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18. SUPPLEMENTARY NOTES This is the comprehensive version of <u>HUMAN RESOURCES TEST AND EVALUATION SYSTEM (HRTES)</u> . It differs in many respects from the later <u>HRTES TEST PROCEDURES AND SUPPLEMENT</u> . This is Volume II of a two-volume set. (over)		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Test Evaluation, Performance Taxonomy, Performance Testing, Criteria Operational Testing, Human Factors Testing.		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This research note is the second volume of a two-volume set designed to aid in making the decisions needed in operational testing, including front-end analysis. The series of structured decision aids herein aid in determining the required classes of performance, the conditions that apply to performance, the criteria for performance, the measures of performance, the value of performance outcomes, and the causes of inadequate system performance.		

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Research Note 84-120

**HUMAN RESOURCES TEST AND EVALUATION SYSTEM
(HRTES) Comprehensive Workbook**

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Mark S. Sanders, and Rina Dechter**

Perceptronics, Inc.

**Contracting Officer's Representatives
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U. S. Army

Research Institute for the Behavioral and Social Sciences

August 1984

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Volume I is published separately as ARI Research Note 84-119. See also related ARI Research Products 84-19 and 84-20.

Irving N. Alderman and Charles O. Nystrom, contracting officer's representatives

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HRTES

1. INTRODUCTION

The Human Resources Test and Evaluation System (HRTES) Workbook consists of a series of Worksheets and applicable Guidelines. Each Worksheet and Guideline is referenced by associated text in a chapter of the HRTES Handbook. The chapter numbers in the Workbook and the Handbook are equivalent. When Chapter 5 of the Handbook references Worksheets and Guidelines in the Workbook, they will be found in Workbook Chapter 5.

Since the HRTES Workbook is likely to be used for more than one Operational Test, the recommended strategy is to use the contained Worksheets as master copies. When each is to be used, copy it, and work only on the copy.

If you make additions or substantial changes to the material in HRTES, such as adding new "System Performance Issues," "Conditions," or "Human Performance Functions," it is suggested that you include a statement of these changes on a copy of a HRTESGRAM (see the following page), and send it to:

U.S. ARMY RESEARCH INSTITUTE
for the BEHAVIORAL and SOCIAL SCIENCES
Attention: PERI-SZ
5001 Eisenhower Avenue
Alexandria, Virginia 22333

HRTESGRAM

We suggest that the following
change(s), addition(s), or deletion(s)
be made to HRTES:

(This area is intentionally left blank for providing comments.)

Please return comments to: U.S. ARMY RESEARCH INSTITUTE
for the BEHAVIORAL and SOCIAL SCIENCES
Attention: PERI-SZ
5001 Eisenhower Avenue
Alexandria, Virginia 22333

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CONTENTS

1. Definition of System to be Tested
2. Set of twelve System Function Worksheets
3. Guidelines for Selecting System Functions
4. Sample System Function Worksheet
5. System Rating Questionnaire

HRTES

DEFINITION OF SYSTEM TO BE TESTED

NAME OF TESTED SYSTEM:

ITEMS TO BE INCLUDED IN TEST (Number and Type):

OPERATOR AND MAINTAINER PERSONNEL (Number and Type):

SYSTEM TO BE AUGMENTED OR REPLACED:

DIAGRAM OF SYSTEM TO BE TESTED:

SYSTEM _____ TEST _____ DATE _____ PAGE _____
NAME _____ TELEPHONE _____

HRTES

SYSTEM FUNCTION WORKSHEET FOR AIR DEFENSE WEAPONS

SYSTEM CLASS:

AIR DEFENSE WEAPONS including:
Short Range Missiles, Medium Range
Missiles, Long Range Missiles, Air
Defense Guns, High Energy Systems

SYSTEM FUNCTION RATINGS

SYSTEM FUNCTIONS	1. DESIGNED FOR SYSTEM FUNCTION	2. PERFORMED WITH OTHER FUNCTIONS	3. PROBABILITY OF SYSTEM LOSS	4. PROBABILITY OF UNSUCCESSFUL CONDUCT	5. GENERIC SYSTEMS HAD PROBLEMS	6. SPECIFIC SYSTEM HAD PROBLEMS	SUM OF RATINGS/ SELECTION WEIGHT ↓	SPI CATEGORY REFERENCES ↓	
1. Destroy aircraft.								1,2,4 5,7	36 35 34
2. Confuse and disrupt aircraft.								1,2,4 5,7	33 32 31
3. Deny selected airspace/formation to attacking aircraft.								1,2,4 5,7	30 29 28
4. Destroy ground targets.								1,2,5 7	27 26 25
5. Protect operator/crew from enemy action.								2,3,7	24 23 22
									21 20 19
									18 17 16
									15 14 13
									12 11 10
									9 8 7
									6 5 4
									3 2 1
									0

SYSTEM _____ TEST _____ DATE _____ PAGE _____

NAME _____ TELEPHONE _____

HRTES

SYSTEM FUNCTION WORKSHEET FOR ARMORED VEHICLES

SYSTEM CLASS: ARMORED VEHICLES including: Main Battle Tanks, Armored Reconnaissance Vehicles/Light Tanks, Infantry/Cavalry Fighting Vehicle, Armored Personnel Carriers-Mounting, Anti-Tank Weapons	SYSTEM FUNCTION RATINGS						SUM OF RATINGS/ SELECTION WEIGHT	SPI CATEGORY REFERENCES
	1. DESIGNED FOR SYSTEM FUNCTION	2. PERFORMED WITH OTHER FUNCTIONS	3. PROBABILITY OF SYSTEM LOSS	4. PROBABILITY OF UNSUCCESSFUL CONDUCT	5. GENERIC SYSTEMS HAD PROBLEMS	6. SPECIFIC SYSTEM HAD PROBLEMS		
SYSTEM FUNCTIONS								
1. Destroy fixed emplacements.							1,2,5 7	36 35 34
2. Destroy armored vehicles.							1,2,5 7	33 32
3. Destroy enemy personnel.							1,2,5 7	31 30 29
4. Destroy/disrupt enemy aircraft.							1,2,5 7	28 27 26
5. Suppress/disrupt enemy activity.							1,2,5 7	25 24 23
6. Serve as a platform for mounted attack.							1,2,5 7	22 21 20
7. Transport troops/materiel.							2,5,7	19 18 17
8. Perform reconnaissance.							2,5,6 7	16 15 14
9. Protect crew/passengers/materiel from enemy action.							2,3	13 12 11
								10 9 8 7 6 5 4 3 2 1 0

SYSTEM _____ TEST _____ DATE _____ PAGE _____

NAME _____ TELEPHONE _____

HRTES

SYSTEM FUNCTION WORKSHEET FOR AVIATION SYSTEMS

SYSTEM CLASS: AVIATION SYSTEMS including: Attack Helicopters, Scout Helicopters, Transport Helicopters, Utility Helicopters, Fixed-Wing Reconnaissance, Fixed- Wing Transport	SYSTEM FUNCTION RATINGS						SUM OF RATINGS/ SELECTION WEIGHT ↓	SPI CATEGORY REFERENCES ↓
	1. DESIGNED FOR SYSTEM FUNCTION	2. PERFORMED WITH OTHER FUNCTIONS	3. PROBABILITY OF SYSTEM LOSS	4. PROBABILITY OF UNSUCCESSFUL CONDUCT	5. GENERIC SYSTEMS HAD PROBLEMS	6. SPECIFIC SYSTEM HAD PROBLEMS		
SYSTEM FUNCTIONS								
1. Destroy enemy vehicles.							1,2,5 7	36 35 34
2. Destroy anti-aircraft systems.							1,2,5 7	33 32 31
3. Destroy fixed emplacements.							1,2,5 7	30 29 28
4. Destroy enemy personnel.							1,2,5 7	27 26 25
5. Disrupt/suppress enemy activity.							1,2,5 7	24 23 22
6. Perform reconnaissance.							2,5,6 7	21 20 19
7. Serve as platform for electronics warfare systems.							2,5,6 7,8	18 17 16
8. Transport troops/materiel.							2,5,7	15 14 13
9. Transport injured troops.							2,5,7	12 11 10
10. Protect crew/passengers/materiel from enemy action.							2,3	9 8 7 6 5 4 3 2 1 0

