____
7.1.13	Other (Specify) . . . . .	_____
7.1.14	Other (Specify) . . . . .	_____

Question 7.2 For the performances rated "radically different", what is the nature of the difference?

Question 7.3 For the performances rated "substantially different", what is the nature of the difference?

- 7.1.9 50 percent increase in range
- 7.1.10 More accurate

Question 7.4 For the performances rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

New System Aircraft Rocket Systems

Question 8.1 In terms of cockpit crew operations, how much difference is there between the new system and the current systems which it replaces? (Degrees of difference are defined in Question 6.1).

<u>Operation</u>	<u>Degree of Difference</u>
8.1.1 Basic Flying . . . . .	<u>D</u>
8.1.2 Instrument Flying . . . . .	<u>D</u>
8.1.3 Nap of Earth Flying . . . . .	<u>D</u>
8.1.4 Navigation . . . . .	<u>D</u>
8.1.5 Communication . . . . .	<u>D</u>
8.1.6 Other (Specify) . . . . .	<u>          </u>
8.1.7 Other (Specify) . . . . .	<u>          </u>

Question 8.2 For the operations rated "radically different", what is the nature of the difference?

Question 8.3 For the operations rated "substantially different", what is the nature of the difference?

Question 8.4 For the operations rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

New System Aircraft Rocket Systems

Question 9.1 In terms of combat operations tasks, how much difference is there between the new system and current systems which it replaces? (Degrees of difference are defined in Question 6.1).

	<u>Operation</u>	<u>Degree of Difference</u>
9.1.1	Target Detection . . . . .	_____
9.1.2	Target Attack . . . . .	<u>B</u>
9.1.3	Weapon Aiming and Firing . . .	<u>B</u>
9.1.4	Air-to-Air Combat Flight Maneuvers . . . . .	<u>-</u>
9.1.5	Air-to-Ground Combat Flight Maneuvers . . . . .	<u>D</u>
9.1.6	Multiple Aircraft Operation .	<u>D</u>
9.1.7	Reconnaissance . . . . .	<u>-</u>
9.1.8	Command and Control Informa- tion Processing . . . . .	<u>-</u>
9.1.9	Other (Specify) . . . . .	_____
9.1.10	Other (Specify) . . . . .	_____

Question 9.2 For the operations rated "radically different", what is the nature of the difference?

Question 9.3 For the operations rated "substantially different", what is the nature of the difference?

- 9.1.2 *Area weapon capability is increased*  
9.1.3 *More accurate and easier to aim*

Question 9.4 For the operations rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

New System Aircraft Rocket Systems

Question 10.1 What are the differences in man-machine skill requirements between the new system and the current systems which it replaces? (Degrees of difference are defined in Question 6.1).

	<u>Skill Category</u>	<u>Degree of Difference</u>
10.1.1	Monitoring Displays . . . . .	<u>D</u>
10.1.2	Tracking Outside Aircraft . .	<u>D</u>
10.1.3	Recognition . . . . .	<u>D</u>
10.1.4	Memory . . . . .	<u>-</u>
10.1.5	Decision-Making . . . . .	<u>C</u>
10.1.6	Physical Responses . . . . .	<u>          </u>
10.1.7	Other (Specify) . . . . .	<u>          </u>
10.1.8	Other (Specify) . . . . .	<u>          </u>

Question 10.2 For the skills rated "radically different", what is the nature of the difference?

Question 10.3 For the skills rated "substantially different", what is the nature of the difference?

Question 10.4 For the skills rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

10.1.5 Pilot could get range information from laser thus eliminating some pilot's decision-making requirement

New System Aircraft Rocket Systems

Question 11.1 What are the differences in crew interaction requirements between the new system and the current systems which it replaces? (Degrees of difference are defined in Question 6.1).

	<u>Interaction Category</u>	<u>Degree of Difference</u>
11.1.1	Verbal Exchange . . . . .	<u>D</u>
11.1.2	Non-Verbal Exchange . . . . .	<u>D</u>
11.1.3	Coordinated Physical Responses . . . . .	<u>D</u>
11.1.4	Other (Specify) . . . . .	<u>          </u>
11.1.5	Other (Specify) . . . . .	<u>          </u>

Question 11.2 For the interactions rated "radically different", what is the nature of the difference?

Question 11.3 For the interactions rated "substantially different", what is the nature of the difference?

Question 11.4 For the interactions rated "somewhat different", is the difference enough to require a change in training methods?

New System Aircraft Rocket Systems

Question 12.1 In terms of training methods, how much difference will there be between the new system and the current systems it replaces? (Note that this differs from Questions 8.1 and 9.1, by emphasizing training difference instead of system operation differences, i.e., differences in system operation might not always necessitate differences in training methods.)

	<u>Training Areas</u>	<u>Degree of Difference</u>
12.1.1	Basic Flying . . . . .	_____
12.1.2	Instrument Flying . . . . .	_____
12.1.3	Map of Earth Flying . . . . .	_____
12.1.4	Navigation . . . . .	_____
12.1.5	Communications . . . . .	_____
12.1.6	Target Detection . . . . .	_____
12.1.7	Target Attack . . . . .	_____
12.1.8	Weapon Aiming and Firing . .	<u>C</u>
12.1.9	Air-to-Air Combat Flight Maneuvers . . . . .	_____
12.1.10	Air-to-Ground Combat Flight Maneuvers . . . . .	_____
12.1.11	Multiple Aircraft Operations	_____
12.1.12	Reconnaissance . . . . .	<u>D</u>
12.1.13	Command and Control Informa- tion Processing . . . . .	_____
12.1.14	Other (Specify) . . . . .	_____
12.1.15	Other (Specify) . . . . .	_____

Question 12.2 For the training areas rated "radically different", what is the nature of the difference?

Question 12.3 For the training areas rated "substantially different", what is the nature of the difference?

Question 12.4 For the training areas rated "somewhat different", what is the nature of the difference?

12.1.8 New system

New System Aircraft Guns

Question 6.1 How much difference will there be between the new system and the current systems which it replaces in terms of physical characteristics? (Degrees of difference are defined as: "a" = radically different; "b" = substantially different; "c" = somewhat different; and "d" = minimal or no difference.)

<u>Component</u>	<u>Degree of Difference</u>
6.1.1 Flight Controls . . . . .	_____
6.1.2 Instruments . . . . .	_____
6.1.3 Displays . . . . .	_____
6.1.4 Power Controls . . . . .	_____
6.1.5 Seating Arrangement . . . . .	_____
6.1.6 Visibility . . . . .	_____
6.1.7 Weapon Guidance . . . . .	_____
6.1.8 Guns . . . . .	<u>B</u>
6.1.9 Rockets . . . . .	_____
6.1.10 Laser . . . . .	_____
6.1.11 Threat Detection . . . . .	_____
6.1.12 Navigation . . . . .	_____
6.1.13 Communication . . . . .	_____
6.1.14 ECM/EW . . . . .	_____
6.1.15 Other (Specify) . . . . .	_____
6.1.16 Other (Specify) . . . . .	_____

Question 6.2 For the components rated "radically different", what is the nature of the difference?

Question 6.3 For the components rated "substantially different", what is the nature of the difference?

6.1.8 Differences in drive, feed systems and ammunition

Question 6.4 For the components rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

New System Aircraft Guns

Question 7.1 How much performance difference will there be between the new system and the current systems which it replaces? (Degrees of difference are defined in Question 6.1).

	<u>Performance</u>	<u>Degree of Difference</u>
7.1.1	Maneuverability . . . . .	_____
7.1.2	Flight Stability . . . . .	_____
7.1.3	Control Responsiveness . . . . .	_____
7.1.4	Flying Workload . . . . .	_____
7.1.5	Flight Safety Characteristics . . . . .	_____
7.1.6	Complexity . . . . .	_____
7.1.7	Speed . . . . .	_____
7.1.8	Target Detection Capabilities . . . . .	_____
7.1.9	Weapon Range . . . . .	<u>C</u>
7.1.10	Weapon Accuracy . . . . .	<u>B</u>
7.1.11	Troop Capacity . . . . .	_____
7.1.12	Cargo Capacity . . . . .	_____
7.1.13	Other (Specify) . . . . .	_____
7.1.14	Other (Specify) . . . . .	_____

Question 7.2 For the performances rated "radically different", what is the nature of the difference?

Question 7.3 For the performances rated "substantially different", what is the nature of the difference?

7.1.10 Better pointing accuracy

Question 7.4 For the performances rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

7.1.9 Greater range

New System Aircraft Guns

Question 8.1 In terms of cockpit crew operations, how much difference is there between the new system and the current systems which it replaces? (Degrees of difference are defined in Question 6.1).

<u>Operation</u>	<u>Degree of Difference</u>
8.1.1 Basic Flying . . . . .	<u>D</u>
8.1.2 Instrument Flying . . . . .	<u>D</u>
8.1.3 Nap of Earth Flying . . . . .	<u>D</u>
8.1.4 Navigation . . . . .	<u>D</u>
8.1.5 Communication . . . . .	<u>D</u>
8.1.6 Other (Specify) . . . . .	<u>                    </u>
8.1.7 Other (Specify) . . . . .	<u>                    </u>

Question 8.2 For the operations rated "radically different", what is the nature of the difference?

Question 8.3 For the operations rated "substantially different", what is the nature of the difference?

Question 8.4 For the operations rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

New System Aircraft Guns

Question 9.1 In terms of combat operations tasks, how much difference is there between the new system and current systems which it replaces? (Degrees of difference are defined in Question 6.1).

	<u>Operation</u>	<u>Degree of Difference</u>
9.1.1	Target Detection . . . . .	_____
9.1.2	Target Attack . . . . .	_____
9.1.3	Weapon Aiming and Firing . . .	_____
9.1.4	Air-to-Air Combat Flight Maneuvers . . . . .	<u>A</u>
9.1.5	Air-to-Ground Combat Flight Maneuvers . . . . .	_____
9.1.6	Multiple Aircraft Operation .	_____
9.1.7	Reconnaissance . . . . .	_____
9.1.8	Command and Control Informa- tion Processing . . . . .	_____
9.1.9	Other (Specify) . . . . .	_____
9.1.10	Other (Specify) . . . . .	_____

Question 9.2 For the operations rated "radically different", what is the nature of the difference?

9.1.4 *New additional capabilities for attack and scout helicopters (heavier ammo)*

Question 9.3 For the operations rated "substantially different", what is the nature of the difference?

Question 9.4 For the operations rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

New System Aircraft Guns

Question 10.1 What are the differences in man-machine skill requirements between the new system and the current systems which it replaces? (Degrees of difference are defined in Question 6.1).

<u>Skill Category</u>	<u>Degree of Difference</u>
10.1.1 Monitoring Displays . . . . .	<u>D</u>
10.1.2 Tracking Outside Aircraft . . . . .	<u>A</u>
10.1.3 Recognition . . . . .	<u>B</u>
10.1.4 Memory . . . . .	<u>D</u>
10.1.5 Decision-Making . . . . .	<u>C</u>
10.1.6 Physical Responses . . . . .	<u>D</u>
10.1.7 Other (Specify) . . . . .	<u>          </u>
10.1.8 Other (Specify) . . . . .	<u>          </u>

Question 10.2 For the skills rated "radically different", what is the nature of the difference?

*10.1.2 Due to air-to-air capabilities*

Question 10.3 For the skills rated "substantially different", what is the nature of the difference?

*10.1.3 Due to increase in range and accuracy*

Question 10.4 For the skills rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

New System Aircraft Guns

Question 11.1 What are the differences in crew interaction requirements between the new system and the current systems which it replaces? (Degrees of difference are defined in Question 6.1).

	<u>Interaction Category</u>	<u>Degree of Difference</u>
11.1.1	Verbal Exchange . . . . .	<u>B</u>
11.1.2	Non-Verbal Exchange . . . . .	<u>B</u>
11.1.3	Coordinated Physical Responses . . . . .	<u>B</u>
11.1.4	Other (Specify) . . . . .	<u>          </u>
11.1.5	Other (Specify) . . . . .	<u>          </u>

Question 11.2 For the interactions rated "radically different", what is the nature of the difference?

Question 11.3 For the interactions rated "substantially different", what is the nature of the difference?

*All due to air-to-air capabilities*

Question 11.4 For the interactions rated "somewhat different", is the difference enough to require a change in training methods?

New System Aircraft Guns

Question 12.1 In terms of training methods, how much difference will there be between the new system and the current systems it replaces? (Note that this differs from Questions 8.1 and 9.1, by emphasizing training difference instead of system operation differences, i.e., differences in system operation might not always necessitate differences in training methods.)

	<u>Training Areas</u>	<u>Degree of Difference</u>
12.1.1	Basic Flying . . . . .	<u>D</u>
12.1.2	Instrument Flying . . . . .	<u>        </u>
12.1.3	Nap of Earth Flying . . . . .	<u>        </u>
12.1.4	Navigation . . . . .	<u>        </u>
12.1.5	Communications . . . . .	<u>        </u>
12.1.6	Target Detection . . . . .	<u>B</u>
12.1.7	Target Attack . . . . .	<u>B</u>
12.1.8	Weapon Aiming and Firing . .	<u>B</u>
12.1.9	Air-to-Air Combat Flight Maneuvers . . . . .	<u>B</u>
12.1.10	Air-to-Ground Combat Flight Maneuvers . . . . .	<u>C</u>
12.1.11	Multiple Aircraft Operations	<u>D</u>
12.1.12	Reconnaissance . . . . .	<u>D</u>
12.1.13	Command and Control Informa- tion Processing . . . . .	<u>C</u>
12.1.14	Other (Specify) . . . . .	<u>        </u>
12.1.15	Other (Specify) . . . . .	<u>        </u>

Question 12.2 For the training areas rated "radically different", what is the nature of the difference?

Question 12.3 For the training areas rated "substantially different", what is the nature of the difference?

12.1.6 - 12.1.9 Due to air-to-air capabilities

Question 12.4 For the training areas rated "somewhat different", what is the nature of the difference?

12.1.13 Need to process information in terms of air-to-air defense capabilities

New System Fire Control

Question 6.1 How much difference will there be between the new system and the current systems which it replaces in terms of physical characteristics? (Degrees of difference are defined as: "a" = radically different; "b" = substantially different; "c" = somewhat different; and "d" = minimal or no difference.)

<u>Component</u>	<u>Degree of Difference</u>
6.1.1 Flight Controls . . . . .	<u>D</u>
6.1.2 Instruments . . . . .	<u>D</u>
6.1.3 Displays . . . . .	<u>D</u>
6.1.4 Power Controls . . . . .	<u>D</u>
6.1.5 Seating Arrangement . . . . .	<u>D</u>
6.1.6 Visibility . . . . .	<u>A</u>
6.1.7 Weapon Guidance . . . . .	<u>D</u>
6.1.8 Guns . . . . .	<u>D</u>
6.1.9 Rockets . . . . .	<u>D</u>
6.1.10 Laser . . . . .	<u>D</u>
6.1.11 Threat Detection . . . . .	<u>A</u>
6.1.12 Navigation . . . . .	<u>D</u>
6.1.13 Communication . . . . .	<u>D</u>
6.1.14 ECM/EW . . . . .	<u>D</u>
6.1.15 Other (Specify) . . . . .	<u>          </u>
6.1.16 Other (Specify) . . . . .	<u>          </u>

Question 6.2 For the components rated "radically different", what is the nature of the difference?

6.1.6 and 6.1.11 New capability due to mast mounted sight

Question 6.3 For the components rated "substantially different", what is the nature of the difference?

Question 6.4 For the components rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

New System Fire Control

Question 7.1 How much performance difference will there be between the new system and the current systems which it replaces? (Degrees of difference are defined in Question 6.1).

	<u>Performance</u>	<u>Degree of Difference</u>
7.1.1	Maneuverability . . . . .	_____
7.1.2	Flight Stability . . . . .	_____
7.1.3	Control Responsiveness . .	_____
7.1.4	Flying Workload . . . . .	<u>    D    </u>
7.1.5	Flight Safety Character- istics . . . . .	<u>    C    </u>
7.1.6	Complexity . . . . .	<u>    B    </u>
7.1.7	Speed . . . . .	_____
7.1.8	Target Detection Capa- bilities . . . . .	<u>    A    </u>
7.1.9	Weapon Range . . . . .	_____
7.1.10	Weapon Accuracy . . . . .	_____
7.1.11	Troop Capacity . . . . .	_____
7.1.12	Cargo Capacity . . . . .	_____
7.1.13	Other (Specify) . . . . .	_____
7.1.14	Other (Specify) . . . . .	_____

Question 7.2 For the performances rated "radically different", what is the nature of the difference?

7.1.8 *Due to mast mounted sight*

Question 7.3 For the performances rated "substantially different", what is the nature of the difference?

7.1.6 *More difficult in maintenance and increasing workload*

Question 7.4 For the performances rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

7.1.5 *Due to the increased weight of mast mounted sight in shaft*

New System Fire Control

Question 8.1 In terms of cockpit crew operations, how much difference is there between the new system and the current systems which it replaces? (Degrees of difference are defined in Question 6.1).

<u>Operation</u>	<u>Degree of Difference</u>
8.1.1 Basic Flying . . . . .	_____
8.1.2 Instrument Flying . . . . .	_____
8.1.3 Nap of Earth Flying . . . . .	<u>D</u>
8.1.4 Navigation . . . . .	<u>D</u>
8.1.5 Communication . . . . .	_____
8.1.6 Other (Specify) <u>Survivability</u> . . . . .	<u>A</u>
8.1.7 Other (Specify) <u>Target Detection</u> . . . . .	<u>B</u>

Question 8.2 For the operations rated "radically different", what is the nature of the difference?

8.1.6 Increase survivability (due to MMS)

Question 8.3 For the operations rated "substantially different", what is the nature of the difference?

8.1.7 Target detection due to MMS

Question 8.4 For the operations rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

New System Fire Control

Question 9.1 In terms of combat operations tasks, how much difference is there between the new system and current systems which it replaces? (Degrees of difference are defined in Question 6.1).

<u>Operation</u>	<u>Degree of Difference</u>
9.1.1 Target Detection . . . . .	<u>A</u>
9.1.2 Target Attack . . . . .	<u>A</u>
9.1.3 Weapon Aiming and Firing . . .	<u>A</u>
9.1.4 Air-to-Air Combat Flight Maneuvers . . . . .	<u>C</u>
9.1.5 Air-to-Ground Combat Flight Maneuvers . . . . .	<u>B</u>
9.1.6 Multiple Aircraft Operation .	<u>D</u>
9.1.7 Reconnaissance . . . . .	<u>A</u>
9.1.8 Command and Control Informa- tion Processing . . . . .	<u>C</u>
9.1.9 Other (Specify) . . . . .	<u>          </u>
9.1.10 Other (Specify) . . . . .	<u>          </u>

Question 9.2 For the operations rated "radically different", what is the nature of the difference?

9.1.1 - 9.1.3 Mast mounted sight allows masking of aircraft  
9.1.7 Be able to see without exposure (MMS)

Question 9.3 For the operations rated "substantially different", what is the nature of the difference?

9.1.5 Depends on terrain

Question 9.4 For the operations rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

9.1.4 Enhance air-to-air combat capabilities  
9.1.8 Greater coordination required between friendly aircraft

New System Fire Control

Question 10.1 What are the differences in man-machine skill requirements between the new system and the current systems which it replaces? (Degrees of difference are defined in Question 6.1).

<u>Skill Category</u>	<u>Degree of Difference</u>
10.1.1 Monitoring Displays . . . . .	<u>D</u>
10.1.2 Tracking Outside Aircraft . .	<u>D</u>
10.1.3 Recognition . . . . .	<u>D</u>
10.1.4 Memory . . . . .	<u>D</u>
10.1.5 Decision-Making . . . . .	<u>D</u>
10.1.6 Physical Responses . . . . .	<u>D</u>
10.1.7 Other (Specify) . . . . .	<u>                    </u>
10.1.8 Other (Specify) . . . . .	<u>                    </u>

Question 10.2 For the skills rated "radically different", what is the nature of the difference?

Question 10.3 For the skills rated "substantially different", what is the nature of the difference?

Question 10.4 For the skills rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

New System Fire Control

Question 11.1 What are the differences in crew interaction requirements between the new system and the current systems which it replaces? (Degrees of difference are defined in Question 6.1).

	<u>Interaction Category</u>	<u>Degree of Difference</u>
11.1.1	Verbal Exchange . . . . .	<u>D</u>
11.1.2	Non-Verbal Exchange . . . . .	<u>D</u>
11.1.3	Coordinated Physical Responses . . . . .	<u>D</u>
11.1.4	Other (Specify) . . . . .	<u>          </u>
11.1.5	Other (Specify) . . . . .	<u>          </u>

Question 11.2 For the interactions rated "radically different", what is the nature of the difference?

Question 11.3 For the interactions rated "substantially different", what is the nature of the difference?

Question 11.4 For the interactions rated "somewhat different", is the difference enough to require a change in training methods?

New System Fire Control

Question 12.1 In terms of training methods, how much difference will there be between the new system and the current systems it replaces? (Note that this differs from Questions 8.1 and 9.1, by emphasizing training difference instead of system operation differences, i.e., differences in system operation might not always necessitate differences in training methods.)

	<u>Training Areas</u>	<u>Degree of Difference</u>
12.1.1	Basic Flying . . . . .	<u>D</u>
12.1.2	Instrument Flying . . . . .	<u>D</u>
12.1.3	Map of Earth Flying . . . . .	<u>D</u>
12.1.4	Navigation . . . . .	<u>D</u>
12.1.5	Communications . . . . .	<u>D</u>
12.1.6	Target Detection . . . . .	<u>D</u>
12.1.7	Target Attack . . . . .	<u>D</u>
12.1.8	Weapon Aiming and Firing . .	<u>D</u>
12.1.9	Air-to-Air Combat Flight Maneuvers . . . . .	<u>D</u>
12.1.10	Air-to-Ground Combat Flight Maneuvers . . . . .	<u>D</u>
12.1.11	Multiple Aircraft Operations	<u>D</u>
12.1.12	Reconnaissance . . . . .	<u>D</u>
12.1.13	Command and Control Informa- tion Processing . . . . .	<u>D</u>
12.1.14	Other (Specify) . . . . .	<u>          </u>
12.1.15	Other (Specify) . . . . .	<u>          </u>

Question 12.2 For the training areas rated "radically different", what is the nature of the difference?

Question 12.3 For the training areas rated "substantially different", what is the nature of the difference?

Question 12.4 For the training areas rated "somewhat different", what is the nature of the difference?

Question 13 As stated at the beginning of the questionnaire the objective of this study is to identify new Army aviation systems and system characteristics which will require behavioral changes necessitating new training techniques.

Given this objective, is there anything further which you believe will require changes in training as a result of the introduction of new Army aviation systems?

*RPV training may be an area to look at*

QUESTIONNAIRE FOR UNIVERSITY OF DAYTON STUDY OF ARMY  
 AVIATION TRAINING R&D REQUIREMENTS  
 (ARMY RESEARCH INSTITUTE FIELD UNIT  
 CONTRACT NO. MDA903-80-C-0229

DATE 27 May 1980

QUESTIONNAIRE NO. 6

RESPONDER'S NAME \_\_\_\_\_

RESPONDER'S ORGANIZATION \_\_\_\_\_

RESPONDER'S TITLE OR POSITION \_\_\_\_\_

The objective of this study is to identify new Army aviation systems and system characteristics which will require behavioral changes necessitating new training techniques.

Question 1 What new systems will be in the U.S. Army aviation inventory for the period of 1985 to 2000 (within your area of cognizance)?