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HRTES

SYSTEM FUNCTION WORKSHEET FOR C²/C²I SYSTEMS

SYSTEM CLASS:
C²/C²I SYSTEMS including:
Field Artillery Fire Control, Tank Fire
Control, Air Defense Fire Control

SYSTEM FUNCTION RATINGS

SYSTEM FUNCTIONS	1. DESIGNED FOR SYSTEM FUNCTION	2. PERFORMED WITH OTHER FUNCTIONS	3. PROBABILITY OF SYSTEM LOSS	4. PROBABILITY OF UNSUCCESSFUL CONDUCT	5. GENERIC SYSTEMS HAD PROBLEMS	6. SPECIFIC SYSTEM HAD PROBLEMS	SUM OF RATINGS/ SELECTION WEIGHT	SPI CATEGORY REFERENCES	
1. Provide information on current battlefield conditions and situation.							4,7	36	
2. Provide projections of probable future conditions and enemy behavior.							4,7	35	
3. Control the behavior of friendly forces.							4,7	34	
4. Manage friendly weapon operation.							4,7	33	
5. Manage logistics.							4,7	32	
6. Communicate information to appropriate units.							5,7	31	
7. Protect system/crew from enemy action.							3,7	30	
								29	
								28	
								27	
								26	
								25	
								24	
								23	
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								4	
								3	
								2	
								1	
								0	

SYSTEM _____ TEST _____ DATE _____ PAGE _____

NAME _____ TELEPHONE _____

HRTES

SYSTEM FUNCTION WORKSHEET FOR COMBAT/TACTICAL SUPPORT EQUIPMENT

SYSTEM CLASS:
COMBAT/TACTICAL SUPPORT EQUIPMENT including: Combat Engineer Vehicles, Recovery Vehicles, Demolition Equipment, and Bridging Equipment.

SYSTEM FUNCTION RATINGS

SYSTEM FUNCTIONS	1. DESIGNED FOR SYSTEM FUNCTION	2. PERFORMED WITH OTHER FUNCTIONS	3. PROBABILITY OF SYSTEM LOSS	4. PROBABILITY OF UNSUCCESSFUL CONDUCT	5. GENERIC SYSTEMS HAD PROBLEMS	6. SPECIFIC SYSTEM HAD PROBLEMS	SUM OF RATINGS/ SELECTION WEIGHT	SPI CATEGORY REFERENCES
1. Destroy/remove obstacles/roadblocks.							1,2,5 7	36 35 34
2. Construct obstacles/roadblocks.							1,2,5 7	33 32 31
3. Bridge obstacles.							2,5,7 9	30 29 28
4. Construct emplacement/shelters.							2,5,7 9	27 26 25
5. Transport command posts.							2,5,7 9	24 23 22
6. Transport damaged vehicles.							2,7	21 20 19
7. Destroy armored vehicles/personnel.							2,5,7 9	18 17 16
8. Protect crew/material from enemy action.							2,3,7	15 14 13
								12 11 10
								9 8 7
								6 5 4
								3 2 1
								0

SYSTEM _____ TEST _____ DATE _____ PAGE _____

NAME _____ TELEPHONE _____

HRTES

SYSTEM FUNCTION WORKSHEET FOR ELECTRONIC WARFARE & SURVEILLANCE SYSTEMS

SYSTEM CLASS:
ELECTRONIC WARFARE AND SURVEILLANCE SYSTEMS including:
Countermeasures Equipment and Sighting and Surveillance Equipment.

SYSTEM FUNCTION RATINGS

SYSTEM FUNCTIONS	1. DESIGNED FOR SYSTEM FUNCTION	2. PERFORMED WITH OTHER FUNCTIONS	3. PROBABILITY OF SYSTEM LOSS	4. PROBABILITY OF UNSUCCESSFUL CONDUCT	5. GENERIC SYSTEMS HAD PROBLEMS	6. SPECIFIC SYSTEM HAD PROBLEMS	SUM OF RATINGS/ SELECTION WEIGHT	SPI CATEGORY REFERENCES	
1. Provide critical information on potential targets.							5, 6, 7	36 35 34	
2. Confuse/disrupt/disable enemy systems.								33 32	
3. Protect operator/crew from enemy action.							2, 3, 5, 7	31 30 29 28	
4. Jam electronic signals.								27 26 25	
5. Produce false targets/target signatures.								24 23 22	
								21 20 19	
								18 17 16	
								15 14 13	
								12 11 10	
								9 8 7	
								6 5 4	
								3 2 1	
								0	

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HRTES

SYSTEM FUNCTION WORKSHEET FOR GROUND TRANSPORTATION EQUIPMENT

SYSTEM CLASS:
GROUND TRANSPORTATION EQUIPMENT including: 1/4 Ton Utility Trucks, 3/4 to 1-1/2 Ton Trucks, 5 Ton Trucks, 8 to 10 Ton Trucks, Heavy Equipment Transport Trucks

SYSTEM FUNCTION RATINGS

SYSTEM FUNCTIONS	1. DESIGNED FOR SYSTEM FUNCTION	2. PERFORMED WITH OTHER FUNCTIONS	3. PROBABILITY OF SYSTEM LOSS	4. PROBABILITY OF UNSUCCESSFUL CONDUCT	5. GENERIC SYSTEMS HAD PROBLEMS	6. SPECIFIC SYSTEM HAD PROBLEMS	SUM OF RATINGS/ SELECTION WEIGHT	SPI CATEGORY REFERENCES	
1. Transport command personnel.							2, 5, 7	36	
2. Transport troops.							2, 5, 7	35	
								34	
3. Transport materiel.							2, 5, 7	33	
								32	
4. Serve as an ambulance.							2, 5, 7	31	
								30	
5. Protect operator/crew from enemy action.							2, 3, 7	29	
								28	
								27	
								26	
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HRTES

SYSTEM FUNCTION WORKSHEET FOR INFANTRY WEAPONS

SYSTEM CLASS:

INFANTRY WEAPONS including:
Pistols/revolvers, Rifles, Sub-Machine
Guns, Machine Guns, Recoilless Rifles,
Anti-Tank Missile Systems, Anti-Aircraft
Missile Systems, Grenades/Grenade
Launchers, Anti-Armor Mines, Anti-
Personnel Mines, Flamethrowers,
Mortars

SYSTEM FUNCTION RATINGS

SYSTEM FUNCTIONS	1. DESIGNED FOR SYSTEM FUNCTION	2. PERFORMED WITH OTHER FUNCTIONS	3. PROBABILITY OF SYSTEM LOSS	4. PROBABILITY OF UNSUCCESSFUL CONDUCT	5. GENERIC SYSTEMS HAD PROBLEMS	6. SPECIFIC SYSTEM HAD PROBLEMS	SUM OF RATINGS/ SELECTION WEIGHT	SPI CATEGORY REFERENCES
1. Destroy enemy vehicles.							1,7	36 35 34
2. Destroy low flying enemy aircraft.							1,7	33 32 31
3. Destroy fixed emplacements.							1,7	30 29 28
4. Destroy enemy troops.							1,7	27 26 25
5. Disrupt/suppress enemy activity.							1,7	24 23 22
6. Provide illumination.							1,7	21 20 19
7. Protect operator/crew from enemy action.							3,7	18 17 16
8. Conceal friendly forces by making smoke.							1,7	15 14 13
								12 11 10
								9 8 7
								6 5 4
								3 2 1
								0