- 1.1 ADAS (Army Digital Avionic Systems) - 3 generations
- 1.2 Landing Systems (mini, microwave landing system, self-contained landing system)
- 1.3 Air Traffic Control
- 1.4 (ICNI; TDMS)

Question 2 What are the probabilities that each of these new systems will be introduced into Army inventory? (Values of probability are defined as 1.0 = almost certain, 0.8 = highly probable, 0.6 = probable, 0.4 = uncertain, and 0.2 = highly unlikely.)

<u>New System</u>	<u>Probability</u>
2.1 <u>ADAS</u>	0.8 for 1st generation 0.7 for 2nd and 3rd generations
2.2 <u>Landing Systems</u>	Not determined (0.7 for our own guessing value)
2.3 <u>Air Traffic Control</u>	<u>2</u>
2.4 _____	_____

## QUESTION 2 (Continued)

1st generation of ADAS includes: (1) IACS (Integrated Avionic Control System), with  $P = 0.8$ ; (2) AMD (Advanced Map Display) with  $P = 0.8$ ; (3) Doppler with  $P = 0.9$ ; (4) NNPS (Night Navigation Pilot Systems) with  $P = 0.7$ ; (5) ADTS/TH (Airborne Data Transfer System/Target Hand-Off) with  $P = 0.7$ .

2nd generation of ADAS includes: (1) EMMADS (Electronic Master Monitor Advisory Display) with  $P = 0.1 - 0.9$ ; (2) Advanced Audio Systems with  $P = 0.6$ ; (3) Integrated Multi-Function Display (FLIR, LLTV) with  $P = 0.6$ ; (4) Solid-State Programmable Multi-Format Display with  $P = 0.7$ ; (5) Wire and Wire-like Optical Detect System ( $CO_2$ ) with  $P = 0.7$ .

3rd generation of ADAS will integrate Fire Control, Flight Control, and EW landing systems to achieve night and all weather NOE capabilities,  $P = 0.7$ .



New System Army Digital Avionic Systems

Question 6.1 How much difference will there be between the new system and the current systems which it replaces in terms of physical characteristics? (Degrees of difference are defined as: "a" = radically different; "b" = substantially different; "c" = somewhat different; and "d" = minimal or no difference.)

<u>Component</u>	<u>Degree of Difference</u>
6.1.1 Flight Controls . . . . .	-
6.1.2 Instruments . . . . .	A
6.1.3 Displays . . . . .	A
6.1.4 Power Controls . . . . .	-
6.1.5 Seating Arrangement . . . . .	D
6.1.6 Visibility . . . . .	B
6.1.7 Weapon Guidance . . . . .	-
6.1.8 Guns . . . . .	-
6.1.9 Rockets . . . . .	-
6.1.10 Laser . . . . .	-
6.1.11 Threat Detection . . . . .	-
6.1.12 Navigation . . . . .	B
6.1.13 Communication . . . . .	D
6.1.14 ECM/EW . . . . .	-
6.1.15 Other (Specify) . . . . .	
6.1.16 Other (Specify) . . . . .	

Question 6.2 For the components rated "radically different", what is the nature of the difference?

6.1.2 - 6.1.3 *New technology and advance the state of the art, will be much easier to use*

Question 6.3 For the components rated "substantially different", what is the nature of the difference?

6.1.6 *Smaller panels*  
6.1.12 *Advanced Map Display*

Question 6.4 For the components rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

New System Army Digital Avionic Systems

Question 7.1 How much performance difference will there be between the new system and the current systems which it replaces? (Degrees of difference are defined in Question 6.1).

	<u>Performance</u>	<u>Degree of Difference</u>
7.1.1	Maneuverability . . . . .	<u>D</u>
7.1.2	Flight Stability . . . . .	<u>D</u>
7.1.3	Control Responsiveness . . . . .	<u>D</u>
7.1.4	Flying Workload . . . . .	<u>B</u>
7.1.5	Flight Safety Characteristics . . . . .	<u>B</u>
7.1.6	Complexity . . . . .	<u>B</u>
7.1.7	Speed . . . . .	<u>-</u>
7.1.8	Target Detection Capabilities . . . . .	<u>-</u>
7.1.9	Weapon Range . . . . .	<u>-</u>
7.1.10	Weapon Accuracy . . . . .	<u>-</u>
7.1.11	Troop Capacity . . . . .	<u>-</u>
7.1.12	Cargo Capacity . . . . .	<u>C</u>
7.1.13	Other (Speci. . . . .	<u>_____</u>
7.1.14	Other (Specify) . . . . .	<u>_____</u>

Question 7.2 For the performances rated "radically different", what is the nature of the difference?

Question 7.3 For the performances rated "substantially different", what is the nature of the difference?

- 7.1.4 *Cut down avionic workload*
- 7.1.5 *More time and better information provided*
- 7.1.6 *Need some programming effort*

Question 7.4 For the performances rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

- 7.1.12 *More space and lighter weight in helicopters*

New System Army Digital Avionic Systems

Question 8.1 In terms of cockpit crew operations, how much difference is there between the new system and the current systems which it replaces? (Degrees of difference are defined in Question 6.1).

<u>Operation</u>	<u>Degree of Difference</u>
8.1.1 Basic Flying . . . . .	<u>D</u>
8.1.2 Instrument Flying . . . . .	<u>B</u>
8.1.3 Nap of Earth Flying . . . . .	<u>A</u>
8.1.4 Navigation . . . . .	<u>A</u>
8.1.5 Communication . . . . .	<u>D</u>
8.1.6 Other (Specify) . . . . .	<u>                    </u>
8.1.7 Other (Specify) . . . . .	<u>                    </u>

Question 8.2 For the operations rated "radically different", what is the nature of the difference?

8.1.3 Easier to fly

8.1.4 Advanced map display

Question 8.3 For the operations rated "substantially different", what is the nature of the difference?

8.1.2 Easier to read instruments and not so many of them

Question 8.4 For the operations rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

New System Army Digital Avionic Systems

Question 9.1 In terms of combat operations tasks, how much difference is there between the new system and current systems which it replaces? (Degrees of difference are defined in Question 6.1).

	<u>Operation</u>	<u>Degree of Difference</u>
9.1.1	Target Detection . . . . .	-
9.1.2	Target Attack . . . . .	-
9.1.3	Weapon Aiming and Firing . . .	-
9.1.4	Air-to-Air Combat Flight Maneuvers . . . . .	-
9.1.5	Air-to-Ground Combat Flight Maneuvers . . . . .	-
9.1.6	Multiple Aircraft Operation .	-
9.1.7	Reconnaissance . . . . .	-
9.1.8	Command and Control Informa- tion Processing . . . . .	-
9.1.9	Other (Specify) . . . . .	-
9.1.10	Other (Specify) . . . . .	-

Question 9.2 For the operations rated "radically different", what is the nature of the difference?

Question 9.3 For the operations rated "substantially different", what is the nature of the difference?

Question 9.4 For the operations rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

New System Army Digital Avionic Systems

Question 10.1 What are the differences in man-machine skill requirements between the new system and the current systems which it replaces? (Degrees of difference are defined in Question 6.1).

	<u>Skill Category</u>	<u>Degree of Difference</u>
10.1.1	Monitoring Displays . . . . .	<u>B</u>
10.1.2	Tracking Outside Aircraft . . . . .	<u>-</u>
10.1.3	Recognition . . . . .	<u>B</u>
10.1.4	Memory . . . . .	<u>B</u>
10.1.5	Decision-Making . . . . .	<u>B</u>
10.1.6	Physical Responses . . . . .	<u>B</u>
10.1.7	Other (Specify) . . . . .	<u>-</u>
10.1.8	Other (Specify) . . . . .	<u>-</u>

Question 10.2 For the skills rated "radically different", what is the nature of the difference?

Question 10.3 For the skills rated "substantially different", what is the nature of the difference?

- 10.1.1 Displays are easier to read
- 10.1.3 - 10.1.6 More time for these tasks

Question 10.4 For the skills rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

New System Army Digital Avionic Systems

Question 11.1 What are the differences in crew interaction requirements between the new system and the current systems which it replaces? (Degrees of difference are defined in Question 6.1).

	<u>Interaction Category</u>	<u>Degree of Difference</u>
11.1.1	Verbal Exchange . . . . .	<u>C</u>
11.1.2	Non-Verbal Exchange . . . . .	<u>C</u>
11.1.3	Coordinated Physical Responses . . . . .	<u>C</u>
11.1.4	Other (Specify) . . . . .	<u>          </u>
11.1.5	Other (Specify) . . . . .	<u>          </u>

Question 11.2 For the interactions rated "radically different", what is the nature of the difference?

Question 11.3 For the interactions rated "substantially different", what is the nature of the difference?

Question 11.4 For the interactions rated "somewhat different", is the difference enough to require a change in training methods?

11.1.1 - 11.1.3 *Depends on who has displays and the number of redundant displays*

New System Army Digital Avionic Systems

Question 12.1 In terms of training methods, how much difference will there be between the new system and the current systems it replaces? (Note that this differs from Questions 8.1 and 9.1, by emphasizing training difference instead of system operation differences, i.e., differences in system operation might not always necessitate differences in training methods.)

	<u>Training Areas</u>	<u>Degree of Difference</u>
12.1.1	Basic Flying . . . . .	<u>D</u>
12.1.2	Instrument Flying . . . . .	<u>D</u>
12.1.3	Map of Earth Flying . . . . .	<u>A</u>
12.1.4	Navigation . . . . .	<u>A</u>
12.1.5	Communications . . . . .	<u>C</u>
12.1.6	Target Detection . . . . .	_____
12.1.7	Target Attack . . . . .	_____
12.1.8	Weapon Aiming and Firing . .	_____
12.1.9	Air-to-Air Combat Flight Maneuvers . . . . .	_____
12.1.10	Air-to-Ground Combat Flight Maneuvers . . . . .	_____
12.1.11	Multiple Aircraft Operations	_____
12.1.12	Reconnaissance . . . . .	_____
12.1.13	Command and Control Informa- tion Processing . . . . .	_____
12.1.14	Other (Specify) . . . . .	_____
12.1.15	Other (Specify) . . . . .	_____

Question 12.2 For the training areas rated "radically different", what is the nature of the difference?

12.1.3 - 12.1.4 *Better equipment and displays and easier to operate*

Question 12.3 For the training areas rated "substantially different", what is the nature of the difference?

Question 12.4 For the training areas rated "somewhat different", what is the nature of the difference?

12.1.5 *Better control arrangements (functions contained in one box instead of four or five boxes, i.e., IACS)*

New System Landing Systems

Question 6.1 How much difference will there be between the new system and the current systems which it replaces in terms of physical characteristics? (Degrees of difference are defined as: "a" = radically different; "b" = substantially different; "c" = somewhat different; and "d" = minimal or no difference.)

<u>Component</u>	<u>Degree of Difference</u>
6.1.1 Flight Controls . . . . .	_____
6.1.2 Instruments . . . . .	<u>C</u>
6.1.3 Displays . . . . .	<u>C</u>
6.1.4 Power Controls . . . . .	<u>D</u>
6.1.5 Seating Arrangement . . . . .	<u>D</u>
6.1.6 Visibility . . . . .	<u>D</u>
6.1.7 Weapon Guidance . . . . .	_____
6.1.8 Guns . . . . .	_____
6.1.9 Rockets . . . . .	_____
6.1.10 Laser . . . . .	_____
6.1.11 Threat Detection . . . . .	_____
6.1.12 Navigation . . . . .	_____
6.1.13 Communication . . . . .	_____
6.1.14 ECM/EW . . . . .	_____
6.1.15 Other (Specify) . . . . .	_____
6.1.16 Other (Specify) . . . . .	_____

Question 6.2 For the components rated "radically different", what is the nature of the difference?

Question 6.3 For the components rated "substantially different", what is the nature of the difference?

Question 6.4 For the components rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

6.1.2 - 6.1.3 *New equipment and better control features*

New System Landing Systems

Question 7.1 How much performance difference will there be between the new system and the current systems which it replaces? (Degrees of difference are defined in Question 6.1).

	<u>Performance</u>	<u>Degree of Difference</u>
7.1.1	Maneuverability . . . . .	_____
7.1.2	Flight Stability . . . . .	_____
7.1.3	Control Responsiveness . . . . .	<u>    c    </u>
7.1.4	Flying Workload . . . . .	<u>    c    </u>
7.1.5	Flight Safety Characteristics . . . . .	<u>    c    </u>
7.1.6	Complexity . . . . .	<u>    c    </u>
7.1.7	Speed . . . . .	_____
7.1.8	Target Detection Capabilities . . . . .	_____
7.1.9	Weapon Range . . . . .	_____
7.1.10	Weapon Accuracy . . . . .	_____
7.1.11	Troop Capacity . . . . .	_____
7.1.12	Cargo Capacity . . . . .	_____
7.1.13	Other (Specify) . . . . .	_____
7.1.14	Other (Specify) . . . . .	_____

Question 7.2 For the performances rated "radically different", what is the nature of the difference?

Question 7.3 For the performances rated "substantially different", what is the nature of the difference?

Question 7.4 For the performances rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

7.1.3 - 7.1.6 *Less complex (new equipment representing advanced state of art)*

New System Landing Systems

Question 8.1 In terms of cockpit crew operations, how much difference is there between the new system and the current systems which it replaces? (Degrees of difference are defined in Question 6.1).

<u>Operation</u>	<u>Degree of Difference</u>
8.1.1 Basic Flying . . . . .	_____
8.1.2 Instrument Flying . . . . .	<u>    C    </u>
8.1.3 Nap of Earth Flying . . . . .	_____
8.1.4 Navigation . . . . .	_____
8.1.5 Communication . . . . .	_____
8.1.6 Other (Specify) . . . . .	_____
8.1.7 Other (Specify) . . . . .	_____

Question 8.2 For the operations rated "radically different", what is the nature of the difference?

Question 8.3 For the operations rated "substantially different", what is the nature of the difference?

Question 8.4 For the operations rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

8.1.2 New system

New System Landing Systems

Question 9.1 In terms of combat operations tasks, how much difference is there between the new system and current systems which it replaces? (Degrees of difference are defined in Question 6.1).

	<u>Operation</u>	<u>Degree of Difference</u>
9.1.1	Target Detection . . . . .	<u>N/A</u>
9.1.2	Target Attack . . . . .	<u>N/A</u>
9.1.3	Weapon Aiming and Firing . . .	<u>N/A</u>
9.1.4	Air-to-Air Combat Flight Maneuvers . . . . .	<u>N/A</u>
9.1.5	Air-to-Ground Combat Flight Maneuvers . . . . .	<u>N/A</u>
9.1.6	Multiple Aircraft Operation .	<u>N/A</u>
9.1.7	Reconnaissance . . . . .	<u>N/A</u>
9.1.8	Command and Control Informa- tion Processing . . . . .	<u>N/A</u>
9.1.9	Other (Specify) . . . . .	<u>          </u>
9.1.10	Other (Specify) . . . . .	<u>          </u>

Question 9.2 For the operations rated "radically different", what is the nature of the difference?

Question 9.3 For the operations rated "substantially different", what is the nature of the difference?

Question 9.4 For the operations rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

New System Landing Systems

Question 10.1 What are the differences in man-machine skill requirements between the new system and the current systems which it replaces? (Degrees of difference are defined in Question 6.1).

	<u>Skill Category</u>	<u>Degree of Difference</u>
10.1.1	Monitoring Displays . . . . .	<u>c</u>
10.1.2	Tracking Outside Aircraft . .	<u>          </u>
10.1.3	Recognition . . . . .	<u>          </u>
10.1.4	Memory . . . . .	<u>          </u>
10.1.5	Decision-Making . . . . .	<u>c</u>
10.1.6	Physical Responses . . . . .	<u>c</u>
10.1.7	Other (Specify) . . . . .	<u>          </u>
10.1.8	Other (Specify) . . . . .	<u>          </u>

Question 10.2 For the skills rated "radically different", what is the nature of the difference?

Question 10.3 For the skills rated "substantially different", what is the nature of the difference?

Question 10.4 For the skills rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

10.1.1 *Integrated system*

10.1.5 *Easier*

10.1.6 *Integrated system*

New System Landing Systems

Question 11.1 What are the differences in crew interaction requirements between the new system and the current systems which it replaces? (Degrees of difference are defined in Question 6.1).

	<u>Interaction Category</u>	<u>Degree of Difference</u>
11.1.1	Verbal Exchange . . . . .	<u>D</u>
11.1.2	Non-Verbal Exchange . . . . .	<u>D</u>
11.1.3	Coordinated Physical Responses . . . . .	<u>D</u>
11.1.4	Other (Specify) . . . . .	<u>          </u>
11.1.5	Other (Specify) . . . . .	<u>          </u>

Question 11.2 For the interactions rated "radically different", what is the nature of the difference?

Question 11.3 For the interactions rated "substantially different", what is the nature of the difference?

Question 11.4 For the interactions rated "somewhat different", is the difference enough to require a change in training methods?

New System Landing Systems

Question 12.1 In terms of training methods, how much difference will there be between the new system and the current systems it replaces? (Note that this differs from Questions 8.1 and 9.1, by emphasizing training difference instead of system operation differences, i.e., differences in system operation might not always necessitate differences in training methods.)

	<u>Training Areas</u>	<u>Degree of Difference</u>
12.1.1	Basic Flying . . . . .	<u>D</u>
12.1.2	Instrument Flying . . . . .	<u>C</u>
12.1.3	Map of Earth Flying . . . . .	_____
12.1.4	Navigation . . . . .	_____
12.1.5	Communications . . . . .	_____
12.1.6	Target Detection . . . . .	_____
12.1.7	Target Attack . . . . .	_____
12.1.8	Weapon Aiming and Firing . . . . .	_____
12.1.9	Air-to-Air Combat Flight Maneuvers . . . . .	_____
12.1.10	Air-to-Ground Combat Flight Maneuvers . . . . .	_____
12.1.11	Multiple Aircraft Operations	_____
12.1.12	Reconnaissance . . . . .	_____
12.1.13	Command and Control Informa- tion Processing . . . . .	_____
12.1.14	Other (Specify) . . . . .	_____
12.1.15	Other (Specify) . . . . .	_____

Question 12.2 For the training areas rated "radically different", what is the nature of the difference?

Question 12.3 For the training areas rated "substantially different", what is the nature of the difference?

Question 12.4 For the training areas rated "somewhat different", what is the nature of the difference?

12.1.2 Training methods should reflect characteristics of new system

Question 13 As stated at the beginning of the questionnaire the objective of this study is to identify new Army aviation systems and system characteristics which will require behavioral changes necessitating new training techniques.

Given this objective, is there anything further which you believe will require changes in training as a result of the introduction of new Army aviation systems?

QUESTIONNAIRE FOR UNIVERSITY OF DAYTON STUDY OF ARMY  
 AVIATION TRAINING R&D REQUIREMENTS  
 (ARMY RESEARCH INSTITUTE FIELD UNIT  
 CONTRACT NO. MDA903-80-C-0229

DATE 6 May 1980

QUESTIONNAIRE NO. 7

RESPONDER'S NAME \_\_\_\_\_

RESPONDER'S ORGANIZATION \_\_\_\_\_

RESPONDER'S TITLE OR POSITION \_\_\_\_\_

The objective of this study is to identify new Army aviation systems and system characteristics which will require behavioral changes necessitating new training techniques.

Question 1 What new systems will be in the U.S. Army aviation inventory for the period of 1985 to 2000 (within your area of cognizance)?

- 1.1 AH-64 Attack Helicopter
- 1.2 \_\_\_\_\_
- 1.3 \_\_\_\_\_
- 1.4 \_\_\_\_\_

Question 2 What are the probabilities that each of these new systems will be introduced into Army inventory? (Values of probability are defined as 1.0 = almost certain, 0.8 = highly probable, 0.6 = probable, 0.4 = uncertain, and 0.2 = highly unlikely.)

	<u>New System</u>	<u>Probability</u>
2.1	<u>AH-64</u>	<u>0.8</u>
2.2	_____	_____
2.3	_____	_____
2.4	_____	_____



New System AH-64

Question 6.1 How much difference will there be between the new system and the current systems which it replaces in terms of physical characteristics? (Degrees of difference are defined as: "a" = radically different; "b" = substantially different; "c" = somewhat different; and "d" = minimal or no difference.)

<u>Component</u>	<u>Degree of Difference</u>
6.1.1 Flight Controls . . . . .	<u>D</u>
6.1.2 Instruments . . . . .	<u>C</u>
6.1.3 Displays . . . . .	<u>C</u>
6.1.4 Power Controls . . . . .	<u>D</u>
6.1.5 Seating Arrangement . . . . .	<u>D</u>
6.1.6 Visibility . . . . .	<u>D</u>
6.1.7 Weapon Guidance . . . . .	<u>B</u>
6.1.8 Guns . . . . .	<u>D</u>
6.1.9 Rockets . . . . .	<u>D</u>
6.1.10 Laser . . . . .	<u>C</u>
6.1.11 Threat Detection . . . . .	<u>C</u>
6.1.12 Navigation . . . . .	<u>D</u>
6.1.13 Communication . . . . .	<u>D</u>
6.1.14 ECM/EW . . . . .	<u>D</u>
6.1.15 Other (Specify) <i>Pilot Night Vision</i>	<u>A</u>
6.1.16 Other (Specify) <i>Target Acquisition</i>	<u>A</u>
6.1.17 Other (Specify) <i>Optics, FLIR, LLTV</i>	<u>A</u>

Question 6.2 For the components rated "radically different", what is the nature of the difference?

6.1.15 (Pilot Night Vision) - AH-1 Cobra Night Vision, goggles only  
AH-64 FLIR, Optics, LLTV, Helmet Display

Question 6.3 For the components rated "substantially different", what is the nature of the difference?

Question 6.4 For the components rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

AH-64 Bar displays, expanded HUD  
AH-1 Gauges, gunsight HUD

New System AH-64

Question 7.1 How much performance difference will there be between the new system and the current systems which it replaces? (Degrees of difference are defined in Question 6.1).

	<u>Performance</u>	<u>Degree of Difference</u>
7.1.1	Maneuverability . . . . .	<u>B</u>
7.1.2	Flight Stability . . . . .	<u>C</u>
7.1.3	Control Responsiveness . . . . .	<u>B</u>
7.1.4	Flying Workload . . . . .	<u>C</u>
7.1.5	Flight Safety Characteristics . . . . .	<u>C</u>
7.1.6	Complexity . . . . .	<u>B</u>
7.1.7	Speed . . . . .	<u>C</u>
7.1.8	Target Detection Capabilities . . . . .	<u>A</u>
7.1.9	Weapon Range . . . . .	<u>B</u>
7.1.10	Weapon Accuracy . . . . .	<u>D</u>
7.1.11	Troop Capacity . . . . .	<u>B</u>
7.1.12	Cargo Capacity . . . . .	<u>C</u>
7.1.13	Other (Specify) . . . . .	<u>        </u>
7.1.14	Other (Specify) . . . . .	<u>        </u>

Question 7.2 For the performances rated "radically different", what is the nature of the difference?

*Covered in 6*

Question 7.3 For the performances rated "substantially different", what is the nature of the difference?

*Agility, maneuverability, superior to AH-1*

*More power, control response better*

*Maintenance - box concept, complex*

*25 to 30 percent greater in weapon range*

Question 7.4 For the performances rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

New System AH-64

Question 8.1 In terms of cockpit crew operations, how much difference is there between the new system and the current systems which it replaces? (Degrees of difference are defined in Question 6.1).

<u>Operation</u>	<u>Degree of Difference</u>
8.1.1 Basic Flying . . . . .	<u>D</u>
8.1.2 Instrument Flying . . . . .	<u>D</u>
8.1.3 Nap of Earth Flying . . . . .	<u>B</u>
8.1.4 Navigation . . . . .	<u>D</u>
8.1.5 Communication . . . . .	<u>D</u>
8.1.6 Other (Specify) . . . . .	<u>          </u>
8.1.7 Other (Specify) . . . . .	<u>          </u>

Question 8.2 For the operations rated "radically different", what is the nature of the difference?

Question 8.3 For the operations rated "substantially different", what is the nature of the difference?

*Nap of earth flying - more training needed  
(PNVS) night flying and WX training*

Question 8.4 For the operations rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

New System AH-64

Question 8.1 In terms of cockpit crew operations, how much difference is there between the new system and the current systems which it replaces? (Degrees of difference are defined in Question 6.1).

<u>Operation</u>	<u>Degree of Difference</u>
8.1.1 Basic Flying . . . . .	<u>D</u>
8.1.2 Instrument Flying . . . . .	<u>D</u>
8.1.3 Nap of Earth Flying . . . . .	<u>B</u>
8.1.4 Navigation . . . . .	<u>D</u>
8.1.5 Communication . . . . .	<u>D</u>
8.1.6 Other (Specify) . . . . .	<u>          </u>
8.1.7 Other (Specify) . . . . .	<u>          </u>

Question 8.2 For the operations rated "radically different", what is the nature of the difference?

Question 8.3 For the operations rated "substantially different", what is the nature of the difference?

Nap of earth flying - more training needed  
(PNVS) night flying & WX training

Question 8.4 For the operations rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

New System AH-64

Question 9.1 In terms of combat operations tasks, how much difference is there between the new system and current systems which it replaces? (Degrees of difference are defined in Question 6.1).

	<u>Operation</u>	<u>Degree of Difference</u>
9.1.1	Target Detection . . . . .	<u>B</u>
9.1.2	Target Attack . . . . .	<u>D</u>
9.1.3	Weapon Aiming and Firing . . .	<u>C</u>
9.1.4	Air-to-Air Combat Flight Maneuvers . . . . .	<u>N/A</u>
9.1.5	Air-to-Ground Combat Flight Maneuvers . . . . .	<u>D</u>
9.1.6	Multiple Aircraft Operation .	<u>D</u>
9.1.7	Reconnaissance . . . . .	<u>N/A</u>
9.1.8	Command and Control Informa- tion Processing . . . . .	<u>D</u>
9.1.9	Other (Specify) . . . . .	<u>          </u>
9.1.10	Other (Specify) . . . . .	<u>          </u>

Question 9.2 For the operations rated "radically different", what is the nature of the difference?

Question 9.3 For the operations rated "substantially different", what is the nature of the difference?

Question 9.4 For the operations rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

*Covered in Question 6*

*Shifts in memory skills such as automated preflight procedures and engine starting*

*Combat and flight operations are same for AH-64 and AH-1, but job is getting more difficult*

New System AH-64

Question 10.1 What are the differences in man-machine skill requirements between the new system and the current systems which it replaces? (Degrees of difference are defined in Question 6.1).

<u>Skill Category</u>	<u>Degree of Difference</u>
10.1.1 Monitoring Displays . . . . .	<u>B</u>
10.1.2 Tracking Outside Aircraft . . . . .	<u>D</u>
10.1.3 Recognition . . . . .	<u>B</u>
10.1.4 Memory . . . . .	<u>B</u>
10.1.5 Decision-Making . . . . .	<u>C</u>
10.1.6 Physical Responses . . . . .	<u>C</u>
10.1.7 Other (Specify) . . . . .	<u>          </u>
10.1.8 Other (Specify) . . . . .	<u>          </u>

Question 10.2 For the skills rated "radically different", what is the nature of the difference?

Question 10.3 For the skills rated "substantially different", what is the nature of the difference?

- 10.1.1 *More research to build necessary confidence  
PNVS (coordination of flying and helmet display)*
- 10.1.3 *TADS and FLIR image will be different  
teach a guy how to recognize targets on FLIR image*
- 10.1.4 *Shift in memory skills - mission up, non-mission down*

Question 10.4 For the skills rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

- 10.1.5 *Target identification easier - more time for real decision making*
- 10.1.6 *Criteria for PNVS in AH-64, AH-64 easier to fly NOE at night primary consideration  
People selection (Research Item Dominant Eye Problem to be resolved)*

New System AH-64

Question 11.1 What are the differences in crew interaction requirements between the new system and the current systems which it replaces? (Degrees of difference are defined in Question 6.1).

	<u>Interaction Category</u>	<u>Degree of Difference</u>
11.1.1	Verbal Exchange . . . . .	<u>D</u>
11.1.2	Non-Verbal Exchange . . . . .	<u>D</u>
11.1.3	Coordinated Physical Responses . . . . .	<u>D</u>
11.1.4	Other (Specify) . . . . .	<u>          </u>
11.1.5	Other (Specify) . . . . .	<u>          </u>

Question 11.2 For the interactions rated "radically different", what is the nature of the difference?

Question 11.3 For the interactions rated "substantially different", what is the nature of the difference?

Question 11.4 For the interactions rated "somewhat different", is the difference enough to require a change in training methods?

New System AH-64

Question 12.1 In terms of training methods, how much difference will there be between the new system and the current systems it replaces? (Note that this differs from Questions 8.1 and 9.1, by emphasizing training difference instead of system operation differences, i.e., differences in system operation might not always necessitate differences in training methods.)

	<u>Training Areas</u>	<u>Degree of Difference</u>
12.1.1	Basic Flying . . . . .	<u>D</u>
12.1.2	Instrument Flying . . . . .	<u>D</u>
12.1.3	Map of Earth Flying . . . . .	<u>D</u>
12.1.4	Navigation . . . . .	<u>D</u>
12.1.5	Communications . . . . .	<u>D</u>
12.1.6	Target Detection . . . . .	<u>B</u>
12.1.7	Target Attack . . . . .	<u>D</u>
12.1.8	Weapon Aiming and Firing . . . . .	<u>D</u>
12.1.9	Air-to-Air Combat Flight Maneuvers . . . . .	<u>A</u>
12.1.10	Air-to-Ground Combat Flight Maneuvers . . . . .	<u>D</u>
12.1.11	Multiple Aircraft Operations	<u>D</u>
12.1.12	Reconnaissance . . . . .	<u>N/A</u>
12.1.13	Command and Control Informa- tion Processing . . . . .	<u>D</u>
12.1.14	Other (Specify) . . . . .	<u>          </u>
12.1.15	Other (Specify) . . . . .	<u>          </u>

Question 12.2 For the training areas rated "radically different", what is the nature of the difference?

12.1.9 *Air-to-air in all systems*

Question 12.3 For the training areas rated "substantially different", what is the nature of the difference?

12.1.6 *TADS*

Question 12.4 For the training areas rated "somewhat different", what is the nature of the difference?

Question 13 As stated at the beginning of the questionnaire the objective of this study is to identify new Army aviation systems and system characteristics which will require behavioral changes necessitating new training techniques.

Given this objective, is there anything further which you believe will require changes in training as a result of the introduction of new Army aviation systems?

*Significant thing about AH-64 is night capability (PNVS) (FLIR and LLTV) (also optic system).*

*Another area - how do we train pilots - backseat only - or do we train a guy for both seats? Would like to see a guy qualified for both seats.*

*Separate night pilots and day pilots.*

QUESTIONNAIRE FOR UNIVERSITY OF DAYTON STUDY OF ARMY  
 AVIATION TRAINING R&D REQUIREMENTS  
 (ARMY RESEARCH INSTITUTE FIELD UNIT  
 CONTRACT NO. MDA903-80-C-0229

DATE 27 May 1980

QUESTIONNAIRE NO. 8

RESPONDER'S NAME \_\_\_\_\_

RESPONDER'S ORGANIZATION \_\_\_\_\_

RESPONDER'S TITLE OR POSITION \_\_\_\_\_

The objective of this study is to identify new Army aviation systems and system characteristics which will require behavioral changes necessitating new training techniques.

Question 1 What new systems will be in the U.S. Army aviation inventory for the period of 1985 to 2000 (within your area of cognizance)?

- 1.1 LH-X
- 1.2 SEMA-X
- 1.3 \_\_\_\_\_
- 1.4 \_\_\_\_\_

Question 2 What are the probabilities that each of these new systems will be introduced into Army inventory? (Values of probability are defined as 1.0 = almost certain, 0.8 = highly probable, 0.6 = probable, 0.4 = uncertain, and 0.2 = highly unlikely.)

	<u>New System</u>	<u>Probability</u>
2.1	<u>LH-X</u>	<u>0.6</u>
2.2	<u>SEMA-X</u>	<u>0.8</u>
2.3	_____	_____
2.4	_____	_____

Question 3 What are the scheduled years for introducing each of these new aviation systems?

	<u>New System</u>	<u>Year</u>
3.1	<u>LH-X</u>	<u>1992-1995 (planned)</u>
3.2	<u>SEMA-X</u>	<u>1990-1995 (planned)</u>
3.3	<u>                    </u>	<u>                    </u>
3.4	<u>                    </u>	<u>                    </u>

Question 4 How extensive will be the use of each of these new systems? (Degrees of use are defined as "a" = more than three thousand items, "b" = one to three thousand items, "c" = three hundred to one thousand items, "d" = one to three hundred items, and "e" = thirty to one hundred items.)

	<u>New System</u>	<u>Degree of Use</u>
4.1	<u>LH-X</u>	<u>A</u>
4.2	<u>SEMA-X</u>	<u>D</u>
4.3	<u>                    </u>	<u>                    </u>
4.4	<u>                    </u>	<u>                    </u>

Question 5 What are the current systems, if any, to be replaced by each of these systems?

	<u>New Systems</u>	<u>Current Systems</u>
5.1	<u>LH-X</u>	<u>AH-1, OH-58</u>
5.2	<u>SEMA-X</u>	<u>OV-1, RU-21, EH-1</u>
5.3	<u>                    </u>	<u>                    </u>
5.4	<u>                    </u>	<u>                    </u>

The questionnaire responder should answer Questions 6 to 12, on separate sheets, for each of the new systems identified in the answer to Question 1.

New System LH-X

Question 6.1 How much difference will there be between the new system and the current systems which it replaces in terms of physical characteristics? (Degrees of difference are defined as: "a" = radically different; "b" = substantially different; "c" = somewhat different; and "d" = minimal or no difference.)

<u>Component</u>	<u>Degree of Difference</u>
6.1.1 Flight Controls . . . . .	<u>A</u>
6.1.2 Instruments . . . . .	<u>A</u>
6.1.3 Displays . . . . .	<u>A</u>
6.1.4 Power Controls . . . . .	<u>A</u>
6.1.5 Seating Arrangement . . . . .	<u>A</u>
6.1.6 Visibility . . . . .	<u>A</u>
6.1.7 Weapon Guidance . . . . .	<u>B</u>
6.1.8 Guns . . . . .	<u>D</u>
6.1.9 Rockets . . . . .	<u>D</u>
6.1.10 Laser . . . . .	<u>D</u>
6.1.11 Threat Detection . . . . .	<u>A</u>
6.1.12 Navigation . . . . .	<u>A</u>
6.1.13 Communication . . . . .	<u>A</u>
6.1.14 ECM/EW . . . . .	<u>C</u>
6.1.15 Other (Specify) <i>Self-deployability</i>	<u>B</u>
6.1.16 Other (Specify) <i>New protective environment</i>	<u>A</u>

Question 6.2 For the components rated "radically different", what is the nature of the difference?

6.1.2 - 6.1.3 *Integrated into HUD and CRT display*  
 6.1.5 *One-man seat*  
*(continued on attached)*

Question 6.3 For the components rated "substantially different", what is the nature of the difference?

6.1.7 *Fire and forget*  
 6.1.15 *Refuelability across the Atlantic Ocean*

Question 6.4 For the components rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

6.1.14 *Evasive maneuvers*

New System LH-X

Question 6.2 (Continued)

6.1.11 *Integrated threat detection*

6.1.12 *No maps; NOE at 200 knots*

6.1.13 *Voice encoded coordinate locations on CRT*

New System LH-X

Question 7.1 How much performance difference will there be between the new system and the current systems which it replaces? (Degrees of difference are defined in Question 6.1).

	<u>Performance</u>	<u>Degree of Difference</u>
7.1.1	Maneuverability . . . . .	<u>A</u>
7.1.2	Flight Stability . . . . .	<u>B</u>
7.1.3	Control Responsiveness . . . . .	<u>A</u>
7.1.4	Flying Workload . . . . .	<u>A</u>
7.1.5	Flight Safety Characteristics . . . . .	<u>C</u>
7.1.6	Complexity . . . . .	<u>C</u>
7.1.7	Speed . . . . .	<u>A</u>
7.1.8	Target Detection Capabilities . . . . .	<u>B</u>
7.1.9	Weapon Range . . . . .	<u>B</u>
7.1.10	Weapon Accuracy . . . . .	<u>B</u>
7.1.11	Troop Capacity . . . . .	<u>N/A</u>
7.1.12	Cargo Capacity . . . . .	<u>N/A</u>
7.1.13	Other (Specify) . . . . .	<u>      </u>
7.1.14	Other (Specify) . . . . .	<u>      </u>

Question 7.2 For the performances rated "radically different", what is the nature of the difference?

- 7.1.1 *Replace some of black box*  
7.1.4 *Drastic reduction*

Question 7.3 For the performances rated "substantially different", what is the nature of the difference?

- 7.1.8 *Increase capabilities*  
7.1.9 - 7.1.10 *Radically different sensor*

Question 7.4 For the performances rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

- 7.1.5 *Automatic limiting of flight conditions not planned, increased maneuverability could increase risk*  
7.1.6 *All displays integrated, less complexity for pilot*

New System LH-X

Question 8.1 In terms of cockpit crew operations, how much difference is there between the new system and the current systems which it replaces? (Degrees of difference are defined in Question 6.1).

<u>Operation</u>	<u>Degree of Difference</u>
8.1.1 Basic Flying . . . . .	<u>C</u>
8.1.2 Instrument Flying . . . . .	<u>B</u>
8.1.3 Nap of Earth Flying . . . . .	<u>A</u>
8.1.4 Navigation (NOE). . . . .	<u>B</u>
8.1.5 Communication . . . . .	<u>C</u>
8.1.6 Other (Specify) <i>Path Finding</i> . . .	<u>C</u>
8.1.7 Other (Specify) <i>NBC Operations</i> . .	<u>A</u>
8.1.8 Operation in icing condition	<u>C</u>
8.1.9 Wire-cutting operations	<u>B</u>

Question 8.2 For the operations rated "radically different", what is the nature of the difference?

Question 8.3 For the operations rated "substantially different", what is the nature of the difference?

8.1.4 Satellite navigation in NOE

Question 8.4 For the operations rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

- 8.1.1 Increase maneuverability
- 8.1.5 Reduce workload
- 8.1.6 Knowing where you are and where you are going under NOE conditions
- 8.1.8 LH-X will have de-icing

New System LH-X

Question 9.1 In terms of combat operations tasks, how much difference is there between the new system and current systems which it replaces? (Degrees of difference are defined in Question 6.1).

	<u>Operation</u>	<u>Degree of Difference</u>
9.1.1	Target Detection . . . . .	<u>B</u>
9.1.2	Target Attack . . . . .	<u>A</u>
9.1.3	Weapon Aiming and Firing . . .	<u>A</u>
9.1.4	Air-to-Air Combat Flight Maneuvers . . . . .	<u>A</u>
9.1.5	Air-to-Ground Combat Flight Maneuvers . . . . .	<u>B</u>
9.1.6	Multiple Aircraft Operation .	<u>C</u>
9.1.7	Reconnaissance . . . . .	<u>C</u>
9.1.8	Command and Control Informa- tion Processing . . . . .	<u>B</u>
* 9.1.9	Other (Specify) . . . . .	<u>A</u>
9.1.10	Other (Specify) . . . . .	<u>      </u>

Question 9.2 For the operations rated "radically different", what is the nature of the difference?

- 9.1.2 *Launch and leave*
- 9.1.4 *New weapon suit for mm wave radar for threat detection*

Question 9.3 For the operations rated "substantially different", what is the nature of the difference?

- 9.1.1 *Much more automation in cueing of pilot*
- 9.1.5 *Less hover time*

Question 9.4 For the operations rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

- 9.1.6 *Dedicated ECM with group*
- 9.1.7 *Armed reconnaissance*

\* *Penetrating FEBA, attacking enemy reserve units*

New System LH-X

Question 10.1 What are the differences in man-machine skill requirements between the new system and the current systems which it replaces? (Degrees of difference are defined in Question 6.1).

<u>Skill Category</u>	<u>Degree of Difference</u>
10.1.1 Monitoring Displays . . . . .	<u>B</u>
10.1.2 Tracking Outside Aircraft . . . . .	<u>B</u>
10.1.3 Recognition . . . . .	<u>B</u>
10.1.4 Memory . . . . .	<u>B</u>
10.1.5 Decision-Making . . . . .	<u>B</u>
10.1.6 Physical Responses . . . . .	<u>C</u>
10.1.7 Other (Specify) . . . . .	<u>                    </u>
10.1.8 Other (Specify) . . . . .	<u>                    </u>

Question 10.2 For the skills rated "radically different", what is the nature of the difference?

Question 10.3 For the skills rated "substantially different", what is the nature of the difference?

- 10.1.1 Much less information processing by pilot
- 10.1.3 One-man cockpit
- 10.1.4 Much more storage and use automation
- 10.1.5 Pilot decisions versus decisions machine can make
- 10.1.6 Less stable (utilization of maneuverability)

Question 10.4 For the skills rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

New System LH-X

Question 11.1 What are the differences in crew interaction requirements between the new system and the current systems which it replaces? (Degrees of difference are defined in Question 6.1).

	<u>Interaction Category</u>	<u>Degree of Difference</u>
11.1.1	Verbal Exchange . . . . .	<u>N/A</u>
11.1.2	Non-Verbal Exchange . . . . .	<u>N/A</u>
11.1.3	Coordinated Physical Responses . . . . .	<u>N/A</u>
11.1.4	Other (Specify) . . . . .	<u>          </u>
11.1.5	Other (Specify) . . . . .	<u>          </u>

Question 11.2 For the interactions rated "radically different", what is the nature of the difference?

Question 11.3 For the interactions rated "substantially different", what is the nature of the difference?

Question 11.4 For the interactions rated "somewhat different", is the difference enough to require a change in training methods?

New System LH-X

Question 12.1 In terms of training methods, how much difference will there be between the new system and the current systems it replaces? (Note that this differs from Questions 8.1 and 9.1, by emphasizing training difference instead of system operation differences, i.e., differences in system operation might not always necessitate differences in training methods.)

	<u>Training Areas</u>	<u>Degree of Difference</u>
12.1.1	Basic Flying . . . . .	<u>B</u>
12.1.2	Instrument Flying . . . . .	<u>B</u>
12.1.3	Map of Earth Flying . . . . .	<u>B</u>
12.1.4	Navigation . . . . .	<u>B</u>
12.1.5	Communications . . . . .	<u>C</u>
12.1.6	Target Detection . . . . .	<u>B</u>
12.1.7	Target Attack . . . . .	<u>A</u>
12.1.8	Weapon Aiming and Firing . .	<u>A</u>
12.1.9	Air-to-Air Combat Flight Maneuvers . . . . .	<u>A</u>
12.1.10	Air-to-Ground Combat Flight Maneuvers . . . . .	<u>B</u>
12.1.11	Multiple Aircraft Operations	<u>C</u>
12.1.12	Reconnaissance . . . . .	<u>C</u>
12.1.13	Command and Control Informa- tion Processing . . . . .	<u>B</u>
12.1.14	Other (Specify) . . . . .	<u>        </u>
12.1.15	Other (Specify) . . . . .	<u>        </u>

Question 12.2 For the training areas rated "radically different", what is the nature of the difference?

Question 12.3 For the training areas rated "substantially different", what is the nature of the difference?

12.1.1 Side arm controller

12.1.2 - 12.1.3 More maneuverability under adverse weather

12.1.4 Path finding

12.1.10 More performance type training

Question 12.4 For the training areas rated "somewhat different", what is the nature of the difference?

New System SEMA-X

Question 6.1 How much difference will there be between the new system and the current systems which it replaces in terms of physical characteristics? (Degrees of difference are defined as: "a" = radically different; "b" = substantially different; "c" = somewhat different; and "d" = minimal or no difference.)

<u>Component</u>	<u>Degree of Difference</u>
6.1.1 Flight Controls . . . . .	<u>A</u>
6.1.2 Instruments . . . . .	<u>A</u>
6.1.3 Displays . . . . .	<u>A</u>
6.1.4 Power Controls . . . . .	<u>B</u>
6.1.5 Seating Arrangement . . . . .	<u>D</u>
6.1.6 Visibility . . . . .	<u>D</u>
6.1.7 Weapon Guidance . . . . .	<u>N/A</u>
6.1.8 Guns . . . . .	<u>N/A</u>
6.1.9 Rockets . . . . .	<u>N/A</u>
6.1.10 Laser . . . . . <i>Designation</i>	<u>C</u>
6.1.11 Threat Detection . . . . .	<u>B</u>
6.1.12 Navigation . . . . .	<u>B</u>
6.1.13 Communication . . . . .	<u>C</u>
6.1.14 ECM/EW . . . . .	<u>B</u>
6.1.15 Other (Specify) <i>Intelligence - real time aspect</i>	<u>B</u>
6.1.16 Other (Specify) <i>Transmission to Field Commander</i>	<u>B</u>

Question 6.2 For the components rated "radically different", what is the nature of the difference?

Question 6.3 For the components rated "substantially different", what is the nature of the difference?

- 6.1.12 *Inertial or pulse Doppler*
- 6.1.14 *Down on deck/close range*
- 6.1.15 *Artificial intelligence - electronic algorithms to enhance images - multi-spectral image building*

Question 6.4 For the components rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

- 6.1.13 *Secure data link*

New System SEMA-X

Question 7.1 How much performance difference will there be between the new system and the current systems which it replaces? (Degrees of difference are defined in Question 6.1).

	<u>Performance</u>	<u>Degree of Difference</u>
7.1.1	Maneuverability . . . . .	<u>D</u>
7.1.2	Flight Stability . . . . .	<u>B</u>
7.1.3	Control Responsiveness . . . . .	<u>D</u>
7.1.4	Flying Workload . . . . .	<u>B</u>
7.1.5	Flight Safety Characteristics . . . . .	<u>C</u>
7.1.6	Complexity . . . . .	<u>B</u>
7.1.7	Speed . . . . .	<u>D</u>
7.1.8	Target Detection Capabilities . . . . .	<u>A</u>
7.1.9	Weapon Range . . . . .	<u>N/A</u>
7.1.10	Weapon Accuracy . . . . .	<u>N/A</u>
7.1.11	Troop Capacity . . . . .	<u>N/A</u>
7.1.12	Cargo Capacity . . . . .	<u>N/A</u>
7.1.13	Other (Specify) <sup>Electronic equipment</sup> volume	<u>C</u>
7.1.14	Other (Specify) . . . . .	<u>          </u>

Question 7.2 For the performances rated "radically different", what is the nature of the difference?

7.1.8 *Millimeter wave radar may be used extensively for all-weather reconnaissance*  
Also see Question 6

Question 7.3 For the performances rated "substantially different", what is the nature of the difference?

7.1.2 *Stability needed for pointing a raster side-looking radar*  
7.1.4 *Workload will increase*  
7.1.6 *Different types of intelligence gathering sensors and processors*

Question 7.4 For the performances rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

7.1.5 *Generally safer*

New System SEMA-X

Question 8.1 In terms of cockpit crew operations, how much difference is there between the new system and the current systems which it replaces? (Degrees of difference are defined in Question 6.1).