SYSTEM _____ TEST _____ DATE _____ PAGE _____

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HRTES

SYSTEM FUNCTION WORKSHEET FOR ORDNANCE SYSTEMS

SYSTEM CLASS:

ORDNANCE SYSTEMS including:
Light, Towed, Tube Artillery; Light, Self-Propelled, Tube Artillery; Medium, Towed, Tube Artillery; Medium Self-Propelled, Tube Artillery; Heavy, Towed Tube Artillery; Heavy, Self-Propelled Tube Artillery; Battlefield Support Guided Missile; Battlefield Support Unguided Missiles; Multiple Launch, Guided Missiles; Multiple Launch, Unguided Missiles

SYSTEM FUNCTION RATINGS

SYSTEM FUNCTIONS	1. DESIGNED FOR SYSTEM FUNCTION	2. PERFORMED WITH OTHER FUNCTIONS	3. PROBABILITY OF SYSTEM LOSS	4. PROBABILITY OF UNSUCCESSFUL CONDUCT	5. GENERIC SYSTEMS HAD PROBLEMS	6. SPECIFIC SYSTEM HAD PROBLEMS	SUM OF RATINGS/ SELECTION WEIGHT	SPI CATEGORY REFERENCES
							↓	↓
1. Destroy fixed emplacements on or behind the battlefield.							1,2,5 7	36 35 34
2. Destroy enemy vehicles/weapons.							1,2	33 32 31
3. Destroy enemy personnel.							1,2,5 7	30 29 28
4. Suppress/deny enemy activity, and deny terrain to enemy.							1,2,5 7	27 26 25
5. Provide illumination.							1,2,5 7	24 23 22
6. Conceal friendly forces by making smoke.							1,2,5 7	21 20 19
7. Protect crew/material from enemy action.							2,3,7	18 17 16
								15 14 13
								12 11 10
								9 8 7
								6 5 4
								3 2 1
								0

SYSTEM _____ TEST _____ DATE _____ PAGE _____

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HRTES

SYSTEM FUNCTION WORKSHEET FOR TARGET ACQUISITION AND/OR DESIGNATOR SYSTEMS

SYSTEM CLASS:
TARGET ACQUISITION AND/OR
DESIGNATOR SYSTEMS

SYSTEM FUNCTION RATINGS

SYSTEM FUNCTIONS	1. DESIGNED FOR SYSTEM FUNCTION	2. PERFORMED WITH OTHER FUNCTIONS	3. PROBABILITY OF SYSTEM LOSS	4. PROBABILITY OF UNSUCCESSFUL CONDUCT	5. GENERIC SYSTEMS HAD PROBLEMS	6. SPECIFIC SYSTEM HAD PROBLEMS	SUM OF RATINGS/ SELECTION WEIGHT	SPI CATEGORY REFERENCES	
1. Provide critical information on potential targets.							5, 7, 8	36	
2. Designate/illuminate target.							7, 8	35	
3. Protect system/crew from enemy action.							3, 7	34	
								33	
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SYSTEM _____ TEST _____ DATE _____ PAGE _____

NAME _____ TELEPHONE _____

HRTES

SYSTEM FUNCTION WORKSHEET

SYSTEM CLASS: _____

SYSTEM FUNCTION RATINGS

SYSTEM FUNCTIONS	1. DESIGNED FOR SYSTEM FUNCTION	2. PERFORMED WITH OTHER FUNCTIONS	3. PROBABILITY OF SYSTEM LOSS	4. PROBABILITY OF UNSUCCESSFUL CONDUCT	5. GENERIC SYSTEMS HAD PROBLEMS	6. SPECIFIC SYSTEM HAD PROBLEMS	SUM OF RATINGS/ SELECTION WEIGHT	SPI CATEGORY REFERENCES	36
									35
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								0	

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HRTES

GUIDELINES FOR SELECTING SYSTEM FUNCTIONS

System Functions are the ultimate purposes of a system, not intermediate steps leading to those purposes. Normally they are purposes which can be performed successfully by an individual system. To develop a test plan, it is necessary that the most critical System Functions be identified and included. To insure that the field test is not impractically long or expensive, it is necessary that less critical System Functions be identified and eliminated from consideration. To evaluate field test results, it is necessary that the relative criticality of System Functions which are tested be specified. The process of weighting the criticality of System Functions is described below.

- (1) Read the "System Function Worksheet," and add any System Functions you find relevant to your system which are not present. These new System Functions will be treated in the same manner as those already listed.
- (2) Rate each System Function using the "System Function Rating Questionnaire." Record the values on the "System Function Worksheet." (See "Sample System Function Worksheet.")
- (3) Total the ratings for each System Function, and enter this total in the "Sum of Rating/Selection Weight" column of the "System Function Worksheet."
- (4) Record the identification number of each System Function (which precedes each System Function) in the last column, according to the sum of its ratings. For example, if System Function number 1 received a sum of ratings of 24, then the number "1" would be recorded on line 24 in the last column.

HRTES

GUIDELINES FOR SELECTING SYSTEM FUNCTIONS (Continued)

- (5) Select the System Function(s) which you feel must definitely be tested, based on the sum of its ratings, by establishing a cut-off point in the last column. The cut-off point should be based on a consideration of costs of testing differences between ratings, and MENS, ROC, and LOA requirements.

- (6) Return the completed "System Function Worksheet" to sender.

SAMPLE

HRTES

SYSTEM FUNCTION WORKSHEET FOR AIR DEFENSE WEAPONS

SYSTEM CLASS:
AIR DEFENSE WEAPONS including:
Short Range Missiles, Medium Range
Missiles, Long Range Missiles, Air
Defense Guns, High Energy Systems

SYSTEM FUNCTION RATINGS

SYSTEM FUNCTIONS	1. DESIGNED FOR SYSTEM FUNCTION	2. PERFORMED WITH OTHER FUNCTIONS	3. PROBABILITY OF SYSTEM LOSS	4. PROBABILITY OF UNSUCCESSFUL CONDUCT	5. GENERIC SYSTEMS HAD PROBLEMS	6. SPECIFIC SYSTEM HAD PROBLEMS	SUM OF RATINGS/ SELECTION WEIGHT	SPI CATEGORY REFERENCES	
1. Destroy aircraft.	6	2	4	3	5	4	24	1,2,4,5,7	36 35 34
2. Confuse and disrupt aircraft.	2	1	2	1	2	1	9	1,2,4,5,7	33 32 31
3. Deny selected airspace/formation to attacking aircraft.	5	2	4	2	4	2	19	1,2,4,5,7	30 29 28
4. Destroy ground targets.	0	0	0	0	0	0	0	1,2,5,7	27 26 25
5. Protect operator/crew from enemy action.	3	2	3	5	2	2	17	2,3,7	24 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
									7
									3
									5
									2
									4

SYSTEM MERCURY AIR DEFENSE WEAPON SYSTEM TEST OT-II DATE 25 MAR 61 PAGE _____

NAME _____ TELEPHONE _____

HRTES

RATING QUESTIONNAIRE FOR DETERMINING CRITICALITY OF SYSTEM FUNCTION

To determine the relative criticality of a System Function for the system, rate each System Function against the attributes of criticality listed below. This is done by assigning a number from zero to six to each attribute, and record them on the "System Function Worksheet."

1. DESIGNED FOR SYSTEM FUNCTION: To what extent is this system, or a major component of this system, designed specifically to carry out this System Function?

No Extent			Some Extent			Very Great Extent
0	1	2	3	4	5	6
Not designed for System Function			Design incor- porates System Function			Designed speci- fically for System Function

2. PERFORMED WITH OTHER FUNCTIONS: How often/how long will this System Function be performed in comparison to its other System Functions?

Never			Moderately			Always
0	1	2	3	4	5	6
This System Function never performed			This System Function performed as often as others			Only this System Func- tion performed

HRTES

RATING QUESTIONNAIRE FOR DETERMINING CRITICALITY OF SYSTEM FUNCTION (Continued)

3. PROBABILITY OF SYSTEM LOSS: To what extent would failure to successfully complete this System Function in expected battlefield conditions increase the probability of system loss?

No Extent			Some Extent			Very Great Extent
0	1	2	3	4	5	6
No increase in probability			Some increase in probability		Great increase in probability	

4. PROBABILITY OF UNSUCCESSFUL CONDUCT: To what extent would failure to successfully complete this System Function increase the probability of unsuccessful conduct of the military exercise?

No Extent			Some Extent			Very Great Extent
0	1	2	3	4	5	6
No increase in probability			Some increase in probability		Great increase in probability	

5. GENERIC SYSTEMS HAD PROBLEMS: To what extent have other systems in this generic class had a history of problems in carrying out this System Function? (If this is an entirely new System Function for this generic class, rate this question six.)

No Extent			Some Extent			Very Great Extent
0	1	2	3	4	5	6
No problems			Some non- severe problems		Severe and/or frequent problems	

HRTES

RATING QUESTIONNAIRE FOR DETERMINING CRITICALITY OF SYSTEM FUNCTION (Continued)

6. SPECIFIC SYSTEM HAS PROBLEMS: To what extent have prior OT's and DT's of this specific system demonstrated a history of problems in performing this System Function? (If this System Function has not been tested in a prior OT or DT, substitute the following question: To what extent do you predict that this System Function will have performance problems?)

No Extent			Some Extent			Very Great Extent
0	1	2	3	4	5	6
No problems			Some non- severe problems			Severe and/or frequent problems

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1. System Performance Issue (SPI) Worksheet
2. Guidelines for Selecting SPI's
3. Sample System Performance Issue Worksheet
4. SPI Rating Questionnaire
5. SPI Cutoff Worksheet

HRTES

GUIDELINES FOR SELECTING SYSTEM PERFORMANCE ISSUES

System Performance Issues (SPI's) are the intermediate actions which the system must take to perform each System Function. Normally, they are formatted as questions. It is the answers to these SPI questions which are sought in the field tests. On your "System Performance Issue Worksheets" they are formatted as statements both to simplify the rating process and to save space. These SPI's do not contain mention of tactics, training, Human Factors Engineering, nor any other condition in general. They are phrased as simple actions. Qualifying conditions will be added, as required, in a later stage of the HRTES procedures.

You have received a package of Worksheets including: (a) "System Performance Issue Worksheets" for each System Function, (b) an "SPI Rating Questionnaire," (c) "Guidelines for Selecting SPI's" (which you are reading at this moment), and (d) a "Sample Worksheet." You are asked to aid in the process of selecting the appropriate SPI's.

- (1) Examine the "System Performance Issue" Worksheets you have received and add any issues you feel are significant for that System Function. Those new SPI's will be treated in the same manner as those already listed.
- (2) Read the "SPI Rating Questionnaire" found in this package.
- (3) Rate each SPI according to the specific attributes in the questionnaire. Record the ratings in the "SPI Rating Columns" of the Worksheet. (See "Sample SPI Worksheet.")

HRTES

GUIDELINES FOR SELECTING SYSTEM PERFORMANCE ISSUES (Continued)

- (4) Total the ratings for each SPI, and enter this total in the "Sum of Ratings Column." Do not write in the last 3 columns of the Worksheet.

- (5) Return the completed Worksheets to sender.

SAMPLE

HRTES

SYSTEM PERFORMANCE ISSUE WORKSHEET

SYSTEM FUNCTION	DESTROY AIRCRAFT								
SYSTEM FUNCTION SELECTION WEIGHT	SPI RATINGS								
24	HPF-GROUP REFERENCE	1 PERFORMED WITH OTHER SPI'S	2 PROBABILITY OF SYSTEM FUNCTION FAILURE	3 GENERIC SYSTEMS HAD PROBLEMS	4 SPECIFIC SYSTEMS HAD PROBLEMS	SUM OF RATINGS/ SELECTION WEIGHT	RELATIVE WEIGHT	PRODUCT	SELECTED SPI (*)
SPI'S FOR THIS SYSTEM FUNCTION	↓	↓	↓	↓	↓	↓	↓	↓	↓
TARGET ACQUISITION	2	6	6	6	5	23			
DELIVER AMMUNITION ON TARGET	1	6	4	4	4	18			
ENGAGE SEVERAL TARGETS	1	5	2	6	6	19			
NAVIGATION	27	1	1	1	2	5			
MANEUVER IN TRAVEL	24	3	3	3	3	12			
MANEUVER IN ATTACK/DEFENSE	24	0	0	0	0	0			
SELF-RECOVERY	30	1	1	2	3	7			
ESTABLISHMENT & MAINTENANCE OF COMMUNICATIONS	21	2	3	3	2	10			
PREVENTION OF INTERCEPTION/JAMMING	22	5	6	4	5	20			
INFORMATION ROUTING	23	2	2	2	2	8			
ABILITY TO BE TRANSPORTED	24	0	0	0	0	0			
DELIVERY OF CARGO	24	3	6	5	5	19			
GRAND TOTAL						NEXT WORK-SHEET	OVER		

SYSTEM MERCURY AIR DEFENSE WEAPON SYSTEM OF II DATE 25 MAR 81 PAGE _____

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SAMPLE

HRTES

SYSTEM PERFORMANCE ISSUE WORKSHEET

SYSTEM FUNCTION		<i>DESTROY AIRCRAFT</i>								
SYSTEM FUNCTION SELECTION WEIGHT		SPI RATINGS								
24		HPF-GROUP REFERENCE	1. PERFORMED WITH OTHER SPI'S	2. PROBABILITY OF SYSTEM FUNCTION FAILURE	3. GENERIC SYSTEMS HAD PROBLEMS	4. SPECIFIC SYSTEMS HAD PROBLEMS	SUM OF RATINGS / SELECTION WEIGHT	RELATIVE WEIGHT	PRODUCT	SELECTED SPI (*)
SPI'S FOR THIS SYSTEM FUNCTION										
<i>LOADING / UNLOADING</i>		<i>2B</i>	<i>3</i>	<i>3</i>	<i>2</i>	<i>2</i>	<i>10</i>			
GRAND TOTAL							<i>151</i>			

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HRTES

RATING QUESTIONNAIRE FOR DETERMINING CRITICALITY OF SYSTEM PERFORMANCE ISSUES

To determine the relative criticality of SPI's for a given System Function, rate each SPI against the attributes of criticality listed below. This is done by assigning a number from zero to six on each criticality attribute for each SPI.

1. PERFORMED WITH OTHER SPI'S: How often/how long will this SPI be performed in comparison to the performance of other SPI's?

Never			Moderately			Always
0	1	2	3	4	5	6
This SPI not performed			This SPI performed as often as others			Only this SPI is performed

2. PROBABILITY OF SYSTEM FUNCTION FAILURE: To what extent would failure to successfully complete this SPI increase the probability of System Function failure?

No Extent			Some Extent			Very Great Extent
0	1	2	3	4	5	6
No increase in probability			Some increase in probability			Great increase in probability

HRTES

RATING QUESTIONNAIRE FOR DETERMINING CRITICALITY OF SYSTEM PERFORMANCE ISSUES (Continued)

3. GENERIC SYSTEMS HAD PROBLEMS: To what extent have other systems in this generic class had a history of problems in carrying out this SPI as part of the System Function? (If this is an entirely new SPI for this generic class, rate this question six.)

No Extent			Some Extent			Very Great Extent
0	1	2	3	4	5	6
No history of problems			History of some non- severe problems			History of severe and/or frequent problems

4. SPECIFIC SYSTEM HAD PROBLEMS: To what extent have prior DT's/OT's for this specific system demonstrated a history of problems in successfully carrying out this SPI as part of the System Function? (If this SPI has not been tested in a prior OT or DT, substitute the following question: To what extent do you predict that this SPI will have performance problems?)