<u>Operation</u>	<u>Degree of Difference</u>
8.1.1 Basic Flying . . . . .	<u>B</u>
8.1.2 Instrument Flying . . . . .	<u>D</u>
8.1.3 Nap of Earth Flying . . . . .	<u>D</u>
8.1.4 Navigation . . . . .	<u>B</u>
8.1.5 Communication . . . . .	<u>B</u>
8.1.6 Other (Specify) <i>Microwave Landing System</i>	<u>C</u>
8.1.7 Other (Specify) . . . . .	<u>      </u>

Question 8.2 For the operations rated "radically different", what is the nature of the difference?

Question 8.3 For the operations rated "substantially different", what is the nature of the difference?

- 8.1.1 *For transition mode XV-15, X wing, directed thrust (AV-8).  
If current type aircraft is chosen, then no change.*
- 8.1.4 *Substantially more precise location, tracking, and stability*
- 8.1.5 *Much more on-board processing for real-time intelligence to  
Field Commander*

Question 8.4 For the operations rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

- 8.1.6 *Air Traffic Management Systems*

New System SEMA-X

Question 9.1 In terms of combat operations tasks, how much difference is there between the new system and current systems which it replaces? (Degrees of difference are defined in Question 6.1).

	<u>Operation</u>	<u>Degree of Difference</u>
9.1.1	Target Detection . . . . .	<u>A</u>
9.1.2	Target Attack . . . . .	<u>N/A</u>
9.1.3	Weapon Aiming and Firing . . . . .	<u>N/A</u>
9.1.4	Air-to-Air Combat Flight Maneuvers . . . . .	<u>N/A</u>
9.1.5	Air-to-Ground Combat Flight Maneuvers . . . . .	<u>N/A</u>
9.1.6	Multiple Aircraft Operation . . . . .	<u>C</u>
9.1.7	Reconnaissance . . . . .	<u>B</u>
9.1.8	Command and Control Informa- tion Processing . . . . .	<u>B</u>
9.1.9	Other (Specify) <i>Target Designation</i>	<u>C</u>
9.1.10	Other (Specify) . . . . .	<u>      </u>

Question 9.2 For the operations rated "radically different", what is the nature of the difference?

9.1.1 See Questions 6 and 7

Question 9.3 For the operations rated "substantially different", what is the nature of the difference?

9.1.7 See Question 7

9.1.8 See Question 8

Question 9.4 For the operations rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

9.1.6 Occasionally send two now for triangulation - type target fixing, primary for electronic emitters.

SEMA-X will use time as variable.

9.1.7 Laser designation

New System SEMA-X

Question 10.1 What are the differences in man-machine skill requirements between the new system and the current systems which it replaces? (Degrees of difference are defined in Question 6.1).

	<u>Skill Category</u>	<u>Degree of Difference</u>
10.1.1	Monitoring Displays . . . . .	<u>C</u>
10.1.2	Tracking Outside Aircraft . . . . .	<u>D</u>
10.1.3	Recognition . . . . .	<u>D</u>
10.1.4	Memory . . . . .	<u>C</u>
10.1.5	Decision-Making . . . . .	<u>B</u>
10.1.6	Physical Responses . . . . .	<u>D</u>
10.1.7	Other (Specify) <i>Intelligence Gathering</i>	<u>B</u>
10.1.8	Other (Specify) . . . . .	<u>          </u>

Question 10.2 For the skills rated "radically different", what is the nature of the difference?

Question 10.3 For the skills rated "substantially different", what is the nature of the difference?

10.1.5 *Radar warning now tells quadrant in which threat is located. In future, maneuver and timing will be dictated to pilot by computer processing of threat information.*

10.1.7 *More highly automated*

Question 10.4 For the skills rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

10.1.1 *More types of displays will have to be oriented*

10.1.4 *Machinery will offset additional loading*

New System SEMA-X

Question 11.1 What are the differences in crew interaction requirements between the new system and the current systems which it replaces? (Degrees of difference are defined in Question 6.1).

	<u>Interaction Category</u>	<u>Degree of Difference</u>
11.1.1	Verbal Exchange . . . . .	<u>D</u>
11.1.2	Non-Verbal Exchange . . . . .	<u>D</u>
11.1.3	Coordinated Physical Responses . . . . .	<u>D</u>
11.1.4	Other (Specify) <i>Time Aloft</i> . . . . .	<u>C</u>
11.1.5	Other (Specify) . . . . .	<u>        </u>

Question 11.2 For the interactions rated "radically different", what is the nature of the difference?

Question 11.3 For the interactions rated "substantially different", what is the nature of the difference?

Question 11.4 For the interactions rated "somewhat different", is the difference enough to require a change in training methods?

*11.1.4 Time aloft will be increased to minimize aircraft numbers required. Airplane can be flown by one man, but time aloft will require both to be pilots, since it will be very fatiguing.*

New System SEMA-X

Question 12.1 In terms of training methods, how much difference will there be between the new system and the current systems it replaces? (Note that this differs from Questions 8.1 and 9.1, by emphasizing training difference instead of system operation differences, i.e., differences in system operation might not always necessitate differences in training methods.)

	<u>Training Areas</u>	<u>Degree of Difference</u>
12.1.1	Basic Flying . . . . .	<u>D</u>
12.1.2	Instrument Flying . . . . .	<u>C</u>
12.1.3	Nap of Earth Flying . . . . .	<u>D</u>
12.1.4	Navigation . . . . .	<u>D</u>
12.1.5	Communications . . . . .	<u>D</u>
12.1.6	Target Detection . . . . .	<u>D</u>
12.1.7	Target Attack . . . . .	<u>N/A</u>
12.1.8	Weapon Aiming and Firing . . . . .	<u>N/A</u>
12.1.9	Air-to-Air Combat Flight Maneuvers . . . . .	<u>N/A</u>
12.1.10	Air-to-Ground Combat Flight Maneuvers . . . . .	<u>N/A</u>
12.1.11	Multiple Aircraft Operations	<u>N/A</u>
12.1.12	Reconnaissance . . . . .	<u>C</u>
12.1.13	Command and Control Informa- tion Processing . . . . .	<u>C</u>
12.1.14	Other (Specify) <i>Intelligence</i> . . . . .	<u>C</u>
12.1.15	Other (Specify) . . . . .	<u>        </u>

Question 12.2 For the training areas rated "radically different", what is the nature of the difference?

Question 12.3 For the training areas rated "substantially different", what is the nature of the difference?

Question 12.4 For the training areas rated "somewhat different", what is the nature of the difference?

12.1.2 Display watching, microwave landing system

12.1.12 - 12.1.14 Greater use of synthetic displays

Question 13 As stated at the beginning of the questionnaire the objective of this study is to identify new Army aviation systems and system characteristics which will require behavioral changes necessitating new training techniques.

Given this objective, is there anything further which you believe will require changes in training as a result of the introduction of new Army aviation systems?

*Army aviation will be a combat-oriented activity*

QUESTIONNAIRE FOR UNIVERSITY OF DAYTON STUDY OF ARMY  
AVIATION TRAINING R&D REQUIREMENTS  
(ARMY RESEARCH INSTITUTE FIELD UNIT  
CONTRACT NO. MDA903-80-C-0229

DATE 28 May 1980

QUESTIONNAIRE NO. 9

RESPONDER'S NAME \_\_\_\_\_

RESPONDER'S ORGANIZATION \_\_\_\_\_

RESPONDER'S TITLE OR POSITION \_\_\_\_\_

The objective of this study is to identify new Army aviation systems and system characteristics which will require behavioral changes necessitating new training techniques.

Question 1 What new systems will be in the U.S. Army aviation inventory for the period of 1985 to 2000 (within your area of cognizance)?

- 1.1 AAH
- 1.2 \_\_\_\_\_
- 1.3 \_\_\_\_\_
- 1.4 \_\_\_\_\_

Question 2 What are the probabilities that each of these new systems will be introduced into Army inventory? (Values of probability are defined as 1.0 = almost certain, 0.8 = highly probable, 0.6 = probable, 0.4 = uncertain, and 0.2 = highly unlikely.)

	<u>New System</u>	<u>Probability</u>
2.1	<u>AAH</u>	<u>0.8</u>
2.2	_____	_____
2.3	_____	_____
2.4	_____	_____

Question 3 What are the scheduled years for introducing each of these new aviation systems?

	<u>New System</u>	<u>Year</u>
3.1	<u>AAH</u>	<u>1984</u>
3.2	<u>_____</u>	<u>_____</u>
3.3	<u>_____</u>	<u>_____</u>
3.4	<u>_____</u>	<u>_____</u>

Question 4 How extensive will be the use of each of these new systems? (Degrees of use are defined as "a" = more than three thousand items, "b" = one to three thousand items, "c" = three hundred to one thousand items, "d" = one to three hundred items, and "e" = thirty to one hundred items.)

	<u>New System</u>	<u>Degree of Use</u>
4.1	<u>AAH</u>	<u>C</u>
4.2	<u>_____</u>	<u>_____</u>
4.3	<u>_____</u>	<u>_____</u>
4.4	<u>_____</u>	<u>_____</u>

Question 5 What are the current systems, if any, to be replaced by each of these systems?

	<u>New Systems</u>	<u>Current Systems</u>
5.1	<u>AAH</u>	<u>Cobra</u>
5.2	<u>_____</u>	<u>_____</u>
5.3	<u>_____</u>	<u>_____</u>
5.4	<u>_____</u>	<u>_____</u>

The questionnaire responder should answer Questions 6 to 12, on separate sheets, for each of the new systems identified in the answer to Question 1.

New System AAH

Question 6.1 How much difference will there be between the new system and the current systems which it replaces in terms of physical characteristics? (Degrees of difference are defined as: "a" = radically different; "b" = substantially different; "c" = somewhat different; and "d" = minimal or no difference.)

<u>Component</u>	<u>Degree of Difference</u>
6.1.1 Flight Controls . . . . .	<u>D for pilot</u> <u>A for CP/G</u>
6.1.2 Instruments . . . . .	<u>C for pilot</u>
6.1.3 Displays . . . . .	<u>A</u>
6.1.4 Power Controls . . . . .	<u>C</u>
6.1.5 Seating Arrangement . . . . .	<u>D</u>
6.1.6 Visibility . . . . .	<u>D</u>
6.1.7 Weapon Guidance . . . . .	<u>B</u>
6.1.8 Guns . . . . .	<u>D</u>
6.1.9 Rockets . . . . .	<u>C</u>
6.1.10 Laser . . . . .	<u>N/A</u>
6.1.11 Threat Detection . . . . .	<u>B</u>
6.1.12 Navigation . . . . .	<u>D</u>
6.1.13 Communication . . . . .	<u>D</u>
6.1.14 ECM/EW . . . . .	<u>D</u>
6.1.15 Other (Specify) <i>TADS for Co-pilot/</i>	<u>A</u>
6.1.16 Other (Specify) <i>Gunner</i>	<u></u>

Question 6.2 For the components rated "radically different", what is the nature of the difference?

6.1.3 *TADS display for co-pilot/gunner, PNVS display for pilot*

Question 6.3 For the components rated "substantially different", what is the nature of the difference?

6.1.7 *TADS for co-pilot/gunner*

Question 6.4 For the components rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

6.1.4 *Twin engine versus single engine*

6.1.9 *Pilot has capabilities for 30 mm gun and 2.75 inch rockets*

New System AAH

Question 7.1 How much performance difference will there be between the new system and the current systems which it replaces? (Degrees of difference are defined in Question 6.1).

	<u>Performance</u>	<u>Degree of Difference</u>
7.1.1	Maneuverability . . . . .	<u>B</u>
7.1.2	Flight Stability . . . . .	<u>D</u>
7.1.3	Control Responsiveness . . . . .	<u>B</u>
7.1.4	Flying Workload <i>Pilot</i> . . . . .	<u>B</u>
7.1.5	Flight Safety Characteristics . . . . .	<u>A</u>
7.1.6	Complexity <i>for Pilot/Co-pilot/Gunner</i> . . . . .	<u>B</u>
7.1.7	Speed . . . . .	<u>C</u>
7.1.8	Target Detection Capabilities . . . . .	<u>A</u>
7.1.9	Weapon Range <i>longer</i> . . . . .	<u>B</u>
7.1.10	Weapon Accuracy . . . . .	<u>C</u>
7.1.11	Troop Capacity . . . . .	<u>N/A</u>
7.1.12	Cargo Capacity . . . . .	<u>N/A</u>
7.1.13	Other (Specify) <i>Survivability</i> . . . . .	<u>A</u>
7.1.14	Other (Specify) . . . . .	<u>          </u>

Question 7.2 For the performances rated "radically different", what is the nature of the difference?

- 7.1.5 42 ft/sec crash load survival twin-engine
- 7.1.8 TADS
- 7.1.13 Single 23 mm hit survivable aircraft

Question 7.3 For the performances rated "substantially different", what is the nature of the difference?

- 7.1.1 More power available than any previous helicopter
- 7.1.3 Superior accelerations
- 7.1.4 Higher workload under both visual and PNVS
- 7.1.6 Cross-training

Question 7.4 For the performances rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

New System AAH

Question 8.1 In terms of cockpit crew operations, how much difference is there between the new system and the current systems which it replaces? (Degrees of difference are defined in Question 6.1).

	<u>Operation</u>	<u>Degree of Difference</u>	
		<u>Pilot</u>	<u>CP/G</u>
8.1.1	Basic Flying . . . . .	<u>D</u>	<u>D</u>
8.1.2	Instrument Flying . . . . .	<u>C</u>	<u>D</u>
8.1.3	Map of Earth Flying . . . . .	<u>A</u>	<u>A</u>
8.1.4	Navigation . . . . .	<u>D</u>	<u>D</u>
8.1.5	Communication . . . . .	<u>D</u>	<u>D</u>
8.1.6	Other (Specify) . . . . . <i>FDLS</i>	<u>N/A</u>	<u>A</u>
8.1.7	Other (Specify) . . . . . <i>Stabilator</i>	<u>C</u>	<u>C</u>

Question 8.2 For the operations rated "radically different", what is the nature of the difference?

8.1.6 *FDLS Fault Detection Isolation System*  
*System status on PNVS CRT*  
*System status on TADS CRT*  
*Caution or warning light cue to check system status*

Question 8.3 For the operations rated "substantially different", what is the nature of the difference?

8.1.7 *Aural tone warning for stabilator*

Question 8.4 For the operations rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

New System AAH

Question 9.1 In terms of combat operations tasks, how much difference is there between the new system and current systems which it replaces? (Degrees of difference are defined in Question 6.1).

	<u>Operation</u>	<u>Degree of Difference</u>	
		<u>Pilot</u>	<u>CP/G</u>
9.1.1	Target Detection . . . . .	<u>D</u>	<u>A</u>
9.1.2	Target Attack . . . . .	<u>C-D</u>	<u>C-D</u>
9.1.3	Weapon Aiming and Firing . . .	<u>C</u>	<u>C</u>
9.1.4	Air-to-Air Combat Flight Maneuvers . . . . .	<u>A</u>	<u>A</u>
9.1.5	Air-to-Ground Combat Flight Maneuvers . . . . .	<u>C</u>	<u>C</u>
9.1.6	Multiple Aircraft Operation .	<u>D</u>	<u>D</u>
9.1.7	Reconnaissance . . . . .	<u>N/A</u>	<u>N/A</u>
9.1.8	Command and Control Informa- tion Processing . . . . .	<u>C</u>	<u>C</u>
9.1.9	Other (Specify) . . . . .	<u>          </u>	<u>          </u>
9.1.10	Other (Specify) . . . . .	<u>          </u>	<u>          </u>

Question 9.2 For the operations rated "radically different", what is the nature of the difference?

- 9.1.1 TADS  
9.1.4 No current doctrine

Question 9.3 For the operations rated "substantially different", what is the nature of the difference?

Question 9.4 For the operations rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

- 9.1.5 Control power and power margins will make all maneuvers better and faster  
9.1.8 Pre-pointing of system to coordinates furnished from outside source

New System AAH

Question 10.1 What are the differences in man-machine skill requirements between the new system and the current systems which it replaces? (Degrees of difference are defined in Question 6.1).

	<u>Skill Category</u>	<u>Degree of Difference</u>	
		<u>Pilot</u>	<u>CP/G</u>
10.1.1	Monitoring Displays . . . . .	A	A
10.1.2	Tracking Outside Aircraft . . . . .	A	A
10.1.3	Recognition . . . . .	N/A	D
10.1.4	Memory . . . . .	B	B
10.1.5	Decision-Making . . . . .	B	B
10.1.6	Physical Responses . . . . .	C	C
10.1.7	Other (Specify) . . . <i>Detection</i> . . . . .	N/A	A
10.1.8	Other (Specify) . . . <i>Acquisition</i> . . . . .	N/A	A

Question 10.2 For the skills rated "radically different", what is the nature of the difference?

10.1.2 *Night tracking with TADS/PNVS is a totally new capability*

10.1.7 - 10.1.8 *TADS/optics quality and stability*

Question 10.3 For the skills rated "substantially different", what is the nature of the difference?

10.1.4 *Will have to memorize (i.e., train) for many different modes of operation and attacks. Capable of operating in degraded modes. Must recall the best way of doing job.*

10.1.5 *Many more decisions to make, weapons to use, etc. Some processing of data will be relieved by computer.*

Question 10.4 For the skills rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

10.1.6 *Higher visual activities. Reaction times must be quicker. More alert and finer tuning.*

New System AAH

Question 11.1 What are the differences in crew interaction requirements between the new system and the current systems which it replaces? (Degrees of difference are defined in Question 6.1).

	<u>Interaction Category</u>	<u>Degree of Difference</u>
11.1.1	Verbal Exchange . . . . .	<u>C</u>
11.1.2	Non-Verbal Exchange . . . . .	<u>B</u>
11.1.3	Coordinated Physical Responses . . . . .	<u>D</u>
11.1.4	Other (Specify) . . . . .	<u>        </u>
11.1.5	Other (Specify) . . . . .	<u>        </u>

Question 11.2 For the interactions rated "radically different", what is the nature of the difference?

Question 11.3 For the interactions rated "substantially different", what is the nature of the difference?

11.1.2 Possibly require training as a team. Very good rapport in all team activity.

Question 11.4 For the interactions rated "somewhat different", is the difference enough to require a change in training methods?

11.1.1 Only through intercom system. Barrier between seats precludes physical contact.

New System AAH

Question 12.1 In terms of training methods, how much difference will there be between the new system and the current systems it replaces? (Note that this differs from Questions 8.1 and 9.1, by emphasizing training difference instead of system operation differences, i.e., differences in system operation might not always necessitate differences in training methods.)

	<u>Training Areas</u>	<u>Degree of Difference</u>	
		<u>Pilot</u>	<u>CP/G</u>
12.1.1	Basic Flying <i>more sophisticated</i>	C	C
12.1.2	Instrument Flying . . . . .	D	D
12.1.3	Nap of Earth Flying . . . . .	B	B
12.1.4	Navigation . . . . .	D	D
12.1.5	Communications . . . . .	N/A	C
12.1.6	Target Detection . . . . .	C	C
12.1.7	Target Attack <i>pilot fires rockets</i>	C	C
12.1.8	Weapon Aiming and Firing . .	C	C
12.1.9	Air-to-Air Combat Flight Maneuvers . . . . .	A	A
12.1.10	Air-to-Ground Combat Flight Maneuvers . . . . .	C	C
12.1.11	Multiple Aircraft Operations	D	D
12.1.12	Reconnaissance . . . . .	N/A	N/A
12.1.13	Command and Control Informa- tion Processing . . . . .	C	C
12.1.14	Other (Specify) <i>Engine Failure</i>	B	
12.1.15	Other (Specify) <i>Target Acquisition</i>	N/A	C
12.1.16	Other <i>Target Recognition</i>	N/A	C

Question 12.2 For the training areas rated "radically different", what is the nature of the difference?

12.1.9 No doctrine now

Question 12.3 For the training areas rated "substantially different", what is the nature of the difference?

12.1.3 Input positions from ground observer coordinates  
(Hellfire, lock-on, etc.)

Question 12.4 For the training areas rated "somewhat different", what is the nature of the difference?

12.1.1 More sophistication  
12.1.10 More capability

Question 13 As stated at the beginning of the questionnaire the objective of this study is to identify new Army aviation systems and system characteristics which will require behavioral changes necessitating new training techniques.

Given this objective, is there anything further which you believe will require changes in training as a result of the introduction of new Army aviation systems?

*Crew involved in FARP activity. Must be able to direct.*

*Preflight is different, e.g., systems test - FDLS (Fault Detection Location System).*

*APU on system.*

*Mission planning requirements more severe.*

*Lock-on after launch firing requires more information, more planning, more responsibility.*

Possible Additions

- a) Automatic Data Link for Target Hand-off System (ATHS)
- b) Projected Map Display  
*on CRT, dedicated CRT on test may or may not be dedicated map in cassette, optical projection*
- c) Fire-and-Forget Missile  
*Imaging IR system (IIR System)*

QUESTIONNAIRE FOR UNIVERSITY OF DAYTON STUDY OF ARMY  
 AVIATION TRAINING R&D REQUIREMENTS  
 (ARMY RESEARCH INSTITUTE FIELD UNIT  
 CONTRACT NO. MDA903-80-C-0229

DATE 27 May 1980

QUESTIONNAIRE NO. 10

RESPONDER'S NAME \_\_\_\_\_

RESPONDER'S ORGANIZATION \_\_\_\_\_

RESPONDER'S TITLE OR POSITION \_\_\_\_\_

The objective of this study is to identify new Army aviation systems and system characteristics which will require behavioral changes necessitating new training techniques.

Question 1 What new systems will be in the U.S. Army aviation inventory for the period of 1985 to 2000 (within your area of cognizance)?

- 1.1 ADOCs (Advanced Digital Optical Control System)
- 1.2 IDSV (Integrated Digital Systems Validation)
- 1.3 \_\_\_\_\_
- 1.4 \_\_\_\_\_

Question 2 What are the probabilities that each of these new systems will be introduced into Army inventory? (Values of probability are defined as 1.0 = almost certain, 0.8 = highly probable, 0.6 = probable, 0.4 = uncertain, and 0.2 = highly unlikely.)

	<u>New System</u>	<u>Probability</u>
2.1	<u>ADOCs</u>	<u>1.0</u>
2.2	<u>IDSV</u>	<u>1.0</u>
2.3	_____	_____
2.4	_____	_____

Question 3 What are the scheduled years for introducing each of these new aviation systems?

	<u>New System</u>	<u>Year</u>
3.1	<u>ADOCS</u>	<u>1987-1990</u>
3.2	<u>IDSV</u>	<u>1987-1990</u>
3.3	<u>                    </u>	<u>                    </u>
3.4	<u>                    </u>	<u>                    </u>

Question 4 How extensive will be the use of each of these new systems? (Degrees of use are defined as "a" = more than three thousand items, "b" = one to three thousand items, "c" = three hundred to one thousand items, "d" = one to three hundred items, and "e" = thirty to one hundred items.)

	<u>New System</u>	<u>Degree of Use</u>
4.1	<u>ADOCS</u>	<u>C</u>
4.2	<u>IDSV</u>	<u>C</u>
4.3	<u>                    </u>	<u>                    </u>
4.4	<u>                    </u>	<u>                    </u>

Question 5 What are the current systems, if any, to be replaced by each of these systems?

	<u>New Systems</u>	<u>Current Systems</u>
5.1	<u>ADOCS</u>	<u>All mechanical control systems</u>
5.2	<u>IDSV</u>	<u>                    </u>
5.3	<u>                    </u>	<u>                    </u>
5.4	<u>                    </u>	<u>                    </u>

The questionnaire responder should answer Questions 6 to 12, on separate sheets, for each of the new systems identified in the answer to Question 1.

New System           ADOCs          

Question 6.1 How much difference will there be between the new system and the current systems which it replaces in terms of physical characteristics? (Degrees of difference are defined as: "a" = radically different; "b" = substantially different; "c" = somewhat different; and "d" = minimal or no difference.)

<u>Component</u>	<u>Degree of Difference</u>
6.1.1 Flight Controls . . . . .	<u>A</u>
6.1.2 Instruments . . . . .	<u>B</u>
6.1.3 Displays . . . . .	<u>B</u>
6.1.4 Power Controls . . . . .	<u>B</u>
6.1.5 Seating Arrangement . . . . .	<u>B</u>
6.1.6 Visibility . . . . .	<u>B</u>
6.1.7 Weapon Guidance . . . . .	<u>B</u>
6.1.8 Guns . . . . .	<u>C</u>
6.1.9 Rockets . . . . .	<u>C</u>
6.1.10 Laser . . . . .	<u>N/A</u>
6.1.11 Threat Detection . . . . .	<u>N/A</u>
6.1.12 Navigation . . . . .	<u>B</u>
6.1.13 Communication . . . . .	<u>B</u>
6.1.14 ECM/EW . . . . .	<u>B</u>
6.1.15 Other (Specify) <i>Survivability</i>	<u>A</u>
6.1.16 Other (Specify) <i>Vulnerability</i>	<u>A</u>

Question 6.2 For the components rated "radically different", what is the nature of the difference?

6.1.15 *1000-fold improvement over dual redundant mechanical system*

Question 6.3 For the components rated "substantially different", what is the nature of the difference?

6.1.3 *CRT displays*  
6.1.5 *One-man cockpit*

*(continued on attached)*

Question 6.4 For the components rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

New System ADOCS

Question 6.3 (Continued)

6.1.6 *Side-arm control clears down and front from control system parts*

6.1.7 *Air-to-air capabilities*

6.1.12 - 6.1.14 *Working in an integrated manner with all others*

New System ADOCS

Question 7.1 How much performance difference will there be between the new system and the current systems which it replaces? (Degrees of difference are defined in Question 6.1).

	<u>Performance</u>	<u>Degree of Difference</u>
7.1.1	Maneuverability . . . . .	<u>B</u>
7.1.2	Flight Stability . . . . .	<u>B</u>
7.1.3	Control Responsiveness . . . . .	<u>C</u>
7.1.4	Flying Workload . . . . .	<u>B</u>
7.1.5	Flight Safety Characteristics . . . . .	<u>B</u>
7.1.6	Complexity . . . . .	<u>B</u>
7.1.7	Speed . . . . .	<u>N/A</u>
7.1.8	Target Detection Capabilities . . . . .	<u>N/A</u>
7.1.9	Weapon Range . . . . .	<u>N/A</u>
7.1.10	Weapon Accuracy . . . . .	<u>C</u>
7.1.11	Troop Capacity . . . . .	<u>N/A</u>
7.1.12	Cargo Capacity . . . . .	<u>B</u>
7.1.13	Other (Specify) . . . . .	<u>          </u>
7.1.14	Other (Specify) . . . . .	<u>          </u>

Question 7.2 For the performances rated "radically different", what is the nature of the difference?

Question 7.3 For the performances rated "substantially different", what is the nature of the difference?

- 7.1.1 Operate at night
- 7.1.4 Less workload
- 7.1.6 Modularized and self-diagnosed
- 7.1.12 HLH requires ADOCS

Question 7.4 For the performances rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

- 7.1.10 Get on target faster

New System ADOCs

Question 8.1 In terms of cockpit crew operations, how much difference is there between the new system and the current systems which it replaces? (Degrees of difference are defined in Question 6.1).

<u>Operation</u>	<u>Degree of Difference</u>
8.1.1 Basic Flying . . . . .	<u>B</u>
8.1.2 Instrument Flying . . . . .	<u>B</u>
8.1.3 Nap of Earth Flying . . . . .	<u>B</u>
8.1.4 Navigation . . . . .	<u>B</u>
8.1.5 Communication . . . . .	<u>B</u>
8.1.6 Other (Specify) . . . . .	<u>                    </u>
8.1.7 Other (Specify) . . . . .	<u>                    </u>

Question 8.2 For the operations rated "radically different", what is the nature of the difference?

Question 8.3 For the operations rated "substantially different", what is the nature of the difference?

8.1.1 Side-arm control and integrated cockpit controls

8.1.2 - 8.1.5 See Question 6

Question 8.4 For the operations rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

New System           ADOCs          

Question 9.1 In terms of combat operations tasks, how much difference is there between the new system and current systems which it replaces? (Degrees of difference are defined in Question 6.1).

	<u>Operation</u>	<u>Degree of Difference</u>
9.1.1	Target Detection . . . . .	<u>N/A</u>
9.1.2	Target Attack . . . . .	<u>N/A</u>
9.1.3	Weapon Aiming and Firing . . .	<u>N/A</u>
9.1.4	Air-to-Air Combat Flight Maneuvers . . . . .	<u>N/A</u>
9.1.5	Air-to-Ground Combat Flight Maneuvers . . . . .	<u>D</u>
9.1.6	Multiple Aircraft Operation .	<u>N/A</u>
9.1.7	Reconnaissance . . . . .	<u>N/A</u>
9.1.8	Command and Control Informa- tion Processing . . . . .	<u>N/A</u>
9.1.9	Other (Specify) . . . . .	<u>                    </u>
9.1.10	Other (Specify) . . . . .	<u>                    </u>

Question 9.2 For the operations rated "radically different", what is the nature of the difference?

Question 9.3 For the operations rated "substantially different", what is the nature of the difference?

Question 9.4 For the operations rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

New System ADDCS

Question 10.1 What are the differences in man-machine skill requirements between the new system and the current systems which it replaces? (Degrees of difference are defined in Question 6.1).

	<u>Skill Category</u>	<u>Degree of Difference</u>
10.1.1	Monitoring Displays . . . . .	<u>N/A</u>
10.1.2	Tracking Outside Aircraft . . . . .	<u>N/A</u>
10.1.3	Recognition . . . . .	<u>N/A</u>
10.1.4	Memory . . . . .	<u>N/A</u>
10.1.5	Decision-Making . . . . .	<u>N/A</u>
10.1.6	Physical Responses . . . . .	<u>B</u>
10.1.7	Other (Specify) . . . . .	<u>                    </u>
10.1.8	Other (Specify) . . . . .	<u>                    </u>

Question 10.2 For the skills rated "radically different", what is the nature of the difference?

Question 10.3 For the skills rated "substantially different", what is the nature of the difference?

10.1.6 Side-arm control

Question 10.4 For the skills rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

New System           ADOCs          

Question 11.1 What are the differences in crew interaction requirements between the new system and the current systems which it replaces? (Degrees of difference are defined in Question 6.1).

	<u>Interaction Category</u>	<u>Degree of Difference</u>
11.1.1	Verbal Exchange . . . . .	<u>  C  </u>
11.1.2	Non-Verbal Exchange . . . . .	<u>  C  </u>
11.1.3	Coordinated Physical Responses . . . . .	<u>  C  </u>
11.1.4	Other (Specify) . . . . .	<u>          </u>
11.1.5	Other (Specify) . . . . .	<u>          </u>

Question 11.2 For the interactions rated "radically different", what is the nature of the difference?

Question 11.3 For the interactions rated "substantially different", what is the nature of the difference?

Question 11.4 For the interactions rated "somewhat different", is the difference enough to require a change in training methods?

*More time head out of cockpit.  
Reduction of workload will make all of these tasks easier, will permit more verbal exchange, better at spotting targets - detecting threats.*

New System ADOCs

Question 12.1 In terms of training methods, how much difference will there be between the new system and the current systems it replaces? (Note that this differs from Questions 8.1 and 9.1, by emphasizing training difference instead of system operation differences, i.e., differences in system operation might not always necessitate differences in training methods.)

	<u>Training Areas</u>	<u>Degree of Difference</u>
12.1.1	Basic Flying . . . . .	<u>C</u>
12.1.2	Instrument Flying . . . . .	<u>B</u>
12.1.3	Map of Earth Flying . . . . .	<u>B</u>
12.1.4	Navigation . . . . .	<u>N/A</u>
12.1.5	Communications . . . . .	<u>N/A</u>
12.1.6	Target Detection . . . . .	<u>N/A</u>
12.1.7	Target Attack . . . . .	<u>N/A</u>
12.1.8	Weapon Aiming and Firing . . . . .	<u>N/A</u>
12.1.9	Air-to-Air Combat Flight Maneuvers . . . . .	<u>N/A</u>
12.1.10	Air-to-Ground Combat Flight Maneuvers . . . . .	<u>D</u>
12.1.11	Multiple Aircraft Operations	<u>N/A</u>
12.1.12	Reconnaissance . . . . .	<u>N/A</u>
12.1.13	Command and Control Informa- tion Processing . . . . .	<u>N/A</u>
12.1.14	Other (Specify) . . . . .	<u>          </u>
12.1.15	Other (Specify) . . . . .	<u>          </u>

Question 12.2 For the training areas rated "radically different", what is the nature of the difference?

Question 12.3 For the training areas rated "substantially different", what is the nature of the difference?

*12.1.2 - 12.1.3 Much easier, no need to coordinate controls*

Question 12.4 For the training areas rated "somewhat different", what is the nature of the difference?

Question 13 As stated at the beginning of the questionnaire the objective of this study is to identify new Army aviation systems and system characteristics which will require behavioral changes necessitating new training techniques.

Given this objective, is there anything further which you believe will require changes in training as a result of the introduction of new Army aviation systems?

*ADOCs gives capabilities that you can't do today.*

*Might be able to do so many more things that training would have to include such tasks. For instance, pick up container out of ship, hold while ship is rolling.*

*Digital processing can be used to pick up laser or other sensing cues, to position aircraft.*

QUESTIONNAIRE FOR UNIVERSITY OF DAYTON STUDY OF ARMY  
 AVIATION TRAINING R&D REQUIREMENTS  
 (ARMY RESEARCH INSTITUTE FIELD UNIT  
 CONTRACT NO. MDA903-80-C-0229

DATE 27 May 1980

QUESTIONNAIRE NO. 11

RESPONDER'S NAME \_\_\_\_\_

RESPONDER'S ORGANIZATION \_\_\_\_\_

RESPONDER'S TITLE OR POSITION \_\_\_\_\_

The objective of this study is to identify new Army aviation systems and system characteristics which will require behavioral changes necessitating new training techniques.

Question 1 What new systems will be in the U.S. Army aviation inventory for the period of 1985 to 2000 (within your area of cognizance)?

1.1 ADOCs (Advanced Digital Optical Control System)

1.2 IDSV (Integrated Digital Systems Validation)

1.3 \_\_\_\_\_

1.4 \_\_\_\_\_

Question 2 What are the probabilities that each of these new systems will be introduced into Army inventory? (Values of probability are defined as 1.0 = almost certain, 0.8 = highly probable, 0.6 = probable, 0.4 = uncertain, and 0.2 = highly unlikely.)

	<u>New System</u>	<u>Probability</u>
2.1	<u>ADOCs</u>	<u>0.8</u>
2.2	<u>IDSV</u>	<u>0.4</u>
2.3	_____	_____
2.4	_____	_____



New System           ADOCs          

Question 6.1 How much difference will there be between the new system and the current systems which it replaces in terms of physical characteristics? (Degrees of difference are defined as: "a" = radically different; "b" = substantially different; "c" = somewhat different; and "d" = minimal or no difference.)

<u>Component</u>	<u>Degree of Difference</u>
6.1.1 Flight Controls . . . . .	<u>A-B</u>
6.1.2 Instruments . . . . .	<u>C</u>
6.1.3 Displays . . . . .	<u>C</u>
6.1.4 Power Controls . . . . .	<u>A</u>
6.1.5 Seating Arrangement . . . . .	<u>D</u>
6.1.6 Visibility . . . . .	<u>D</u>
6.1.7 Weapon Guidance . . . . .	<u>D</u>
6.1.8 Guns . . . . .	<u>D</u>
6.1.9 Rockets . . . . .	<u>D</u>
6.1.10 Laser . . . . .	<u>D</u>
6.1.11 Threat Detection . . . . .	<u>D</u>
6.1.12 Navigation . . . . .	<u>D</u>
6.1.13 Communication . . . . .	<u>D</u>
6.1.14 ECM/EW . . . . .	<u>D</u>
6.1.15 Other (Specify) . . . . .	<u>                    </u>
6.1.16 Other (Specify) . . . . .	<u>                    </u>

Question 6.2 For the components rated "radically different", what is the nature of the difference?

6.1.1 *Change from mechanical system to Fly-by-Fiber Optics Mechanical Activation to Electrical Actuation Signal Processor combining sensor information and pilot input*

Question 6.3 For the components rated "substantially different", what is the nature of the difference?

6.1.4 *Stick replaced by side-arm controller*

Question 6.4 For the components rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

6.1.2 - 6.1.3 *Changes from hydraulics and mechanical to optical will permit other types of sensors and displays*

New System ADOCs

Question 7.1 How much performance difference will there be between the new system and the current systems which it replaces? (Degrees of difference are defined in Question 6.1).

	<u>Performance</u>	<u>Degree of Difference</u>
7.1.1	Maneuverability . . . . .	<u>B</u>
7.1.2	Flight Stability . . . . .	<u>B</u>
7.1.3	Control Responsiveness . . . . .	<u>B</u>
7.1.4	Flying Workload . . . . .	<u>B</u>
7.1.5	Flight Safety Characteristics . . . . .	<u>B</u>
7.1.6	Complexity . . . . .	<u>B</u>
7.1.7	Speed . . . . .	<u>D</u>
7.1.8	Target Detection Capabilities . . . . .	<u>B</u>
7.1.9	Weapon Range . . . . .	<u>N/A</u>
7.1.10	Weapon Accuracy . . . . .	<u>B</u>
7.1.11	Troop Capacity . . . . .	<u>B</u>
7.1.12	Cargo Capacity . . . . .	<u>B</u>
7.1.13	Other (Specify) <u>Vulnerability</u>	<u>B</u>
7.1.14	Other (Specify) <u>Survivability</u>	<u>B</u>
7.1.15	Other (Specify) <u>Reliability</u>	<u>B</u>

Question 7.2 For the performances rated "radically different", what is the nature of the difference?

Question 7.3 For the performances rated "substantially different", what is the nature of the difference?

- 7.1.1 - 7.1.3 *Flight control laws will be solved in much more precise manner*
- 7.1.4 *Workload reduced*
- 7.1.5 *Redundancy and reliability improve flight safety*

*(continued on attached)*

Question 7.4 For the performances rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

New System ADOCs

Question 7.3 (Continued)

- 7.1.6 Many more things can (will) be done for the pilot, that he used to have to do himself.
- 7.1.8 Pilot is freer to look for targets
- 7.1.10 Improved weapon accuracy
- 7.1.11 - 7.1.12 Weight reduction
- 7.1.13 - 7.1.15 Don't depend on system connection. Fault isolation, self-correction, much smaller redundancy.

New System ADOCs

Question 8.1 In terms of cockpit crew operations, how much difference is there between the new system and the current systems which it replaces? (Degrees of difference are defined in Question 6.1).

<u>Operation</u>	<u>Degree of Difference</u>
8.1.1 Basic Flying . . . . .	<u>B</u>
8.1.2 Instrument Flying . . . . .	<u>B</u>
8.1.3 Nap of Earth Flying . . . . .	<u>B</u>
8.1.4 Navigation . . . . .	<u>D</u>
8.1.5 Communication . . . . .	<u>D</u>
8.1.6 Other (Specify) . . . . .	<u>                    </u>
8.1.7 Other (Specify) . . . . .	<u>                    </u>

Question 8.2 For the operations rated "radically different", what is the nature of the difference?

Question 8.3 For the operations rated "substantially different", what is the nature of the difference?

8.1.1 - 8.1.3 *Much simpler - tailor flight control response to mission requirements - significant improvements in stability - digital controls*

Question 8.4 For the operations rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

New System ADDCS

Question 9.1 In terms of combat operations tasks, how much difference is there between the new system and current systems which it replaces? (Degrees of difference are defined in Question 6.1).

	<u>Operation</u>	<u>Degree of Difference</u>
9.1.1	Target Detection . . . . .	<u>N/A</u>
9.1.2	Target Attack . . . . .	<u>N/A</u>
9.1.3	Weapon Aiming and Firing . . .	<u>N/A</u>
9.1.4	Air-to-Air Combat Flight Maneuvers . . . . .	<u>N/A</u>
9.1.5	Air-to-Ground Combat Flight Maneuvers . . . . .	<u>D</u>
9.1.6	Multiple Aircraft Operation .	<u>N/A</u>
9.1.7	Reconnaissance . . . . .	<u>N/A</u>
9.1.8	Command and Control Informa- tion Processing . . . . .	<u>N/A</u>
9.1.9	Other (Specify) . . . . .	<u>          </u>
9.1.10	Other (Specify) . . . . .	<u>          </u>

Question 9.2 For the operations rated "radically different", what is the nature of the difference?

Question 9.3 For the operations rated "substantially different", what is the nature of the difference?

Question 9.4 For the operations rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

New System ADDCS

Question 10.1 What are the differences in man-machine skill requirements between the new system and the current systems which it replaces? (Degrees of difference are defined in Question 6.1).

	<u>Skill Category</u>	<u>Degree of Difference</u>
10.1.1	Monitoring Displays . . . . .	<u>N/A</u>
10.1.2	Tracking Outside Aircraft . . . . .	<u>N/A</u>
10.1.3	Recognition . . . . .	<u>N/A</u>
10.1.4	Memory . . . . .	<u>N/A</u>
10.1.5	Decision-Making . . . . .	<u>N/A</u>
10.1.6	Physical Responses . . . . .	<u>B</u>
10.1.7	Other (Specify) . . . . .	<u>                    </u>
10.1.8	Other (Specify) . . . . .	<u>                    </u>

Question 10.2 For the skills rated "radically different", what is the nature of the difference?

Question 10.3 For the skills rated "substantially different", what is the nature of the difference?

Question 10.4 For the skills rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

New System           ADDCS          

Question 11.1 What are the differences in crew interaction requirements between the new system and the current systems which it replaces? (Degrees of difference are defined in Question 6.1).

	<u>Interaction Category</u>	<u>Degree of Difference</u>
11.1.1	Verbal Exchange . . . . .	<u>  C  </u>
11.1.2	Non-Verbal Exchange . . . . .	<u>  C  </u>
11.1.3	Coordinated Physical Responses . . . . .	<u>  C  </u>
11.1.4	Other (Specify) . . . . .	<u>          </u>
11.1.5	Other (Specify) . . . . .	<u>          </u>

Question 11.2 For the interactions rated "radically different", what is the nature of the difference?

Question 11.3 For the interactions rated "substantially different", what is the nature of the difference?

Question 11.4 For the interactions rated "somewhat different", is the difference enough to require a change in training methods?

New System ADOCs

Question 12.1 In terms of training methods, how much difference will there be between the new system and the current systems it replaces? (Note that this differs from Questions 8.1 and 9.1, by emphasizing training difference instead of system operation differences, i.e., differences in system operation might not always necessitate differences in training methods.)

	<u>Training Areas</u>	<u>Degree of Difference</u>
12.1.1	Basic Flying . . . . .	<u>C</u>
12.1.2	Instrument Flying . . . . .	<u>B</u>
12.1.3	Map of Earth Flying . . . . .	<u>B</u>
12.1.4	Navigation . . . . .	<u>N/A</u>
12.1.5	Communications . . . . .	<u>N/A</u>
12.1.6	Target Detection . . . . .	<u>N/A</u>
12.1.7	Target Attack . . . . .	<u>N/A</u>
12.1.8	Weapon Aiming and Firing . .	<u>N/A</u>
12.1.9	Air-to-Air Combat Flight Maneuvers . . . . .	<u>N/A</u>
12.1.10	Air-to-Ground Combat Flight Maneuvers . . . . .	<u>D</u>
12.1.11	Multiple Aircraft Operations	<u>N/A</u>
12.1.12	Reconnaissance . . . . .	<u>N/A</u>
12.1.13	Command and Control Informa- tion Processing . . . . .	<u>N/A</u>
12.1.14	Other (Specify) . . . . .	<u>          </u>
12.1.15	Other (Specify) . . . . .	<u>          </u>

Question 12.2 For the training areas rated "radically different", what is the nature of the difference?

Question 12.3 For the training areas rated "substantially different", what is the nature of the difference?

Question 12.4 For the training areas rated "somewhat different", what is the nature of the difference?

New System                     IDSV                    

Question 6.1 How much difference will there be between the new system and the current systems which it replaces in terms of physical characteristics? (Degrees of difference are defined as: "a" = radically different; "b" = substantially different; "c" = somewhat different; and "d" = minimal or no difference.)

<u>Component</u>	<u>Degree of Difference</u>
6.1.1 Flight Controls . . . . .	<u>A</u>
6.1.2 Instruments . . . . .	<u>A</u>
6.1.3 Displays . . . . .	<u>A</u>
6.1.4 Power Controls . . . . .	<u>B</u>
6.1.5 Seating Arrangement . . . . .	<u>D</u>
6.1.6 Visibility . . . . .	<u>B</u>
6.1.7 Weapon Guidance . . . . .	<u>B</u>
6.1.8 Guns . . . . .	<u>B</u>
6.1.9 Rockets . . . . .	<u>B</u>
6.1.10 Laser . . . . .	<u>N/A</u>
6.1.11 Threat Detection . . . . .	<u>A</u>
6.1.12 Navigation . . . . .	<u>B</u>
6.1.13 Communication . . . . .	<u>B</u>
6.1.14 ECM/EW . . . . .	<u>D</u>
6.1.15 Other (Specify) . . . . .	<u>                    </u>
6.1.16 Other (Specify) . . . . .	<u>                    </u>

Question 6.2 For the components rated "radically different", what is the nature of the difference?

- 6.1.3 *Two CRTs to replace all dials, etc.*
- 6.1.11 *Commanded evasive maneuver*

Question 6.3 For the components rated "substantially different", what is the nature of the difference?

- 6.1.7 - 6.1.9 *Integrated systems*
- 6.1.13 *Command and control information on CRT*
- 6.1.6 *Head-up-display*
- 6.1.12 *Map display CRT*

Question 6.4 For the components rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

New System   IDSV  

Question 7.1 How much performance difference will there be between the new system and the current systems which it replaces? (Degrees of difference are defined in Question 6.1).

	<u>Performance</u>	<u>Degree of Difference</u>
7.1.1	Maneuverability . . . . .	<u>  B  </u>
7.1.2	Flight Stability . . . . .	<u>  B  </u>
7.1.3	Control Responsiveness . . . . .	<u>  B  </u>
7.1.4	Flying Workload . . . . .	<u>  B  </u>
7.1.5	Flight Safety Characteristics . . . . .	<u>  B  </u>
7.1.6	Complexity . . . . .	<u>  B  </u>
7.1.7	Speed . . . . .	<u>  N/A  </u>
7.1.8	Target Detection Capabilities . . . . .	<u>  B  </u>
7.1.9	Weapon Range . . . . .	<u>  N/A  </u>
7.1.10	Weapon Accuracy . . . . .	<u>  D  </u>
7.1.11	Troop Capacity . . . . .	<u>  C  </u>
7.1.12	Cargo Capacity . . . . .	<u>  C  </u>
7.1.13	Other (Specify) . . . . .	<u>          </u>
7.1.14	Other (Specify) . . . . .	<u>          </u>

Question 7.2 For the performances rated "radically different", what is the nature of the difference?