No Extent			Some Extent			Very Great Extent
0	1	2	3	4	5	6
No problems			Some non- severe problems			Severy and/ or frequent problems

CONTENTS

1. Set of Condition Rating Worksheets
2. Guidelines for Selecting Conditions
3. Sample Condition Rating Worksheets
4. Set of Condition Rating Worksheets (Method 2)
5. Guidelines for Selecting Conditions (Method 2)
6. Sample Condition Rating Worksheet (Method 2)
7. Conditions x SPI's Matching Worksheet
8. SPI Summary Worksheet

HRTES

CONDITION RATING WORKSHEET

SYSTEM FUNCTION						
CONDITION CATEGORY	1. WEATHER: ILLUMINATION					
	SELECTED SYSTEM PERFORMANCE ISSUES					
ILLUMINATION						
Full Sunlight						
Moonlight						
Starlight						
Dusk						
Overcast, Moonless Night (Pitch Black)						
Artificial Lighting (specify)						
Flares						
Direct Glare						
Indirect Glare (Water, Sand, Clouds, etc.)						
Other (specify)						

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HRTES

CONDITION RATING WORKSHEET

SYSTEM FUNCTION

CONDITION CATEGORY

4. WEATHER: WIND

SELECTED SYSTEM PERFORMANCE ISSUES

WIND					
High Head Wind (specify)					
High Tail Wind (specify)					
Significant Swirling Wind Gusts					
Cross Wind (specify)					
No Wind					
Other (specify)					

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HRTES

CONDITION RATING WORKSHEET

SYSTEM FUNCTION

--

CONDITION CATEGORY

6. TERRAIN: GROUND SLOPE

SELECTED SYSTEM PERFORMANCE ISSUES

GROUND SLOPE						
Flat						
Low Positive Hilly (specify)						
Low Negative Hilly (specify)						
High Positive Mountainous (specify)						
High Negative Mountainous (specify)						
Other (specify)						

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HRTES

CONDITION RATING WORKSHEET

SYSTEM FUNCTION

CONDITION CATEGORY

7. TERRAIN: GROUND SURFACE

SELECTED SYSTEM PERFORMANCE ISSUES

GROUND SURFACE

Sandy

Rocky

Loam (Deep Soil)

Paved (specify type and carrying level)

Broken Paved

Broken Ground

Plowed Fields

Bare Packed

Vegetation Covered

Other (specify)

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HRTES

CONDITION RATING WORKSHEET

SYSTEM FUNCTION						
CONDITION CATEGORY	9. TERRAIN: OBSTACLES					
	SELECTED SYSTEM PERFORMANCE ISSUES					
OBSTACLES						
Dense Vegetation						
Light Vegetation						
Hedge Rows						
Rivers (specify depth, width)						
Manmade Structures (specify)						
Traps (specify)						
No Obstacles						
Other (specify)						

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HRTES

CONDITION RATING WORKSHEET

SYSTEM FUNCTION							
CONDITION CATEGORY		11. TARGET: NUMBER					
		SELECTED SYSTEM PERFORMANCE ISSUES					
NUMBER							
Single Target							
Multiple Simultaneous Targets (specify)							
Multiple Sequential Targets (specify)							
Combination of Multiple Simultaneous and Multiple Sequential Targets (specify)							
Noise - Number/% of Targets Within Nontarget Background (specify)							
Other (specify)							

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CONDITION RATING WORKSHEET

SYSTEM FUNCTION							
CONDITION CATEGORY		12. TARGET: LOCATION					
		SELECTED SYSTEM PERFORMANCE ISSUES					
LOCATION							
Minimum Range (specify)							
Maximum Range (specify)							
Normal Range (specify)							
Azimuth and Elevation Target (specify)							
Other (specify)							

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CONDITION RATING WORKSHEET

SYSTEM FUNCTION						
CONDITION CATEGORY	13. TARGET: SPEED					
	SELECTED SYSTEM PERFORMANCE ISSUES					
SPEED						
Maximum Speed (specify)						
Minimum Speed (specify)						
Cruising Speed (specify)						
Radical Alterations of Speed (specify)						
Stationary						
Other (specify)						

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HRTES

CONDITION RATING WORKSHEET

SYSTEM FUNCTION

CONDITION CATEGORY

14. TARGET: DIRECTION OF MOTION

SELECTED SYSTEM PERFORMANCE ISSUES

DIRECTION OF MOTION					
Closing (specify angle)					
Retreating (specify angle)					
Crossing (specify direction)					
Complex Maneuver (specify)					
Other (specify)					

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HRTES

CONDITION RATING WORKSHEET

SYSTEM FUNCTION						
CONDITION CATEGORY	15. TARGET: CONCEALMENT					
	SELECTED SYSTEM PERFORMANCE ISSUES					
CONCEALMENT						
Concealed by Physical Means (specify)						
Concealed by Electronic Means (specify)						
Partially Concealed (specify)						
Concealed by Smoke						
Unconcealed						
Other (specify)						

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HRTES

CONDITION RATING WORKSHEET

SYSTEM FUNCTION						
CONDITION CATEGORY	16. PERSONNEL: WORKLOAD					
	SELECTED SYSTEM PERFORMANCE ISSUES					
WORKLOAD						
When Personnel are only performing this SPI						
When Personnel perform all activities which might occur at the same time this SPI is being performed (specify)						
Other (specify)						

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HRTES

CONDITION RATING WORKSHEET

SYSTEM FUNCTION

CONDITION CATEGORY

17. PERSONNEL: DURATION OF PRECEEDING WORK

SELECTED SYSTEM PERFORMANCE ISSUES

DURATION OF PRECEEDING WORK

Following No Work

Following an Extended Period of Work (specify)

Following a Normal Period of Work (specify)

Other (specify)

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HRTES

CONDITION RATING WORKSHEET

SYSTEM FUNCTION

CONDITION CATEGORY

25: TRAINING: LATENCY

SELECTED SYSTEM PERFORMANCE ISSUES

LATENCY

Following a Period of Time Without Specific Training or Practice (specify)

Immediately Following Training

With the Normal Period of Latency (specify)

Other (specify)

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CONDITION RATING WORKSHEET

SYSTEM FUNCTION						
CONDITION CATEGORY	29: OPERATIONAL: INFORMATION INPUTS					
	SELECTED SYSTEM PERFORMANCE ISSUES					
INFORMATION INPUTS						
With Full Information Inputs						
With Partial Information Inputs (specify)						
With No Information Inputs						
Other (specify)						

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Tactics as Conditions: Army systems are employed according to the established tactics and doctrine at a specific time. Tactical conditions to be exercised in the field test will be those most significant for the SPI under investigation. It is not possible for this Workbook to list all tactics for Army systems now and in the future. To deal with the question of tactics, two alternatives are presented.

(1) *It is preferable to obtain a list of probable tactics for the system from the appropriate Combat Development Center experts; analyze it into a format similar to that on Page W4-33, and then treat the resulting tactical conditions in the same manner as all other conditions. A blank Tactical Conditions Worksheet is provided for this purpose (page W4-32).*

(2) *If necessary, the Tactics Worksheets (pages W4-33 through W4-40) may be used directly to rate tactics as conditions for each SPI. These Worksheets may be incomplete for a number of system types, and for this reason we suggest that these Tactics Worksheets be used only as examples.*

HRTES

CONDITION RATING WORKSHEET

SYSTEM FUNCTION							
CONDITION CATEGORY		32: TACTICS: SPEED					
		SELECTED SYSTEM PERFORMANCE ISSUES					
SPEED							
Maximum Speed (specify)							
Minimum Speed (specify)							
Cruising Speed (specify)							
Radical Alterations of Speed (specify)							
Stationary							
Other (specify)							

SYSTEM _____ TEST _____ DATE _____ PAGE _____
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HRTES

CONDITION RATING WORKSHEET

SYSTEM FUNCTION						
CONDITION CATEGORY	33: TACTICS: LOCATION					
	SELECTED SYSTEM PERFORMANCE ISSUES					
LOCATION						
Specify						

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HRTES

CONDITION RATING WORKSHEET

SYSTEM FUNCTION

--

CONDITION CATEGORY

34: TACTICS: DIRECTION OF MOTION

SELECTED SYSTEM PERFORMANCE ISSUES

DIRECTION OF MOTION					
Closing (specify angle)					
Retreating (specify angle)					
Crossing (specify angle)					
Complex Maneuver (specify)					
Other (specify)					

SYSTEM _____ TEST _____ DATE _____ PAGE _____
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HRTES

CONDITION RATING WORKSHEET

SYSTEM FUNCTION						
CONDITION CATEGORY	35: TACTICS: CONCEALMENT					
	SELECTED SYSTEM PERFORMANCE ISSUES					
CONCEALMENT						
Concealed by Physical Means (specify)						
Concealed by Electronic Means (specify)						
Partially Concealed						
Concealed by Smoke						
Unconcealed						
Other (specify)						

SYSTEM _____ TEST _____ DATE _____ PAGE _____
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HRTES

CONDITION RATING WORKSHEET

SYSTEM FUNCTION						
CONDITION CATEGORY	38: TACTICS: SYSTEM WORKLOAD					
	SELECTED SYSTEM PERFORMANCE ISSUES					
SYSTEM WORKLOAD						
Overloaded (specify)						
100% Loaded (by weight or volume)						
Operationally Loaded (specify)						
Unloaded						
Other (specify)						

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HRTES

CONDITION RATING WORKSHEET

SYSTEM FUNCTION

CONDITION CATEGORY

39: OTHER CONDITIONS

SELECTED SYSTEM PERFORMANCE ISSUES

OTHER CONDITIONS

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HRTES

GUIDELINES FOR SELECTING CONDITIONS

This package of worksheets consists of "Condition Rating Worksheets" and the Guidelines which you are reading now. You are asked to assist in the selection of conditions under which the "System Performance Issues" (SPI's) will be tested.

Your role is to rate the criticality of the conditions for each of the SPI's listed while considering the System Function associated with each. Based on your and other expert's ratings, the most critical conditions will be picked and combined with the appropriate SPI's to yield more specific SPI's. This procedure will insure that the Operational Test will be conducted in those conditions which are critical concerns for the system.

The rating procedure has two phases. In the first phase you will rate the relevant categories on a 3-point criticality scale for each of the SPI's. In the second phase you will rate the conditions within each of the categories on the same scale for each of the SPI's.

You are not being asked to rate the conditions on specific attributes of criticality, but rather on one overall scale of criticality. It is suggested that you keep in mind the following dimensions when you make this overall rating:

- (a) The extent to which the system is designed specifically to perform the given SPI as part of the System Function in this condition.

- (b) The extent to which this condition is likely to negatively affect the system's ability to perform the SPI as part of the System Function.
- (c) The extent to which this condition has already been associated with inadequate performance of the given SPI--either during prior OT's/DT's or in similar systems in the field.
- (d) The amount or number of times the given SPI will be performed under this condition as part of the System Function.

The following are instructions for rating the conditions for each of the SPI's:

- (1) Examine the "Condition Rating Worksheets" and rate each condition category on the following 3-point scale of criticality. Do this for each SPI. A category might be rated differently for different SPI's.

0	1	2
Irrelevant	Relevant, but not critical	Relevant, and very critical

Use the "2" Rating sparingly! Only the most critical categories should be so designated. Condition categories rated "1" will also be included in the field test, but only those rated "2" will become part of the SPI.

HRTES

GUIDELINES FOR SELECTING CONDITIONS (Continued)

NOTE: The same SPI may occur under different System Functions, and your rating may be different in each occurrence.

- (2) Record your ratings in the appropriate boxes on the worksheets. (See the "Sample Condition Rating Worksheet.") After completing this, each of the boxes at the intersection of the SPI's and the category names will have either "0," "1," or "2."
- (3) Each SPI now has relevant (rated "1" or "2") and irrelevant (rated "0") categories. For each SPI, rate and record each specific condition within its relevant categories (i.e., those categories rated "1" or "2") on the same scale as used above.
- (4) Return the completed rating Worksheets to the sender.

SAMPLE

HRTES

CONDITION RATING WORKSHEET

SYSTEM FUNCTION	<i>DESTROY AIRCRAFT</i>					
CONDITION CATEGORY	1. WEATHER: ILLUMINATION					
	SELECTED SYSTEM PERFORMANCE ISSUES					
	TARGET ACQUISITION	REJECTION OF JAMMING	ESTABLISHMENT OF COMMUNICATION	EMANGEMENT OF SEVERAL TARGETS	DELIVERY OF GARGO	DELIVERY OF AMMO ON TARGET
ILLUMINATION	2	0	0	1	0	2
Full Sunlight	2			2		2
Moonlight	1			1		1
Starlight	0			1		0
Dusk	0			1		0
Overcast, Moonless Night (Pitch Black)	2			2		2
Artificial Lighting (specify)	0			0		0
Flares	1			1		1
Direct Glare	0			1		0
Indirect Glare (Water, Sand, Clouds, etc.)	0			0		0
Other (specify)						

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HRTES

CONDITION RATING WORKSHEET - METHOD 2

WEATHER

1. ILLUMINATION	
<input type="checkbox"/>	Full Sunlight
<input type="checkbox"/>	Moonlight
<input type="checkbox"/>	Starlight
<input type="checkbox"/>	Dusk
<input type="checkbox"/>	Pitch Black
<input type="checkbox"/>	Artificial Light (specify)
<input type="checkbox"/>	Flares
<input type="checkbox"/>	Direct Glare
<input type="checkbox"/>	Indirect Glare
<input type="checkbox"/>	As Occurs
<input type="checkbox"/>	Other (specify)

2. TEMPERATURE	
<input type="checkbox"/>	High (specify)
<input type="checkbox"/>	Low (specify)
<input type="checkbox"/>	Normal (specify)
<input type="checkbox"/>	As Occurs
<input type="checkbox"/>	Other (specify)

3. PRECIPITATION	
<input type="checkbox"/>	Rain
<input type="checkbox"/>	Fog
<input type="checkbox"/>	Falling/Blowing Snow
<input type="checkbox"/>	Sleet
<input type="checkbox"/>	Sand Storm
<input type="checkbox"/>	No Precipitation
<input type="checkbox"/>	As Occurs
<input type="checkbox"/>	Other (specify)

4. WIND	
<input type="checkbox"/>	High Head Wind (specify)
<input type="checkbox"/>	High Tail Wind (specify)
<input type="checkbox"/>	Swirling Gusts
<input type="checkbox"/>	Cross Wind (specify)
<input type="checkbox"/>	No Wind
<input type="checkbox"/>	As Occurs
<input type="checkbox"/>	Other (specify)

5. HUMIDITY	
<input type="checkbox"/>	High (specify)
<input type="checkbox"/>	Low (specify)
<input type="checkbox"/>	Normal (specify)
<input type="checkbox"/>	As Occurs
<input type="checkbox"/>	Other (specify)

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HRTES

CONDITION RATING WORKSHEET -
METHOD 2 (CONTINUED)

TERRAIN

6. GROUND SLOPE	
	Flat (specify)
	Low Positive Hilly (specify)
	Low Negative Hilly (specify)
	High Positive Mountain (specify)
	High Negative Mountain (specify)
	As Occurs
	Other (specify)

7. GROUND SURFACE	
	Sandy
	Rocky
	Loam
	Paved
	Broken Paved
	Broken Ground
	Plowed Fields
	Bare Packed
	Vegetation Covered
	As Occurs
	Other (specify)