Question 7.3 For the performances rated "substantially different", what is the nature of the difference?

7.1.1 - 7.1.6 Refer to responses by Fred Cappetta on IDSV  
7.1.8 Automation and head-out-cockpit

Question 7.4 For the performances rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

7.1.11 - 7.1.12 Reduced weight about 400 pounds

New System IDSV

Question 8.1 In terms of cockpit crew operations, how much difference is there between the new system and the current systems which it replaces? (Degrees of difference are defined in Question 6.1).

<u>Operation</u>	<u>Degree of Difference</u>
8.1.1 Basic Flying . . . . .	<u>B</u>
8.1.2 Instrument Flying . . . . .	<u>B</u>
8.1.3 Nap of Earth Flying . . . . .	<u>B</u>
8.1.4 Navigation . . . . .	<u>B</u>
8.1.5 Communication . . . . .	<u>B</u>
8.1.6 Other (Specify) . . . . .	<u>          </u>
8.1.7 Other (Specify) . . . . .	<u>          </u>

Question 8.2 For the operations rated "radically different", what is the nature of the difference?

Question 8.3 For the operations rated "substantially different", what is the nature of the difference?

8.1.1 Easier to fly

8.1.4 Inertial, Doppler for wire detection and navigation, computer graphic map displays

8.1.5 IACS (Integrated Avionics Control System)

Question 8.4 For the operations rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

New System           IDSV          

Question 9.1 In terms of combat operations tasks, how much difference is there between the new system and current systems which it replaces? (Degrees of difference are defined in Question 6.1).

	<u>Operation</u>	<u>Degree of Difference</u>
9.1.1	Target Detection . . . . .	<u>    A    </u>
9.1.2	Target Attack . . . . .	<u>    A    </u>
9.1.3	Weapon Aiming and Firing . . .	<u>    A    </u>
9.1.4	Air-to-Air Combat Flight Maneuvers . . . . .	<u>    A    </u>
9.1.5	Air-to-Ground Combat Flight Maneuvers . . . . .	<u>    A    </u>
9.1.6	Multiple Aircraft Operation .	<u>    B    </u>
9.1.7	Reconnaissance . . . . .	<u>    B    </u>
9.1.8	Command and Control Informa- tion Processing . . . . .	<u>    B    </u>
9.1.9	Other (Specify) . . . . .	<u>          </u>
9.1.10	Other (Specify) . . . . .	<u>          </u>

Question 9.2 For the operations rated "radically different", what is the nature of the difference?

- 9.1.1 *Cueing and head-out of cockpit*
- 9.1.2 - 9.1.3 *Pilot is relieved of many masked flying acts*

Question 9.3 For the operations rated "substantially different", what is the nature of the difference?

- 9.1.6 *Easier*
- 9.1.7 *Head-out of cockpit*
- 9.1.8 *Automated information processing. Less verbal communication. Automatic fixing of aircraft position and notification to other aircraft from inertial and Doppler.*

Question 9.4 For the operations rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

New System IDSV

Question 10.1 What are the differences in man-machine skill requirements between the new system and the current systems which it replaces? (Degrees of difference are defined in Question 6.1).

	<u>Skill Category</u>	<u>Degree of Difference</u>
10.1.1	Monitoring Displays . . . . .	<u>B</u>
10.1.2	Tracking Outside Aircraft . . . . .	<u>B</u>
10.1.3	Recognition . . . . .	<u>C</u>
10.1.4	Memory . . . . .	<u>B</u>
10.1.5	Decision-Making . . . . .	<u>B</u>
10.1.6	Physical Responses . . . . .	<u>B</u>
10.1.7	Other (Specify) . . . . .	<u>A</u>
10.1.8	Other (Specify) . . . . .	<u>      </u>

Question 10.2 For the skills rated "radically different", what is the nature of the difference?

10.1.7 *Expansion of critical information on CRT*

Question 10.3 For the skills rated "substantially different", what is the nature of the difference?

10.1.1 *Easier*

10.1.2 *Much more freedom*

10.1.4 *Much less requirement*

10.1.5 *Pilot does more new decision-making, routine decisions will be done by system*

10.1.6 *Much reduced workload, much less physical strength*

Question 10.4 For the skills rated "somewhat different", is the difference enough to require a change in training methods? If so, indicate the nature of the difference.

10.1.3 *Synergistic effect of system*

New System           IDSV          

Question 11.1 What are the differences in crew interaction requirements between the new system and the current systems which it replaces? (Degrees of difference are defined in Question 6.1).

	<u>Interaction Category</u>	<u>Degree of Difference</u>
11.1.1	Verbal Exchange . . . . .	<u>        B        </u>
11.1.2	Non-Verbal Exchange . . . . .	<u>        B        </u>
11.1.3	Coordinated Physical Responses . . . . .	<u>        C        </u>
11.1.4	Other (Specify) . . . . .	<u>                  </u>
11.1.5	Other (Specify) . . . . .	<u>                  </u>

Question 11.2 For the interactions rated "radically different", what is the nature of the difference?

Question 11.3 For the interactions rated "substantially different", what is the nature of the difference?

- 11.1.1 *Less verbal discussion by switching images from one display to another*
- 11.1.2 *Cueing to display*

Question 11.4 For the interactions rated "somewhat different", is the difference enough to require a change in training methods?

- 11.1.3 *Automation would reduce requirements for physical coordination such as weapon aiming versus flying*

New System IDSV

Question 12.1 In terms of training methods, how much difference will there be between the new system and the current systems it replaces? (Note that this differs from Questions 8.1 and 9.1, by emphasizing training difference instead of system operation differences, i.e., differences in system operation might not always necessitate differences in training methods.)

	<u>Training Areas</u>	<u>Degree of Difference</u>
12.1.1	Basic Flying . . . . .	<u>B</u>
12.1.2	Instrument Flying . . . . .	<u>B</u>
12.1.3	Map of Earth Flying . . . . .	<u>B</u>
12.1.4	Navigation . . . . .	<u>B</u>
12.1.5	Communications . . . . .	<u>B</u>
12.1.6	Target Detection . . . . .	<u>A</u>
12.1.7	Target Attack . . . . .	<u>A</u>
12.1.8	Weapon Aiming and Firing . . . . .	<u>A</u>
12.1.9	Air-to-Air Combat Flight Maneuvers . . . . .	<u>A</u>
12.1.10	Air-to-Ground Combat Flight Maneuvers . . . . .	<u>A</u>
12.1.11	Multiple Aircraft Operations	<u>B</u>
12.1.12	Reconnaissance . . . . .	<u>B</u>
12.1.13	Command and Control Informa- tion Processing . . . . .	<u>B</u>
12.1.14	Other (Specify) <i>Cargo Operations</i>	<u>A</u>
12.1.15	Other (Specify) <i>Attack targets across the FEPA</i>	<u>A</u>
12.1.16	Other (Specify) <i>Rescue Operations</i>	<u>B</u>

Question 12.2 For the training areas rated "radically different", what is the nature of the difference?

12.1.9 - 12.1.10 More time available

Question 12.3 For the training areas rated "substantially different", what is the nature of the difference?

12.1.1 *Less skill required. Physical lower level jobs reduced, i.e., flying skill coordination requirement. Physical higher level jobs increased to fill workload. More teaching possible in*

Question 12.4 For the <sup>*in the same length of time*</sup> training areas rated "somewhat different", what is the nature of the difference?

Question 13 As stated at the beginning of the questionnaire the objective of this study is to identify new Army aviation systems and system characteristics which will require behavioral changes necessitating new training techniques.

Given this objective, is there anything further which you believe will require changes in training as a result of the introduction of new Army aviation systems?

APPENDIX B  
SCORING MODEL WEIGHTS

TABLE B-1  
 NUMERICAL CONVERSION OF QUESTIONNAIRE ANSWERS

Question 3

<u>Year</u>	<u>Numerical Scale</u>
1980-1983	1.0
1984-1987	.9
1988-1991	.8
1992-1995	.6
1996-2000	.4

Question 4

<u>Degree of Difference</u>	<u>Numerical Scale</u>
A	1.0
B	.8
C	.6
D	.4
E	.2

Question 6-12

<u>Degree of Difference</u>	<u>Numerical Scale</u>
A	1.0
B	.5
C	.2
D	.0
N/A	.0

TABLE B-2  
WEIGHT OF COMPONENT IMPORTANCE

Question 6	<u>Component</u>	<u>Importance</u>
6.1.1	Flight Controls . . . . .	.8
6.1.2	Instruments . . . . .	.5
6.1.3	Displays . . . . .	.8
6.1.4	Power Controls . . . . .	.5
6.1.5	Seating Arrangement . . . . .	.4
6.1.6	Visibility . . . . .	.5
6.1.7	Weapon Guidance . . . . .	.5
6.1.8	Guns . . . . .	.3
6.1.9	Rockets . . . . .	.2
6.1.10	Laser . . . . .	.5
6.1.11	Threat Detection . . . . .	.2
6.1.12	Navigation . . . . .	.3
6.1.13	Communication . . . . .	.3
6.1.14	ECM/EW . . . . .	.2
6.1.15	Other (Specify) . . . . .	.6
6.1.16	Other (Specify) . . . . .	.4
Question 7	<u>Performance</u>	<u>Importance</u>
7.1.1	Maneuverability . . . . .	.7
7.1.2	Flight Stability . . . . .	.6
7.1.3	Control Responsiveness . . . . .	.7
7.1.4	Flying Workload . . . . .	1.0
7.1.5	Flight Safety Characteristics . . . . .	.5
7.1.6	Complexity . . . . .	.3
7.1.7	Speed . . . . .	.2
7.1.8	Target Detection Capabilities . . . . .	.6
7.1.9	Weapon Range . . . . .	.1
7.1.10	Weapon Accuracy . . . . .	.1
7.1.11	Troop Capacity . . . . .	.1

TABLE B-2 (Continued)

	<u>Performance</u>	<u>Importance</u>
7.1.12	Cargo Capacity . . . . .	.1
7.1.13	Other (Specify) . . . . .	.6
7.1.14	Other (Specify) . . . . .	.4
<b>Question 8</b>	<u>Operation</u>	<u>Importance</u>
8.1.1	Basic Flying . . . . .	.5
8.1.2	Instrument Flying . . . . .	.5
8.1.3	Map of Earth Flying . . . . .	1.0
8.1.4	Navigation . . . . .	.3
8.1.5	Communication . . . . .	.2
8.1.6	Other (Specify) . . . . .	.6
8.1.7	Other (Specify) . . . . .	.4
<b>Question 9</b>	<u>Operation</u>	<u>Importance</u>
9.1.1	Target Detection . . . . .	.3
9.1.2	Target Attack . . . . .	.4
9.1.3	Weapon Aiming and Firing . . . . .	.3
9.1.4	Air-to-Air Combat Flight Maneuvers . . . . .	.5
9.1.5	Air-to-Ground Combat Flight Maneuvers . . . . .	1.0
9.1.6	Multiple Aircraft Operation . . . . .	.2
9.1.7	Reconnaissance . . . . .	.4
9.1.8	Command and Control Information Processing . . . . .	.4
9.1.9	Other (Specify) . . . . .	.6
9.1.10	Other (Specify) . . . . .	.4
<b>Question 10</b>	<u>Skill Category</u>	<u>Importance</u>
10.1.1	Monitoring Displays . . . . .	.5
10.1.2	Tracking Outside Aircraft . . . . .	.5
10.1.3	Recognition . . . . .	.2

TABLE B-2 (Continued)

	<u>Skill Category</u>	<u>Importance</u>
10.1.4	Memory . . . . .	.3
10.1.5	Decision-Making . . . . .	1.0
10.1.6	Physical Responses . . . . .	.5
10.1.7	Other (Specify) . . . . .	.6
10.1.8	Other (Specify) . . . . .	.4
Question 11	<u>Interaction Category</u>	<u>Importance</u>
11.1.1	Verbal Exchange . . . . .	.1
11.1.2	Non-Verbal Exchange . . . . .	.6
11.1.3	Coordinated Physical Responses . . . . .	.3
11.1.4	Other (Specify) . . . . .	.6
11.1.5	Other (Specify) . . . . .	.4
Question 12	<u>Training Areas</u>	<u>Importance</u>
12.1.1	Basic Flying . . . . .	.5
12.1.2	Instrument Flying . . . . .	.5
12.1.3	Map of Earth Flying . . . . .	1.0
12.1.4	Navigation . . . . .	.3
12.1.5	Communications . . . . .	.2
12.1.6	Target Detection . . . . .	.3
12.1.7	Target Attack . . . . .	.4
12.1.8	Weapon Aiming and Firing . . . . .	.3
12.1.9	Air-to-Air Combat Flight Maneuvers . . . . .	.5
12.1.10	Air-to-Ground Combat Flight Maneuvers . . . . .	1.0
12.1.11	Multiple Aircraft Operations . . . . .	.2
12.1.12	Reconnaissance . . . . .	.4
12.1.13	Command and Control Information Processing . . . . .	.4
12.1.14	Other (Specify) . . . . .	.6
12.1.15	Other (Specify) . . . . .	.4

Note 1: Scale of importance for each element ranges from 0.1 to 1.0.

Note 2: Scale of importance for each additional element under OTHER followed the reserved two spaces for OTHER is 0.4.

APPENDIX C  
ADJUSTMENTS OF QUESTIONNAIRE ANSWERS

TABLE C-1  
ADJUSTMENTS OF QUESTIONNAIRE ANSWERS IN THE  
SCORING MODEL ANALYSIS

Questionnaire No.	System No.	Question No.	Reported Answer	Modified Answer	Justification
1	5	8.1.3	B	C	Reflect more accurate rating for the complete scout helicopter. The synthesized questionnaire selected the highest rating from all subsystems of the near-term scout helicopter to represent the rating of the complete scout helicopter.
		8.1.4	B	C	
		8.1.6	A	C	
		8.1.7	A	C	
		9.1.2	D	A	
		9.1.5	D	A	
		10.1.1	B	A	
10.1.5	C	B			
2	1	6.1.2	B	A	The respondent tends to have a lower rating on the question than the other two interviewees do. It is reasonable to make the answer consistent with others.
		6.1.3	B	A	
		6.1.5	D	C	
1	1	6.1.3	B	A	Same reason as above.
		6.1.5	D	C	
		6.1.5	D	C	

Questionnaire No.	System No.	Question No.	Reported Answer	Modified Answer	Justification
2	1	6.1.7	N/A	B	MMS and Fire and Forget features might have not been considered in the interviewer's judgment.
4	3	6.1.2	B	C	Use the similar base that other interviewees do.
		6.1.3	B	C	Use the similar base that other interviewees do.
		6.1.10	B	D	It is laser detector, not laser weapon. Therefore, it should not be substantially different.
		6.1.13	B	D	Communication equipment does not appear to be substantially different.
5	15	9.1.2	A	D	We believe that another respondent to this subsystem, a pilot, has a better understanding of combat operation tasks. Thus, the answer is modified to conform the pilot's opinion.
		9.1.5	B	D	Same reason as above.
		9.1.7	A	C	Same reason as above.
7	4	6.1.3	C	A	PNVS is believed to have a strong impact.
		6.1.16	A	Deleted	A redundant item to the one specified in 6.1.15 (PNVS).

TABLE C-1 (Continued)

Question No.	System No.	Question No.	Reported Answer	Modified Answer	Justification
8	1	6.1.17	A	Deleted	A redundant item to the one specified in 6.1.15 (PNVS).
		9.1.4	N/A	A	Assume a multi-purpose light-weight missile system is used.
		10.1.2	D	A	Brabson's answer reflects a more reasonable rating.
9	4	4.1	A	B	Based on the current Army aviation inventory information.
		8.1.3	A	B	Overrated the degree of difference in the NOE operation in terms of cockpit crew operations.
		8.1.7	A	D	NBC operations' affect in cockpit crew operations is important. But the affect is the same on present, near-term and far-term scout helicopters. Therefore, D is an appropriate answer.
		8.1.8	C	D	Similar reason as above.
		8.1.9	B	D	Similar reason as above.
6.1.1	A	B	The interviewee rated A and D for the co-pilot and the pilot, respectively. An intermediate rating, B, is a better answer to the question.		

TABLE C-1 (Continued)

<u>Questionnaire No.</u>	<u>System No.</u>	<u>Question No.</u>	<u>Reported Answer</u>	<u>Modified Answer</u>	<u>Justification</u>
		8.1.1.3	A	B	NOE operations do not create drastic differences in cockpit crew operations. The modified answer agrees with the one given by a pilot.
		8.1.1.6	A	D	The interviewee indicated that Fault Detection Isolation System would make a drastic difference in cockpit operations by the co-pilot/gunner. He indicated no difference in the pilot operation. Therefore, the modified answer, which agrees with the answer by a pilot, is appropriate for the scoring model analysis.
		10.1.1.7	A	Deleted	Extra item identified by the interviewee. Tend to indicate a higher weight in the scoring model analysis.
		10.1.1.8	A	Deleted	Extra item identified by the interviewee. Tend to indicate a higher weight in the scoring model analysis.
10	16	4.1	C	A	Base on the current Army aviation inventory information.

APPENDIX D  
WEIGHTED SCORES FOR SURVEY QUESTIONS 6 THROUGH 12

The scoring model analysis pointed out the relative overall importance of the various systems and subsystems planned to meet future Army aviation needs. It also indicated the relative importance of basic factors relevant to training differences between current and future systems/subsystems. Each of the factor scores for questions 6 through 12 is actually composed of interview responses to the several parts of each question. The factor score is thus a summation of the answers to each part of the questions which is the basis for the factor. These parts of each question are identified as "elements" in the discussion which follows. The "elements" differ from question to question, and include system components, characteristics, and operating functions.

For example, the first "element" (6.1.1) of question 6 asks "How much difference will there be in 'Flight Controls' between the new system and current systems?" Weights were assigned to the elements of each question as indicated in Appendix B, Table B-2. These weights were established by the authors, based on impressions gathered in the survey. Continuing with the above example, "Flight Controls" was given a weight of 0.8 on a scale of 1.0, indicating that it was a relatively important element in question 6. The numerical conversions (per Appendix B, Table B-1) of the questionnaire responses for each element were multiplied by these weights. These weighted scores are given for each element of questions 6 through 12, for each questionnaire in Tables D-1 through D-14. The line identified as QSN #2, SYS #1, on Table D-1, continues the example for the element "Flight Control". The respondent on this questionnaire stated that "Flight Controls" for System #1 (Far Term Scout) would be "radically different" from current systems. The numerical conversion of this statement was a score of 1.0, which when multiplied by the assigned weight of 0.8, gives the weighted score 0.80, as shown in the table. Carrying across the row, the weighted scores are given for each element of question #6.

The averages of the element scores of the three respondents for System #1 are shown in the line identified as "AVE1" on the table. The scores in the "AVE2" lines are the products of the "AVE1" scores and the average of the measure "System Importance". Answers to questions 2, 3, and 4 provided the basis for the "System Importance" measure. This measure, as described in detail in Volume I, combines "probability of system introduction", "scheduled date of introduction", and "extensiveness of system use". Therefore the scores in the "AVE2" lines represent the relative importance of each element in each system in terms of the difference between that element in the new system versus the same element in current systems, combined with the importance of the system itself. Thus the first entry (0.14) in the "AVE2" line for System #1 comes from the multiplication of 0.80 in the "AVE1" line by 0.17, the measure of system importance for System #1.

The measures of system importance, M-1, for the five systems, as reported in Section 5, Volume I, are as follows:

System No.

1	Far Term Scout	0.17
2	SEMA-X	0.17
3	Black Hawk	0.80
4	Advance Attack Helicopter (AH64)	0.43
5	Near Term Scout	0.45

The summation of AVE2 rows for each element is a weighted score (WTGD SCORE) which indicates the relative importance of each element to behavioral research in relation to all systems or all subsystems. These weighted scores are shown in Tables D-1 through D-7 for all systems, and in Tables D-8 through D-14 for all subsystems.

The three elements having the highest weighted scores for systems, and the three having the highest weighted scores for subsystems, were considered the most important contributors to training differences. These elements were reported in Section 6, Volume I. For example, the element "Displays", with a weighted score of 1.20 for systems and 1.13 for subsystems, was the most important element in question 6, concerning the differences in "physical characteristics". This procedure identifies those elements common to all systems/subsystems which are likely to have the greatest bearing on changes in training requirements and consequent needs for behavioral research.

Elements requiring different or new training for individual aviation systems/subsystems can also be identified from these tables. Each system/subsystem will have its own set of major elements which will require different or new training. These findings are synopsisized in Section 6 of Volume I.

TABLE D-1  
ELEMENT RATING VERSUS SYSTEM FOR QUESTION # 6

QSN#	SYS#	ELEMENT RATING VERSUS SYSTEM FOR QUESTION # 6																		SUM
		1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	1.10	1.11	1.12	1.13	1.14	1.15	1.16	1.17	1.18	
2	1	0.80	0.50	0.80	0.25	0.08	0.00	0.25	0.00	0.00	0.00	0.20	0.15	0.10	0.00	0.00	0.00	0.00	0.00	
3	1	0.80	0.50	0.80	0.10	0.08	0.00	0.30	0.20	0.50	0.20	0.30	0.30	0.20	0.00	0.00	0.00	0.00	0.00	
8	1	0.80	0.50	0.80	0.50	0.40	0.50	0.25	0.00	0.00	0.20	0.30	0.30	0.04	0.30	0.40	0.00	0.00	0.00	
AVE1	1	0.80	0.50	0.80	0.28	0.19	0.17	0.33	0.10	0.07	0.17	0.20	0.25	0.11	0.10	0.13	0.00	0.00	0.00	
AVE2	1	0.14	0.09	0.14	0.05	0.03	0.03	0.06	0.02	0.01	0.03	0.03	0.04	0.02	0.02	0.02	0.00	0.00	0.00	
2	2	0.80	0.50	0.80	0.50	0.00	0.00	0.00	0.00	0.00	0.10	0.30	0.30	0.10	0.00	0.00	0.00	0.00	0.00	
8	2	0.80	0.50	0.80	0.25	0.00	0.00	0.00	0.00	0.10	0.10	0.15	0.06	0.10	0.30	0.20	0.00	0.00	0.00	
AVE1	2	0.80	0.50	0.80	0.38	0.00	0.00	0.00	0.00	0.03	0.10	0.23	0.18	0.10	0.15	0.10	0.00	0.00	0.00	
AVE2	2	0.13	0.08	0.13	0.06	0.00	0.00	0.00	0.00	0.01	0.02	0.04	0.03	0.02	0.03	0.02	0.00	0.00	0.00	
4	3	0.40	0.10	0.40	0.10	0.00	0.10	0.25	0.15	0.10	0.00	0.10	0.15	0.00	0.30	0.20	0.00	0.00	0.00	
AVE1	3	0.40	0.10	0.40	0.10	0.00	0.10	0.25	0.15	0.10	0.00	0.10	0.15	0.00	0.30	0.20	0.00	0.00	0.00	
AVE2	3	0.32	0.08	0.32	0.08	0.00	0.08	0.20	0.12	0.08	0.00	0.08	0.12	0.00	0.24	0.16	0.00	0.00	0.00	
7	4	0.00	0.10	0.80	0.00	0.00	0.00	0.25	0.00	0.00	0.10	0.04	0.00	0.00	0.60	0.00	0.00	0.00	0.00	
9	4	0.40	0.10	0.80	0.10	0.00	0.00	0.25	0.00	0.04	0.00	0.10	0.00	0.00	0.60	0.00	0.00	0.00	0.00	
AVE1	4	0.20	0.10	0.80	0.05	0.00	0.00	0.25	0.00	0.02	0.03	0.07	0.00	0.00	0.60	0.00	0.00	0.00	0.00	
AVE2	4	0.09	0.04	0.35	0.02	0.00	0.00	0.11	0.00	0.01	0.02	0.03	0.00	0.00	0.26	0.00	0.00	0.00	0.00	
1	5	0.00	0.25	0.40	0.00	0.00	0.00	0.50	0.30	0.20	0.50	0.04	0.15	0.00	0.00	0.00	0.00	0.00	0.00	
3	5	0.00	0.00	0.80	0.00	0.00	0.00	0.10	0.04	0.04	0.25	0.10	0.06	0.04	0.12	0.20	0.00	0.00	0.00	
AVE1	5	0.00	0.13	0.60	0.00	0.00	0.00	0.30	0.18	0.12	0.38	0.07	0.11	0.03	0.06	0.10	0.00	0.00	0.00	
AVE2	5	0.00	0.06	0.27	0.00	0.00	0.00	0.13	0.08	0.05	0.17	0.03	0.05	0.01	0.03	0.04	0.00	0.00	0.00	
WTOD SCORE	0.68	0.35	1.20	0.21	0.03	0.11	0.50	0.22	0.15	0.23	0.19	0.25	0.09	0.13	0.57	0.24	0.00	0.00	0.00	

Question 6. How much difference will there be between the new system and the current systems which it replaces in terms of physical characteristics?

Element	System #	Description
1.1 Flight Controls	1	Far-term Scout Helicopter
1.2 Instruments	2	SEMA-X Aircraft
1.3 Displays	3	Black Hawk
1.4 Power Controls	4	Advanced Attack Helicopter
1.5 Seating Arrangement	5	Near-term Scout Helicopter
1.6 Visibility		
1.7 Weapon Guidance		
1.8 Guns		
1.9 Rockets		
1.10 Laser		
1.11 Threat Detection		
1.12 Navigation		
1.13 Communication		
1.14 ECM/EW		
1.15 Other (Specify)		
1.16 Other (Specify)		
1.17 Other (Specify)		
1.18 Other (Specify)		

TABLE D-2

ELEMENT RATING VERSUS SYSTEM FOR QUESTION # 7

QSN#	SYS#	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	1.10	1.11	1.12	1.13	1.14	1.15	1.16	1.17	1.18	SUM
2	1	0.35	0.00	0.35	1.00	0.50	0.15	0.00	0.30	0.10	0.10	0.02	0.00	0.30	0.20	0.00	0.00	0.00	0.00	3.37
3	1	0.35	0.30	0.35	1.00	0.25	0.15	0.10	0.60	0.10	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.30
8	1	0.70	0.30	0.70	1.00	0.10	0.06	0.20	0.30	0.05	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.46
AVE1	1	0.47	0.20	0.47	1.00	0.28	0.12	0.10	0.40	0.08	0.08	0.01	0.00	0.10	0.07	0.00	0.00	0.00	0.00	3.38
AVE2	1	0.08	0.03	0.08	0.17	0.05	0.02	0.02	0.07	0.01	0.01	0.00	0.00	0.02	0.01	0.00	0.00	0.00	0.00	0.58
2	2	0.70	0.60	0.70	0.50	0.00	0.30	0.20	0.00	0.00	0.00	0.00	0.00	0.30	0.00	0.00	0.00	0.00	0.00	3.30
8	2	0.00	0.30	0.00	0.50	0.10	0.15	0.00	0.60	0.00	0.00	0.00	0.00	0.12	0.00	0.00	0.00	0.00	0.00	1.77
AVE1	2	0.35	0.45	0.35	0.50	0.05	0.23	0.10	0.30	0.00	0.00	0.00	0.00	0.21	0.00	0.00	0.00	0.00	0.00	2.53
AVE2	2	0.06	0.08	0.06	0.08	0.01	0.04	0.02	0.05	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.43
4	3	0.35	0.30	0.35	0.50	0.00	0.15	0.10	0.30	0.05	0.05	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	2.17
AVE1	3	0.35	0.30	0.35	0.50	0.00	0.15	0.10	0.30	0.05	0.05	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	2.17
AVE2	3	0.28	0.24	0.28	0.40	0.00	0.12	0.08	0.24	0.04	0.04	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	1.74
7	4	0.35	0.12	0.35	0.20	0.10	0.15	0.04	0.60	0.05	0.00	0.05	0.02	0.00	0.00	0.00	0.00	0.00	0.00	2.03
9	4	0.35	0.00	0.35	0.50	0.50	0.15	0.04	0.60	0.05	0.02	0.00	0.00	0.60	0.00	0.00	0.00	0.00	0.00	3.16
AVE1	4	0.35	0.06	0.35	0.35	0.30	0.15	0.04	0.60	0.05	0.01	0.03	0.01	0.30	0.00	0.00	0.00	0.00	0.00	2.60
AVE2	4	0.15	0.03	0.15	0.15	0.13	0.06	0.02	0.26	0.02	0.00	0.01	0.00	0.13	0.00	0.00	0.00	0.00	0.00	1.12
1	5	0.00	0.00	0.00	0.50	0.00	0.06	0.00	0.60	0.10	0.10	0.00	0.00	0.30	0.00	0.00	0.00	0.00	0.00	1.66
3	5	0.00	0.00	0.00	0.50	0.00	0.06	0.00	0.30	0.05	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.96
AVE1	5	0.00	0.00	0.00	0.50	0.00	0.06	0.00	0.45	0.08	0.08	0.00	0.00	0.15	0.00	0.00	0.00	0.00	0.00	1.31
AVE2	5	0.00	0.00	0.00	0.22	0.00	0.03	0.00	0.20	0.03	0.03	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.58
WTGD SCORE		0.57	0.36	0.57	1.03	0.19	0.27	0.13	0.82	0.11	0.09	0.01	0.02	0.25	0.01	0.00	0.00	0.00	0.00	4.45

Question 7. How much performance difference will there be between the new system and the current systems which it replaces?

System #	Description
1	Far-term Scout Helicopter
2	SEMA-X Aircraft
3	Black Hawk
4	Advanced Attack Helicopter
5	Near-term Scout Helicopter

  

Element	1.8	1.9	1.10	1.11	1.12	1.13	1.14
1.1 Maneuverability							
1.2 Flight Stability							
1.3 Control Responsiveness							
1.4 Flying Workload							
1.5 Flight Safety							
Characteristics							
1.6 Complexity							
1.7 Speed							
1.8 Target Detection Capabilities							
1.9 Weapon Range							
1.10 Weapon Accuracy							
1.11 Troop Capacity							
1.12 Cargo Capacity							
1.13 Other (Specify)							
1.14 Other (Specify)							

TABLE D-3  
ELEMENT RATING VERSUS SYSTEM FOR QUESTION # 8

QSN#	SYS#	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	1.10	1.11	1.12	1.13	1.14	1.15	1.16	1.17	1.18	SUM	
2	1	0.00	0.00	0.00	0.06	0.00	0.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.66
3	1	0.00	0.10	0.50	0.15	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.85
8	1	0.10	0.25	0.50	0.15	0.04	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.16
AVE1	1	0.03	0.12	0.33	0.12	0.05	0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.89
AVE2	1	0.01	0.02	0.06	0.02	0.01	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.15
2	2	0.10	0.10	0.00	0.15	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.35
8	2	0.25	0.00	0.00	0.15	0.10	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.62
AVE1	2	0.17	0.05	0.00	0.15	0.05	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.49
AVE2	2	0.03	0.01	0.00	0.03	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08
4	3	0.25	0.25	0.00	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.65
AVE1	3	0.25	0.25	0.00	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.65
AVE2	3	0.20	0.20	0.00	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.52
7	4	0.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50
9	4	0.00	0.10	0.50	0.00	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.68
AVE1	4	0.00	0.05	0.50	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.59
AVE2	4	0.00	0.02	0.22	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25
1	5	0.00	0.00	0.12	0.03	0.00	0.12	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.35
3	5	0.00	0.00	0.00	0.06	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10
AVE1	5	0.00	0.00	0.06	0.05	0.02	0.06	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.23
AVE2	5	0.00	0.00	0.03	0.02	0.01	0.03	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10
WTGD SCORE		0.24	0.25	0.30	0.19	0.03	0.08	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.11

Question 8. In terms of cockpit crew operations, how much difference is there between the new system and the current systems which it replaces?

System #	Description
1	Far-term Scout Helicopter
2	SEMA-X Aircraft
3	Black Hawk
4	Advanced Attack Helicopter
5	Near-term Scout Helicopter

- Element
- 1.1 Basic Flying
  - 1.2 Instrument Flying
  - 1.3 Nap of Earth Flying
  - 1.4 Navigation
  - 1.5 Communication
  - 1.6 Other (Specify)
  - 1.7 Other (Specify)

TABLE D-4

ELEMENT RATING VERSUS SYSTEM FOR QUESTION # 9

QSN#	SYS#	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	1.10	1.11	1.12	1.13	1.14	1.15	1.16	1.17	1.18	SUM
2	1	0.30	0.40	0.30	0.50	0.00	0.00	0.00	0.20	0.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.30
3	1	0.30	0.40	0.30	0.50	1.00	0.20	0.40	0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.50
8	1	0.15	0.40	0.30	0.50	0.50	0.04	0.08	0.20	0.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.77
AVE1	1	0.25	0.40	0.30	0.50	0.50	0.08	0.16	0.27	0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.86
AVE2	1	0.04	0.07	0.05	0.09	0.09	0.01	0.03	0.05	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.49
2	2	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.70
8	2	0.30	0.00	0.00	0.00	0.00	0.04	0.20	0.20	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.86
AVE1	2	0.30	0.00	0.00	0.00	0.00	0.02	0.10	0.30	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.78
AVE2	2	0.05	0.00	0.00	0.00	0.00	0.00	0.02	0.05	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.13
4	3	0.15	0.20	0.15	0.00	0.20	0.10	0.20	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.20
AVE1	3	0.15	0.20	0.15	0.00	0.20	0.10	0.20	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.20
AVE2	3	0.12	0.16	0.12	0.00	0.16	0.08	0.16	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.96
7	4	0.15	0.00	0.06	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.71
9	4	0.30	0.08	0.06	0.50	0.20	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.22
AVE1	4	0.23	0.04	0.06	0.50	0.10	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.97
AVE2	4	0.10	0.02	0.03	0.22	0.04	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.42
1	5	0.30	0.40	0.15	0.50	1.00	0.04	0.08	0.00	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.59
3	5	0.30	0.40	0.30	0.50	1.00	0.10	0.20	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.00
AVE1	5	0.30	0.40	0.23	0.50	1.00	0.07	0.14	0.10	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.80
AVE2	5	0.13	0.18	0.10	0.22	0.45	0.03	0.06	0.04	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.25
WTGD SCORE		0.44	0.42	0.30	0.52	0.73	0.13	0.27	0.32	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.24

Question 9. In terms of combat operations tasks, how much difference is there between the new system and current systems which it replaces?

Element	System #	Description
1.1 Target Detection	1	Far-term Scout Helicopter
1.2 Target Attack	2	SEMA-X Aircraft
1.3 Weapon Aiming and Firing	3	Black Hawk
1.4 Air-to-Air Combat Flight Maneuvers	4	Advanced Attack Helicopter
1.5 Air-to-Ground Combat Flight Maneuvers	5	Near-term Scout Helicopter
1.6 Multiple Aircraft Operation		
1.7 Reconnaissance Command and Control		
1.8 Information Processing		
1.9 Other (Specify)		
1.10 Other (Specify)		

TABLE D-5

ELEMENT RATING VERSUS SYSTEM FOR QUESTION # 10

OSN#	SYS#	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	1.10	1.11	1.12	1.13	1.14	1.15	1.16	1.17	1.18	SUM
2	1	0.25	0.10	0.15	0.15	0.20	0.10	0.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.65
3	1	0.50	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.04
8	1	0.25	0.10	0.15	0.15	0.50	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.35
AVE1	1	0.33	0.08	0.10	0.23	0.07	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.35
AVE2	1	0.06	0.01	0.02	0.04	0.01	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.23
2	2	0.50	0.00	0.00	0.00	0.50	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.10
8	2	0.10	0.00	0.00	0.06	0.50	0.00	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.96
AVE1	2	0.30	0.00	0.00	0.03	0.50	0.05	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.03
AVE2	2	0.05	0.00	0.00	0.01	0.08	0.01	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.17
4	3	0.25	0.00	0.04	0.00	0.00	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.54
AVE1	3	0.25	0.00	0.04	0.00	0.00	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.54
AVE2	3	0.20	0.00	0.03	0.00	0.00	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.43
7	4	0.25	0.50	0.10	0.15	0.20	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.30
9	4	0.50	0.50	0.00	0.15	0.90	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.75
AVE1	4	0.38	0.50	0.05	0.15	0.35	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.53
AVE2	4	0.16	0.22	0.02	0.06	0.15	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.66
1	5	0.50	0.00	0.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00
3	5	0.50	0.00	0.04	0.15	0.50	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.29
AVE1	5	0.50	0.00	0.02	0.08	0.50	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.14
AVE2	5	0.22	0.00	0.01	0.03	0.22	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.51
WTGD	SCORE	0.69	0.27	0.08	0.12	0.50	0.29	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.01

Question 10. What are the differences in man-machine skill requirements between the new system and the current systems which it replaces?

System #	Description
1	Far-term Scout Helicopter
2	SEMA-X
3	Black Hawk
4	Advanced Attack Helicopter
5	Near-term Scout Helicopter

Element

- 1.1 Monitoring Displays
- 1.2 Tracking Outside Aircraft
- 1.3 Recognition
- 1.4 Memory
- 1.5 Decision-Making
- 1.6 Physical Responses
- 1.7 Other (Specify)
- 1.8 Other (Specify)

TABLE D-6  
ELEMENT RATING VERSUS SYSTEM FOR QUESTION # 11

QSN#	SYS#	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	1.10	1.11	1.12	1.13	1.14	1.15	1.16	1.17	1.18	SUM
2	1	0.00	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.30
3	1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AVE1	1	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10
AVE2	1	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02
2	2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	2	0.00	0.00	0.00	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.12
AVE1	2	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06
AVE2	2	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
4	3	0.00	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.30
AVE1	3	0.00	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.30
AVE2	3	0.00	0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.24
7	4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	4	0.02	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.32
AVE1	4	0.01	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14
AVE2	4	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07
1	5	0.02	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14
3	5	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05
AVE1	5	0.04	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10
AVE2	5	0.02	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04
WTGD SCORE	0.02	0.35	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.38

Question 11. What are the differences in crew interaction requirements between the new system and the current systems which it replaces?

System #	Description
1	Far-term Scout Helicopter
2	SEMA-X Aircraft
3	Black Hawk
4	Advanced Attack Helicopter
5	Near-term Scout Helicopter

Element

- 1.1 Verbal Exchange
- 1.2 Non-Verbal Exchange
- 1.3 Coordinated Physical Responses
- 1.4 Other (Specify)
- 1.5 Other (Specify)

TABLE D-7

ELEMENT RATING VERSUS SYSTEM FOR QUESTION # 12

GSN#	SYS#	1 1	1 2	1 3	1 4	1 5	1 6	1 7	1 8	1 9	1 10	1 11	1 12	1 13	1 14	1 15	1 16	1 17	1 18	SUM
2	1	0.10	0.25	0.00	0.06	0.10	0.15	0.40	0.30	0.50	1.00	0.04	0.08	0.40	0.00	0.00	0.00	0.00	0.00	3.38
3	1	0.50	0.10	0.20	0.06	0.04	0.30	0.40	0.30	0.50	1.00	0.04	0.40	0.40	0.00	0.00	0.00	0.00	0.00	4.24
8	1	0.25	0.25	0.50	0.15	0.04	0.15	0.40	0.30	0.50	0.50	0.04	0.08	0.20	0.00	0.00	0.00	0.00	0.00	3.36
AVE1	1	0.28	0.20	0.23	0.09	0.06	0.20	0.40	0.30	0.50	0.83	0.04	0.19	0.33	0.00	0.00	0.00	0.00	0.00	3.66
AVE2	1	0.05	0.03	0.04	0.02	0.01	0.03	0.07	0.05	0.09	0.14	0.01	0.03	0.06	0.00	0.00	0.00	0.00	0.00	0.63
2	2	0.25	0.00	0.00	0.06	0.04	0.00	0.00	0.00	0.50	0.00	0.00	0.00	0.20	0.00	0.00	0.00	0.00	0.00	1.05
8	2	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.08	0.12	0.00	0.00	0.00	0.00	0.38
AVE1	2	0.13	0.05	0.00	0.03	0.02	0.00	0.00	0.00	0.25	0.00	0.00	0.04	0.14	0.06	0.00	0.00	0.00	0.00	0.71
AVE2	2	0.02	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.01	0.02	0.01	0.00	0.00	0.00	0.00	0.12
4	3	0.00	0.10	0.00	0.00	0.00	0.15	0.20	0.15	0.25	0.50	0.10	0.20	0.20	0.00	0.00	0.00	0.00	0.00	1.85
AVE1	3	0.00	0.10	0.00	0.00	0.00	0.15	0.20	0.15	0.25	0.50	0.10	0.20	0.20	0.00	0.00	0.00	0.00	0.00	1.85
AVE2	3	0.00	0.08	0.00	0.00	0.00	0.12	0.14	0.12	0.20	0.40	0.08	0.16	0.16	0.00	0.00	0.00	0.00	0.00	1.48
7	4	0.00	0.00	0.00	0.00	0.00	0.15	0.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.65
9	4	0.10	0.00	0.50	0.00	0.04	0.06	0.08	0.06	0.50	0.20	0.00	0.00	0.08	0.30	0.08	0.08	0.00	0.00	2.08
AVE1	4	0.05	0.00	0.25	0.00	0.02	0.11	0.04	0.03	0.50	0.10	0.00	0.00	0.04	0.15	0.04	0.04	0.00	0.00	1.36
AVE2	4	0.02	0.00	0.11	0.00	0.01	0.05	0.02	0.01	0.22	0.04	0.00	0.00	0.02	0.06	0.02	0.02	0.00	0.00	0.59
1	5	0.00	0.00	0.00	0.06	0.00	0.06	0.00	0.15	0.10	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.41
3	5	0.00	0.10	0.20	0.06	0.04	0.15	0.20	0.15	0.50	1.00	0.04	0.20	0.08	0.00	0.00	0.00	0.00	0.00	2.72
AVE1	5	0.00	0.05	0.10	0.06	0.02	0.11	0.10	0.15	0.30	0.50	0.04	0.10	0.04	0.00	0.00	0.00	0.00	0.00	1.57
AVE2	5	0.00	0.02	0.04	0.03	0.01	0.05	0.04	0.07	0.13	0.22	0.02	0.04	0.02	0.00	0.00	0.00	0.00	0.00	0.70
WGD	SCORE	0.09	0.15	0.19	0.05	0.03	0.25	0.29	0.25	0.68	0.81	0.10	0.24	0.28	0.07	0.02	0.02	0.00	0.00	3.52

Question 12. In terms of training methods, how much difference will there be between the new system and the current systems it replaces?

Element	System #	Description
1.1 Basic Flying	1	Far-term Scout Helicopter
1.2 Instrument Flying	2	SIEMA-X Aircraft
1.3 Map of Earth Flying	3	Black Hawk
1.4 Navigation	4	Advanced Attack Helicopter
1.5 Communications	5	Near-term Scout Helicopter
1.6 Target Detection		
1.7 Target Attack		
1.8 Weapon Aiming and Firing		
1.9 Air-to-Air Combat Flight Maneuvers		
1.10 Air-to-Ground Combat Flight Maneuvers		
1.11 Multiple Aircraft Operations		
1.12 Reconnaissance		
1.13 Command and Control Information Processing		
1.14 Other (Specify)		
1.15 Other (Specify)		
1.16 Other (Specify)		

TABLE D-8  
ELEMENT RATING VERSUS SUBSYSTEM FOR QUESTION # 6

QSN#	SYS#	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	1.10	1.11	1.12	1.13	1.14	1.15	1.16	1.17	1.18	SUM
6	11	0.00	0.50	0.80	0.00	0.00	0.25	0.00	0.00	0.00	0.00	0.00	0.15	0.00	0.00	0.00	0.00	0.00	0.00	1.70
	AVE1	11	0.00	0.50	0.80	0.00	0.25	0.00	0.00	0.00	0.00	0.00	0.15	0.00	0.00	0.00	0.00	0.00	0.00	1.70
	AVE2	11	0.00	0.36	0.58	0.00	0.18	0.00	0.00	0.00	0.00	0.00	0.11	0.00	0.00	0.00	0.00	0.00	0.00	1.22
6	12	0.00	0.10	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.26
	AVE1	12	0.00	0.10	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.26
	AVE2	12	0.00	0.04	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.11
5	13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04
	AVE1	13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04
	AVE2	13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03
5	14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.15
	AVE1	14	0.00	0.00	0.00	0.00	0.00	0.00	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.15
	AVE2	14	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06
1	15	0.00	0.25	0.00	0.00	0.00	0.00	0.50	0.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.25
5	15	0.00	0.00	0.00	0.00	0.00	0.50	0.00	0.00	0.00	0.00	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.70
	AVE1	15	0.00	0.13	0.00	0.00	0.25	0.25	0.00	0.00	0.25	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.98
	AVE2	15	0.00	0.05	0.00	0.00	0.10	0.10	0.00	0.00	0.10	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.39
10	16	0.80	0.25	0.40	0.25	0.20	0.25	0.25	0.06	0.04	0.00	0.00	0.15	0.15	0.10	0.60	0.40	0.00	0.00	3.90
11	16	0.80	0.10	0.16	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.54
	AVE1	16	0.80	0.17	0.28	0.38	0.10	0.13	0.03	0.02	0.00	0.00	0.08	0.08	0.05	0.30	0.20	0.00	0.00	2.73
	AVE2	16	0.65	0.14	0.23	0.30	0.08	0.10	0.02	0.02	0.00	0.00	0.06	0.06	0.04	0.24	0.16	0.00	0.00	2.21
11	17	0.80	0.50	0.80	0.25	0.00	0.25	0.25	0.15	0.10	0.00	0.20	0.15	0.15	0.00	0.00	0.00	0.00	0.00	3.60
	AVE1	17	0.80	0.50	0.80	0.25	0.00	0.25	0.15	0.10	0.00	0.20	0.15	0.15	0.00	0.00	0.00	0.00	0.00	3.60
	AVE2	17	0.26	0.16	0.26	0.08	0.00	0.08	0.05	0.03	0.00	0.06	0.05	0.05	0.00	0.00	0.00	0.00	0.00	1.15
WTGD SCORE	0.90	0.75	1.13	0.38	0.08	0.46	0.28	0.14	0.08	0.10	0.10	0.10	0.22	0.11	0.04	0.24	0.16	0.00	0.00	5.19

Question 6. How much difference will there be between the new system and the current systems which it replaces in terms of physical characteristics?