8. GROUND + WATER	
	Light Mud
	Heavy Mud
	Dry
	Water Covered
	Ice Covered
	Snow Covered
	As Occurs
	Other (specify)

9. OBSTACLES	
	Dense Vegetation
	Light Vegetation
	Hedge Rows
	Rivers Width and Depth
	Manmade Structures (specify)
	Traps (specify)
	No Obstacles
	As Occurs
	Other (specify)

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HRTES

CONDITION RATING WORKSHEET - METHOD 2 (CONTINUED)

TARGET

	10. TYPE
	Type/Size (specify)
	As Occurs
	Other

	11. NUMBER
	Single Target
	Multi Simul Targs (specify)
	Multi Sequent Targs (specify)
	Comb Multi Simul + Sequent (specify)
	Noise - Target/Nontarget Ratio (specify)
	As Occurs
	Other (specify)

	12. LOCATION
	Minimum Range (specify)
	Maximum Range (specify)
	Normal Range (specify)
	Azimuth + Elevation (specify)
	As Occurs
	Other (specify)

	13. SPEED
	Maximum Speed (specify)
	Minimum Speed (specify)
	Cruising Speed (specify)
	Rad Alter of Speed (specify)
	Stationary
	As Occurs
	Other (specify)

	14. DIRECTION
	Closing (specify angle)
	Retreating (specify angle)
	Crossing (specify direction and angle)
	Complex Maneuver (specify)
	As Occurs
	Other (specify)

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HRTES

CONDITION RATING WORKSHEET -
METHOD 2 (CONTINUED)

TARGET (CONTINUED)

	15. CONCEALMENT
	Concealed Physically (specify)
	Concealed Electronically (specify)
	Concealed Partially (specify)
	Concealed by Smoke
	Unconcealed
	As Occurs
	Other (specify)

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HRTES

CONDITION RATING WORKSHEET -
METHOD 2 (CONTINUED)

PERSONNEL

16. WORKLOAD	
	Full Operat Loading
	Partial Operat Loading (specify)
	As Occurs
	Other (specify)

19. STRENGTH	
	Minimum Strength
	Normal Strength
	Optimum Strength
	As Occurs
	Other (specify)

17. WORK DURATION	
	Following no Work
	Following Extended Work (specify)
	Following Normal Work (specify)
	As Occurs
	Other (specify)

20. PERCEPTION	
	Minimum Perception
	Normal Perception
	Optimum Perception
	As Occurs
	Other (specify)

18. PROTECT GEAR	
	Wearing Protect Gear (specify)
	Wearing Normal Gear (specify)
	As Occurs
	Other (specify)

21. EXPERIENCE	
	Minimum Experience (specify)
	Normal Experience (specify)
	Optimum Experience (specify)
	As Occurs
	Other (specify)

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HRTES

CONDITION RATING WORKSHEET -
METHOD 2 (CONTINUED)

PERSONNEL (CONTINUED)

	22. APTITUDES
	Minimum Aptitudes (specify)
	Normal Aptitudes (specify)
	Optimum Aptitudes (specify)
	As Occurs
	Other (specify)

	23. SIZE
	Minimum Size
	Normal Size
	Maximum Size
	As Occurs
	Other (specify)

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HRTES

CONDITION RATING WORKSHEET -
METHOD 2 (CONTINUED)

TRAINING

<input type="checkbox"/>	24. INSTITUTION
<input type="checkbox"/>	OJT-Trained
<input type="checkbox"/>	School-Trained
<input type="checkbox"/>	Comb OJT + School
<input type="checkbox"/>	No Specific Training
<input type="checkbox"/>	Factory-Trained
<input type="checkbox"/>	As Occurs
<input type="checkbox"/>	Other (specify)

<input type="checkbox"/>	25. LATENCY
<input type="checkbox"/>	Period w/o Training/Prac (specify)
<input type="checkbox"/>	Immed After Training
<input type="checkbox"/>	Normal Latency (specify)
<input type="checkbox"/>	As Occurs
<input type="checkbox"/>	Other (specify)

<input type="checkbox"/>	26. TEAM VS INDIV
<input type="checkbox"/>	Only Indiv Training
<input type="checkbox"/>	Only Team Training
<input type="checkbox"/>	Comb of Indiv + Team (specify)
<input type="checkbox"/>	As Occurs
<input type="checkbox"/>	Other (specify)

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HRTES

CONDITION RATING WORKSHEET -
METHOD 2 (CONTINUED)

OPERATIONAL

	27. CREW
	Optimum Crew (specify)
	Normal Crew (specify)
	Minimum Crew (specify)
	As Occurs
	Other (specify)

	28. HARDWARE
	Fully Up
	Partial Breakdown (specify)
	Fully Down
	As Occurs
	Other (specify)

	29. INFORMATION INPUTS
	Full Information Inputs
	Partial Info Inputs (specify)
	No Info Inputs
	As Occurs
	Other (specify)

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HRTES

CONDITION RATING WORKSHEET -
METHOD 2 (CONTINUED)

TACTICS

	30. TACTICS
	Specify Tactic(s) or Rate Tactical Conditions (#'s 31-38)

	31. # OF SYSTEMS
	Single System
	Multiple of Same Type (specify)
	Multiple Sys'ts of Diff Types (specify)
	As Occurs
	Other (specify)

	32. SPEED
	Maximum Speed (specify)
	Minimum Speed (specify)
	Cruising Speed (specify)
	Rad Alter of Speed (specify)
	Stationary
	As Occurs
	Other (specify)

	33. LOCATION(S)
	Specify Location(s)

	34. DIRECTION
	Closing Angle (specify)
	Retreating Angle (specify)
	Crossing Angle, Direction (specify)
	Complex Maneuver (specify)
	As Occurs
	Other (specify)

	35. CONCEALMENT
	Concealed Physically
	Concealed Electronically (specify)
	Partially Concealed (specify)
	Concealed by Smoke
	Unconcealed
	As Occurs
	Other (specify)

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HRTES

CONDITION RATING WORKSHEET -
METHOD 2 (CONTINUED)

TACTICS (CONTINUED)

36. CREW PROTECTION	
<input type="checkbox"/>	Fully Protected-Buttoned Up
<input type="checkbox"/>	Partially Protected Config (specify)
<input type="checkbox"/>	Least Protected Config (specify)
<input type="checkbox"/>	NBC Conditions
<input type="checkbox"/>	As Occurs
<input type="checkbox"/>	Other (specify)

37. AUTOMATIC FUNCTION	
<input type="checkbox"/>	Fully Automatic
<input type="checkbox"/>	Semi-Automatic (specify)
<input type="checkbox"/>	Manual Mode
<input type="checkbox"/>	As Occurs
<input type="checkbox"/>	Other (specify)

38. SYSTEM LOADING	
<input type="checkbox"/>	Overloaded
<input type="checkbox"/>	100% Loaded (WT/VOL)
<input type="checkbox"/>	Operationally Loaded (specify)
<input type="checkbox"/>	Unloaded
<input type="checkbox"/>	As Occurs
<input type="checkbox"/>	Other (specify)

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GUIDELINES FOR SELECTING CONDITIONS - METHOD 2

This package consists of "Condition Rating Worksheets - Method 2" and the Guidelines that you are now reading. Also included is a copy of the "Description of the System to be Tested," several "System Function Worksheets," and a "System Performance Issue Worksheet." These additional pages describe the system that is to be tested during the Operational Test (OT) and list the System Functions and System Performance Issues that have already been identified for this system. Refer to these pages to refresh your memory of the items being included in the test and the Issues that are to be evaluated.

You are asked to assist in selecting the conditions under which the system will be tested during the OT. Your role is to rate the criticality of the conditions for the performance and maintenance of the system.

Some conditions may be so important for this particular system that these conditions should be stated explicitly as part of the Issues upon which the test is planned and conducted. Other conditions may be important for a thorough assessment of the system, but they need not be stated explicitly in the Issues. Finally, some conditions will be left uncontrolled to vary "as occurs" during the test. Your ratings will help to determine how the conditions will be treated in the test.