Element	System #	Description
1.1 Flight Controls	11	ADAS
1.2 Instruments	12	Landing System
1.3 Displays	13	A/C Rocket System
1.4 Power Controls	14	A/C Guns
1.5 Seating Arrangement	15	Fire Control
1.6 Visibility	16	ADOCs
1.7 Weapon Guidance	17	TDSV
1.8 Guns		
1.9 Rockets		
1.10 Laser		
1.11 Threat Detection		
1.12 Navigation		
1.13 Communication		
1.14 ECM/EW		
1.15 Other (Specify)		
1.16 Other (Specify)		

TABLE D-9

ELEMENT RATING VERSUS SUBSYSTEM FOR QUESTION # 7

QSN#	SYS#	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	1.10	1.11	1.12	1.13	1.14	1.15	1.16	1.17	1.18	SUM
6	11	0.00	0.00	0.00	0.50	0.25	0.15	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.92
AVE1	11	0.00	0.00	0.00	0.50	0.25	0.15	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.92
AVE2	11	0.00	0.00	0.00	0.36	0.18	0.11	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.66
6	12	0.00	0.00	0.14	0.20	0.10	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50
AVE1	12	0.00	0.00	0.14	0.20	0.10	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50
AVE2	12	0.00	0.00	0.06	0.08	0.04	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.21
5	13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10
AVE1	13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10
AVE2	13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08
5	14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07
AVE1	14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07
AVE2	14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03
1	15	0.00	0.00	0.00	0.50	0.00	0.06	0.00	0.60	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.26
5	15	0.00	0.00	0.00	0.00	0.10	0.15	0.00	0.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.85
AVE1	15	0.00	0.00	0.00	0.25	0.05	0.11	0.00	0.60	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.06
AVE2	15	0.00	0.00	0.00	0.10	0.02	0.04	0.00	0.24	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.43
10	16	0.35	0.30	0.14	0.50	0.25	0.15	0.00	0.00	0.00	0.02	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	1.76
11	16	0.35	0.30	0.35	0.50	0.25	0.15	0.00	0.30	0.00	0.05	0.05	0.05	0.30	0.20	0.20	0.00	0.00	0.00	3.05
AVE1	16	0.35	0.30	0.24	0.50	0.25	0.15	0.00	0.15	0.00	0.04	0.03	0.05	0.15	0.10	0.10	0.00	0.00	0.00	2.40
AVE2	16	0.28	0.24	0.20	0.41	0.20	0.12	0.00	0.12	0.00	0.03	0.02	0.04	0.12	0.08	0.08	0.00	0.00	0.00	1.95
11	17	0.35	0.30	0.35	0.50	0.25	0.15	0.00	0.30	0.00	0.00	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.00	2.24
AVE1	17	0.35	0.30	0.35	0.50	0.25	0.15	0.00	0.30	0.00	0.00	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.00	2.24
AVE2	17	0.11	0.10	0.11	0.16	0.08	0.05	0.00	0.10	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.72
MTGD SCORE	0	0.34	0.34	0.37	1.11	0.52	0.35	0.00	0.46	0.05	0.11	0.03	0.06	0.12	0.08	0.08	0.00	0.00	0.00	4.07

Question 7. How much performance difference will there be between the new system and the current systems which it replaces?

System #

Description

Element

- 1.1 Maneuverability
- 1.2 Flight Stability
- 1.3 Control Responsiveness
- 1.4 Flying Workload
- 1.5 Flight Safety Character-
- 1.6 Complexity
- 1.7 Speed
- 1.8 Target Detection Capabilities
- 1.9 Weapon Range
- 1.10 Weapon Accuracy
- 1.11 Troop Capacity
- 1.12 Cargo Capacity
- 1.13 Other (Specify)
- 1.14 Other (Specify)
- 1.15 Other (Specify)

11

ADAS

12

Landing System

13

A/C Rocket System

14

A/C Guns

15

Fire Control

16

ADOCs

17

IDSV

TABLE D-10  
ELEMENT RATING VERSUS SUBSYSTEM FOR QUESTION # 8

QSN#	SYS#	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	1.10	1.11	1.12	1.13	1.14	1.15	1.16	1.17	1.18	SUM	
6	11	0.00	0.25	1.00	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.55
	AVE1	0.00	0.25	1.00	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.55
	AVE2	0.00	0.18	0.72	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.12
6	12	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10
	AVE1	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10
	AVE2	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04
5	13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	AVE1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	AVE2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	AVE1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	AVE2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.60
3	5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.80
4	AVE1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.70
	AVE2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.28
10	16	0.25	0.25	0.50	0.15	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.25
	AVE1	0.25	0.25	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00
	AVE2	0.25	0.25	0.50	0.08	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.13
11	17	0.25	0.25	0.50	0.15	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.25
	AVE1	0.25	0.25	0.50	0.15	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.25
	AVE2	0.08	0.08	0.16	0.05	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.40
WTGD SCORE	0.28	0.50	1.28	0.32	0.07	0.24	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.75

Question 8. In terms of cockpit crew operations, how much difference is there between the new system and the current systems which it replaces?

Element

- 1.1 Basic Flying
- 1.2 Instrument Flying
- 1.3 Nap of Earth Flying
- 1.4 Navigation
- 1.5 Communication
- 1.6 Other (Specify)
- 1.7 Other (Specify)

Description

- 11 ADAS
- 12 Landing System
- 13 A/C Rocket System
- 14 A/C Guns
- 15 Fire Control
- 16 ADOCS
- 17 IDSV

TABLE D-11  
ELEMENT RATING VERSUS SUBSYSTEM FOR QUESTION # 9

GSN#	BYS#	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	1.10	1.11	1.12	1.13	1.14	1.15	1.16	1.17	1.18	SUM
6	11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AVE1	11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AVE2	11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AVE1	12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AVE2	12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	13	0.00	0.20	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.35
AVE1	13	0.00	0.20	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.35
AVE2	13	0.00	0.15	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.26
5	14	0.00	0.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50
AVE1	14	0.00	0.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50
AVE2	14	0.00	0.00	0.00	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.22
1	15	0.30	0.00	0.15	0.00	0.00	0.04	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.57
5	15	0.30	0.00	0.30	0.10	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.78
AVE1	15	0.30	0.00	0.23	0.05	0.00	0.02	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.68
AVE2	15	0.12	0.00	0.09	0.02	0.00	0.01	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.27
10	16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11	16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AVE1	16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AVE2	16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11	17	0.30	0.40	0.30	0.50	1.00	0.10	0.20	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.00
AVE1	17	0.30	0.40	0.30	0.50	1.00	0.10	0.20	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.00
AVE2	17	0.10	0.13	0.10	0.16	0.32	0.03	0.06	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.96
WFGD SCORE	0.22	0.28	0.30	0.40	0.32	0.32	0.04	0.10	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.71

Question 9. In terms of combat operations tasks, how much difference is there between the new system and current systems which it replaces?

Element	System #	Description
1.1 Target Detection	11	ADAS
1.2 Target Attack	12	Landing System
1.3 Weapon Aiming and Firing	13	A/C Rocket System
1.4 Air-to-Air Combat Flight	14	A/C Guns
Maneuvers	15	Fire Control
1.5 Air-to-Ground Combat Flight	16	ADOCs
Maneuvers	17	IDSV
1.6 Multiple Aircraft Operation		
1.7 Reconnaissance		
1.8 Command and Control		
Information Processing		
1.9 Other (Specify)		
1.10 Other (Specify)		

TABLE D-12

ELEMENT RATING VERSUS SUBSYSTEM FOR QUESTION # 10

OSM#	SYS#	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	1.10	1.11	1.12	1.13	1.14	1.15	1.16	1.17	1.18	SUM
6	11	0.25	0.00	0.10	0.15	0.50	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.25
	AVE1	0.25	0.00	0.10	0.15	0.50	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.25
	AVE2	0.18	0.00	0.07	0.11	0.36	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.90
6	12	0.10	0.00	0.00	0.00	0.20	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.40
	AVE1	0.10	0.00	0.00	0.00	0.20	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.40
	AVE2	0.04	0.00	0.00	0.00	0.08	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.17
5	13	0.00	0.00	0.00	0.00	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20
	AVE1	0.00	0.00	0.00	0.00	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20
	AVE2	0.00	0.00	0.00	0.00	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.15
5	14	0.00	0.50	0.10	0.00	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.80
	AVE1	0.00	0.50	0.10	0.00	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.80
	AVE2	0.00	0.22	0.04	0.00	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.35
1	15	0.25	0.00	0.00	0.00	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.45
5	15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	AVE1	0.13	0.00	0.00	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.23
	AVE2	0.05	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09
10	16	0.00	0.00	0.00	0.00	0.00	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25
	AVE1	0.00	0.00	0.00	0.00	0.00	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25
	AVE2	0.00	0.00	0.00	0.00	0.00	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20
11	17	0.25	0.25	0.04	0.15	0.50	0.25	0.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.04
	AVE1	0.25	0.25	0.04	0.15	0.50	0.25	0.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.04
	AVE2	0.08	0.08	0.01	0.05	0.16	0.08	0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.65
WTGD SCORE		0.35	0.30	0.13	0.16	0.88	0.50	0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.51

Question 10. What are the differences in man-machine skill requirements between the new system and the current systems which it replaces?

Element	System #	Description
1.1 Monitoring Displays	11	ADAS
1.2 Tracking Outside Aircraft	12	Landing System
1.3 Recognition	13	A/C Rocket System
1.4 Memory	14	A/C Guns
	15	Fire Control
	16	ADDCS
	17	IDSV
1.5 Decision-Making		
1.6 Physical Responses		
1.7 Other (Specify)		
1.8 Other (Specify)		

TABLE D-13

ELEMENT RATING VERSUS SUBSYSTEM FOR QUESTION # 11

GSN#	BYS#	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	1.10	1.11	1.12	1.13	1.14	1.15	1.16	1.17	1.18	SUM
6	11	0.02	0.12	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20
	AVE1	0.02	0.12	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20
	AVE2	0.01	0.09	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14
6	12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	AVE1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	AVE2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	AVE1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	AVE2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	14	0.05	0.30	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50
	AVE1	0.05	0.30	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50
	AVE2	0.02	0.13	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.22
1	15	0.02	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14
	AVE1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	AVE2	0.01	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07
10	16	0.02	0.12	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03
	AVE1	0.02	0.12	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20
	AVE2	0.02	0.10	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.16
11	17	0.05	0.30	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.41
	AVE1	0.05	0.30	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.41
	AVE2	0.02	0.10	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.13
WTGD SCORE		0.07	0.43	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.68

Question 11. What are the differences in crew interaction requirements between the new system and the current systems which it replaces?

Element

- 1.1 Verbal Exchange
- 1.2 Non-Verbal Exchange
- 1.3 Coordinated Physical Responses
- 1.4 Other (Specify)
- 1.5 Other (Specify)

System #	Description
11	ADAS
12	Landing System
13	A/C Rocket System
14	A/C Guns
15	Fire Control
16	ADOCs
17	IDSV

TABLE D-14  
ELEMENT RATING VERSUS SUBSYSTEM FOR QUESTION # 12

QSN#	SYS#	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	1.10	1.11	1.12	1.13	1.14	1.15	1.16	1.17	1.18	SUM
6	11	0.00	0.00	1.00	0.30	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.18
AVE1	11	0.00	0.00	1.00	0.30	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.34
AVE2	11	0.00	0.00	0.72	0.22	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.34
6	12	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10
AVE1	12	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10
AVE2	12	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04
5	13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06
AVE1	13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06
AVE2	13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05
5	14	0.00	0.00	0.00	0.00	0.00	0.15	0.20	0.15	0.25	0.20	0.00	0.00	0.00	0.08	0.00	0.00	0.00	0.00	1.03
AVE1	14	0.00	0.00	0.00	0.00	0.00	0.15	0.20	0.15	0.25	0.20	0.00	0.00	0.00	0.08	0.00	0.00	0.00	0.00	1.03
AVE2	14	0.00	0.00	0.00	0.00	0.00	0.06	0.09	0.06	0.11	0.09	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	1.03
1	15	0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.15	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25
5	15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25
AVE1	15	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.08	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AVE2	15	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.03	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.13
10	16	0.10	0.25	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05
11	16	0.10	0.25	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.85
AVE1	16	0.10	0.25	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.85
AVE2	16	0.08	0.20	0.41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.69
11	17	0.25	0.25	0.50	0.15	0.10	0.30	0.40	0.30	0.50	1.00	0.10	0.20	0.20	0.60	0.40	0.20	0.00	0.00	5.45
AVE1	17	0.25	0.25	0.50	0.15	0.10	0.30	0.40	0.30	0.50	1.00	0.10	0.20	0.20	0.60	0.40	0.20	0.00	0.00	5.45
AVE2	17	0.08	0.08	0.16	0.05	0.03	0.10	0.13	0.10	0.16	0.32	0.03	0.06	0.06	0.19	0.13	0.06	0.00	0.00	1.74
WTGD SCORE	0.16	0.32	1.28	0.26	0.05	0.17	0.21	0.24	0.27	0.41	0.04	0.06	0.06	0.10	0.19	0.13	0.06	0.00	0.00	3.98

Question 12. In terms of training methods, how much difference will there be between the new system and the current systems it replaces?

Element	System #	Description
1.1 Basic Flying	11	ADAS
1.2 Instrument Flying	12	Landing System
1.3 Nap of Earth Flying	13	A/C Rocket System
1.4 Navigation	14	A/C Guns
1.5 Communications	15	Fire Control
1.6 Target Detection	16	ADOCs
1.7 Target Attack	17	IDSV
1.8 Weapon Aiming and Firing		
1.9 Air-to-Air Combat Flight Maneuvers		
1.10 Air-to-Ground Combat Flight Maneuvers		
1.11 Multiple Aircraft Operations		
1.12 Reconnaissance		
1.13 Command and Control		
1.14 Other (Specify)		
1.15 Other (Specify)		

APPENDIX E  
BEHAVIORAL RESEARCH LITERATURE

Behavioral research literature on Army aviation was reviewed using the methodologies discussed in Section 2, Volume I. The review covered several information data bases. Titles and abstracts obtained from these information searches were screened to further identify those important to this study. These important sources were then arranged into subject categories and sub-categories in a computerized data file to facilitate the in-depth literature review.

The sources were arranged into seven subject categories: aircraft systems, subsystems, technology, procedures/tactics, training methods, training devices, and personnel. Each category consists of several sub-categories as shown in Table E-1. The computerized data file operates in an interactive mode which allows users to request information by selected subject categories.

Each literature citation lists the author's name, document title, and date of publication. Citations related to multiple subject areas are cross referenced and listed after the citation's first appearance in the file. A complete list of the behavioral research literature reviewed in this study is shown in Table E-2.

This initial categorization suggested the need for a somewhat different categorization and a reduction of the bibliography to emphasize those documents which deal more specifically with behavioral research related to Army aviation training. This second arrangement of the bibliography is described in Section 9, Volume I, along with the corresponding bibliographic citations.

TABLE E-1  
SUBJECT CATEGORIES FOR ARMY TRAINING PROJECT

- |                       |                                                                                                                                                                                                                                                                                                                                                                                               |
|-----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. AIRCRAFT SYSTEMS   | 1.1 Advanced Attack Helicopter (AAH)<br>1.2 Advanced Scout Helicopter (ASH)<br>1.3 SEMA-X<br>1.4 UH-60, Black Hawk<br>1.5 UH-X<br>1.6 Remotely Piloted Vehicles (RPVS)<br>1.7 Others                                                                                                                                                                                                          |
| 2. SUBSYSTEMS         | 2.1 Foreward Looking Infrared (FLIR)<br>2.2 Night Vision Subsystems<br>2.3 Mast Mounted Sight (MMS)<br>2.4 Global Positioning System (GPS)<br>2.5 Position Location of Reporting System (PLRS)<br>2.6 Head Up Display/Helmet Mounted Display (HUD/HMD)<br>2.7 Wire Guided Missiles<br>2.8 Target Acquisition and Designation System (TADS)<br>2.9 Display Subsystems<br>2.10 Other Subsystems |
| 3. TECHNOLOGY         | 3.1 Aeromechanics and Flight Control<br>3.2 Propulsion<br>3.3 Structures<br>3.4 Aircraft Electronics (Avionics)<br>3.5 Weapons<br>3.6 Mission Support<br>3.7 Systems Integration<br>3.8 Behavioral and Medical<br>3.9 Cockpit Lighting<br>3.10 Information Transfer<br>3.11 Planning                                                                                                          |
| 4. PROCEDURES/TACTICS | 4.1 Nap-of-the-Earth (NOE) Flight<br>4.2 Air Combat<br>4.3 Air-to-Ground Tactics<br>4.4 Battlefield Management<br>4.5 Threats<br>4.6 Weather Operations<br>4.7 Inflight Refueling<br>4.8 Instrument Training<br>4.9 Other                                                                                                                                                                     |

TABLE E-1 (Continued)

5.	TRAINING METHODS	5.1	Adaptive Training
		5.2	Computer Aided Instruction (CAI)
		5.3	Performance Measurement
		5.4	Training Manuals
6.	TRAINING DEVICES	6.1	Simulators
		6.2	Procedures Trainers
		6.3	NOE Training Device
		6.4	Eye-Safe LASER
		6.5	Video Tape Replay
7.	PERSONNEL	7.1	Selection
		7.2	Training Attrition
		7.3	Visual Perception
		7.4	Transfer of Training

TABLE E-2  
LIST OF BEHAVIORAL RESEARCH LITERATURE

1. AIRCRAFT SYSTEMS

1.1 ADVANCED ATTACK HELICOPTER (AAH)

CAE ELECTRONICS LTD.; "AH-64 FLIGHT AND WEAPONS SIMULATOR CONCEPT FORMULATION STUDY VOLUME 1.", 1977.

DICKMAN, JOSEPH L., HOWARD KESTENBAUM, PAUL W. CARO, CAROL O'NEILL AND CHARLES SINCLAIR; "AH-64 FLIGHT AND WEAPONS SIMULATOR CONCEPT FORMULATION STUDY," 1977.

NAVAL TRAINING EQUIPMENT CENTER; "AH-64 AAH CONCEPT FORMULATION SPECIFICATION", 1977.

TSOUBANOS, CHRISTOS M.; "DOPPLER HOVER SYSTEM (DHS) FLIGHT TEST REPORT", 1978.

1.2 ADVANCED SCOUT HELICOPTER (ASH)

TSOUBANOS, CHRISTOS M.; "DOPPLER HOVER SYSTEM (DSH) FLIGHT TEST REPORT", 1978.

1.3 SEMA-X

1.4 UH-60, BLACKHAWK

1.5 UH-X

(SEE 1.7)

1.6 REMOTE PILOTED VEHICLES (RPVS)

FOGEL, LAWRENCE J.; "PRINCIPLES OF DISPLAY AND CONTROL DESIGN FOR STRIKE RPV'S: FINAL REPORT", 1974.

1.7 OTHERS

AGARD; "ADVANCED ROTORCRAFT. VOLUME 1.", 1973.

AGARD; "THE GUIDANCE AND CONTROL OF HELICOPTERS AND V/STOL AIRCRAFT AT NIGHT AND IN POOR VISIBILITY", 1979.

AGARD; "ROTORCRAFT DESIGN", 1978.

AGARD; "V/STOL HANDLING. I. CRITERIA AND DISCUSSION"

ANDERSON, DAVID A.; "AERONAUTICS. AMERICA IN SPACE: THE FIRST DECADE", 1970.

ARMY AVIATION TEST BOARD, FORT RUCKER ALA.; "EVALUATION OF THE L-19A AS MODIFIED FOR TRAINING PURPOSES", 1958.

ARMY AVIATION TEST BOARD, FORT RUCKER ALA.; "MILITARY POTENTIAL TEST OF PRIMARY HELICOPTER TRAINERS", 1967.

BAILES, EDWARD E., VERNON L. DIEKMANN, JOSEPH C. WATTS AND JOHN C. HENDERSON; "INSTRUMENT-FLIGHT-RULES CAPABILITY EVALUATION CH-540 (TARHE) HELICOPTER", 1972.

TABLE E-2 (Continued)

- DAVIS, WILLIE S. AND JOHN F. COMER; "MILITARY POTENTIAL TEST OF OFF-THE-SHELF HELICOPTERS AS BASIC ROTARY-WING INSTRUMENT TRAINERS", 1963.
- DEFENSE DOCUMENTATION CENTER, ALEXANDRIA VA.; "HUMAN FACTORS IN DESIGN AND CONTROL OF AIRCRAFT", 1971.
- FORSYTH, ROBERT F., JOHN I. NAGATA, GIFFEN A. MARR AND JOHN R. BURDEN; "AIRWORTHINESS AND FLIGHT CHARACTERISTICS TEST CH-47C HELICOPTER (CHINOOK) PERFORMANCE", 1971.
- GREEN, DAVID L., GERALD D. SKIOGEL AND ROBERT B. RICHARDS; "HELICOPTER PERFORMANCE", 1968.
- HARENORA, P.B., M.J. JOGLEKAR, T.M. GAFFEY AND R.L. MARR; V/STOL TILT ROTOR STUDY. VOLUME 5: A MATHEMATICAL MODEL FOR REAL TIME FLIGHT SIMULATION OF THE BELL MODEL 301 TILT ROTOR RESEARCH AIRCRAFT", 1973.
- HELMICK, HUGH M. AND EDWARD B. RUSSELL; "UH-1N CATEGORY II AIRFRAME AND SUBSYSTEMS EVALUATION", 1971.
- YAMAKAWA, GEORGE M., ALTON G. SEINMETZ, RICHARD L. GREENLAND AND DONALD E. HENDRICKSON; "TECHNICAL EVALUATION BOEING-VERTOL MODEL 347 ADVANCED TECHNOLOGY HELICOPTER", 1972.
- LAING, EMMETT J., JOHN D. CLAXTON, WILLIAM A. GRAHAM JR. AND LESLIE J. HEPLER; "INSTRUMENT PANEL AND AVIONICS COMPARTMENT ENVIRONMENTAL SURVEY PRODUCTION OH-58A HELICOPTER", 1972.
- LAING, EMMETT J., ROBERT K. MERRILL AND JAMES S. REID; "VIBRATION AND TEMPERATURE SURVEY CH-54B HELICOPTER", 1973.
- LAING, EMMETT J., LESLIE J. HEPLER AND ROBERT K. MERRILL; "VIBRATION AND TEMPERATURE SURVEY PRODUCTION UH-1H HELICOPTER", 1973.
- MONTELEONE, ROBERT A.; "INVESTIGATION OF THE MANEUVERABILITY OF THE S-67 WINGED HELICOPTER", 1973.
- SMITH, JOHN R. AND TOM P. BENSON; "INSTRUMENT FLIGHT EVALUATION OH-58A HELICOPTER", 1972.
- SPRINGER, ROBERT H., AND DONALD BERGER; "CATEGORY II PERFORMANCE TEST OF THE UH-1N HELICOPTER. VOLUME 1.", 1972.
- WELCH, ARTHUR J. AND EDWARD L. WARREN; "COMPARISON OF THE UH-1C FLIGHT TEST DATA WITH MOSTAB-C SMALL PERTURBATION MATH MODEL", 1971.

2. SUBSYSTEMS

2.1 FORWARD LOOKING INFRARED (FLIR)

- ADJUTANT GENERAL'S OFFICE (ARMY), WASHINGTON D.C.; "LESSONS LEARNED", 1971.

TABLE E-2 (Continued)

CHOW, SEN-TE AND JOHN J. PUPICH; "FLIR IMAGE ENHANCEMENT BY AUTOMATIC LOW FREQUENCY GAIN LIMITING", 1978.

FINNESTEAD, RODGER L. AND DONALD E. HENDRICKSON; "VIBRATION AND ELEVATOR LOADS SURVEY TESTS OF THE UH-1H HELICOPTER WITH THE FORWARD-LOOKING INFRARED (FLIR) SYSTEM INSTALLED", 1971.

NODA, T., M. HENNING, T. LEIBOFF, G. ROBINSON AND T. BAXTER; "EXPERIMENTAL DEVELOPMENT OF A FLIR SENSOR PROCESSOR", 1976.

2.2 NIGHT VISION SUBSYSTEMS

ATTLER, A.R., M. SHENKER AND A. PARR; "DEVELOPMENT OF AN ADVANCED DISPLAY FOR A WIDE FIELD NIGHT VISION SYSTEM", 1974.

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