Some of the condition categories or individual conditions within a category may have been crossed out. In this case, it has already been determined either that they are not within the charter of the testing agency to specify these conditions, or that these conditions will be left uncontrolled to vary "as occurs." You may simply ignore these "crossed-out" conditions.

The rating procedure has two parts. In the first part, you will rate the condition categories on a 3-point scale of criticality. In the second part, you will rate the individual conditions within each category. In this second part, you will use two of three points on the same 3-point rating scale.

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HRTES

GUIDELINES FOR SELECTING CONDITIONS - METHOD 2 (CONTINUED)

Rather than asking you to rate these condition categories and individual conditions along several attributes of criticality, you are asked to rate on a single attribute. However, it is suggested that you keep in mind the following four dimensions when you make your ratings of both the condition categories and the individual conditions:

- (1) The amount or number of times the system will perform or be maintained under this condition.
- (2) The extent to which the system is designed specifically to perform or be maintained under this condition.
- (3) The extent to which this condition is likely to negatively affect the performance or maintenance of the system.
- (4) The extent to which this condition has already been associated with inadequate performance or maintenance, either in prior tests of this system, or in significantly similar systems that have already been fielded.

Use the following instructions to rate the condition categories and the individual conditions within each category:

- (1) Examine the "Condition Rating Worksheets - Method 2" and rate each condition category on the following 3-point scale:

0 - Not critical. This condition will be left uncontrolled to vary "as occurs" during the test.

1 - Important. This condition should be controlled during the test, but is not so critical that it need be stated explicitly as part of an Issue.

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2 - Critical. This condition is sufficiently critical to a thorough evaluation of the system that the test must be structured explicitly to include this condition. This condition will be stated explicitly as part of an Issue.

Use the "2" rating sparingly! To rate a condition category as "2" gives great importance to that condition and highlights its visibility throughout the test planning and execution. Also, as a practical matter, every time you rate a condition as "2" you may increase the number of Issues.

Rating a condition category as "1" may be sufficient to flag that condition as worthy of attention. Conditions rated "1" will be controlled during the test.

- (2) Rate the individual conditions that belong to those categories that you rated either "1" or "2." It is not necessary to rate conditions for categories rated "0."

For categories that you have rated "2," individual conditions may be rated either "0" or "2," on the original rating scale. They may not be rated "1." For each condition category rated "2," at least one individual condition must be rated "2." However, any number of conditions in that category may be rated "2," as long as at least one is so rated. You should continue to be sparing in your use of the "2" rating. However, you should be aware that an individual condition which you rate "0" in a category rated "2" will not be used in the field test. Therefore, if you have rated a category "2," and if you want a "normal" or "as occurs" condition in that category to be used for this system, you will have to rate the "normal" or "as occurs" condition as "2," otherwise they will not appear in the field test.

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HRTES

GUIDELINES FOR SELECTING CONDITIONS - METHOD 2 (CONTINUED)

For categories that you have rated "1," individual conditions may be rated either "0," or "1" on the original rating scale. Rating an individual condition "1" in a category rated "1," means that you do not want this condition added to an issue, but you feel that it should be used in the field test.

- (3) When you have completed your ratings, fill in your name and telephone number at the bottom of each Worksheet, and return them to the sender.

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HRTES

CONDITIONS X SPI MATCHING WORKSHEET

		SYSTEM FUNCTION #												
		SPI #												
1.	WEATHER: ILLUMINATION													
	Full Sunlight													
	Moonlight													
	Starlight													
	Dusk													
	Pitch Black													
	Artificial Lighting													
	Flares													
	Direct Glare													
	Indirect Glare													
	As Occurs													
2.	WEATHER: TEMPERATURE													
	High													
	Low													
	Normal													
	As Occurs													
3.	WEATHER: PRECIPITATION													
	Rain													
	Fog													
	Falling/Blowing Snow													
	Sleet													
	Sand Storm													
	No Precipitation													
	As Occurs													
4.	WEATHER: WIND													
	High Head Wind													
	High Tail Wind													
	Swirling Gusts													
	Cross Wind													
	No Wind													
	As Occurs													
5.	WEATHER: HUMIDITY													
	High													
	Low													
	Normal													
	As Occurs													

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HRTES

CONDITIONS X SPI MATCHING WORKSHEET (CONTINUED)

		SYSTEM FUNCTION #												
		SPI #												
6.	TERRAIN: GROUND SLOPE													
	Flat													
	Low Positive Hilly													
	Low Negative Hilly													
	High Positive Mountain													
	High Negative Mountain													
	As Occurs													
7.	TERRAIN: GROUND SURFACE													
	Sandy													
	Rocky													
	Loam													
	Paved													
	Broken Paved													
	Broken Ground													
	Plowed Fields													
	Bare Packed													
	Vegetation Covered													
	As Occurs													
8.	TERRAIN: GROUND + WATER													
	Light Mud													
	Heavy Mud													
	Dry													
	Water Covered													
	Ice Covered													
	Snow Covered													
	As Occurs													
9.	TERRAIN: OBSTACLES													
	Dense Vegetation													
	Light Vegetation													
	Hedge Rows													
	Rivers													
	Manmade Structures													
	Traps													
	No Obstacles													
	As Occurs													

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HRTES

CONDITIONS X SPI MATCHING WORKSHEET (CONTINUED)

		SYSTEM FUNCTION #																
		SPI #																
24.	TRAINING: INSTITUTION																	
	OJT-Trained																	
	School Trained																	
	Comb OJT + School																	
	No Spec Training																	
	Factory-Trained																	
	As Occurs																	
25.	TRAINING: LATENCY																	
	Period W/O Training/Prac																	
	Immed After Training																	
	Normal Latency																	
	As Occurs																	
26.	TRAINING: TEAM VS INDIV																	
	Only Indiv Training																	
	Only Team Training																	
	Comb of Indiv + Team																	
	As Occurs																	

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HRTES

CONDITIONS X SPI MATCHING WORKSHEET (CONTINUED)

		SYSTEM FUNCTION #																				
		SPI #																				
30.	TACTICS																					
31.	TACTICS: # OF SYSTEMS																					
	Single System																					
	Multiple of Same Type																					
	Multiple Sysys of Diff Types																					
	As Occurs																					
32.	TACTICS: SPEED																					
	Maximum Speed																					
	Minimum Speed																					
	Cruising Speed																					
	Rad Alter of Speed																					
	Stationary																					
	As Occurs																					
33.	TACTICS: LOCATION(S)																					
34.	TACTICS: DIRECTION																					
	Closing Angle																					
	Retreating Angle																					
	Crossing Angle, Direction																					
	Complex Maneuver																					
	As Occurs																					
35.	TACTICS: CONCEALMENT																					
	Concealed Physically																					
	Concealed Electronically																					
	Partially Concealed																					
	Concealed by Smoke																					
	Unconcealed																					
	As Occurs																					

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HRTES

CONDITIONS X SPI MATCHING WORKSHEET (CONTINUED)

		SYSTEM FUNCTION #																				
		SPI #																				
36.	TACTICS: CREW PROTECTION																					
	Fully Protected-Buttoned Up																					
	Partially Protected Config																					
	Least Protected Config																					
	NBC Conditions																					
	As Occurs																					
37.	TACTICS: AUTOMATIC FUNCTION																					
	Fully Automatic																					
	Semi-Automatic																					
	Manual Mode																					
	As Occurs																					
38.	TACTICS: SYSTEM LOADING																					
	Overloaded																					
	100% Loaded (WT/VOL)																					
	Operationally Loaded																					
	Unloaded																					
	As Occurs																					

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CONTENTS

1. Set of Operational HPF-Group Worksheets
2. Guidelines for Developing Maintenance Human Performance Functions (HPF's)
3. Maintenance Worksheet
4. Test Condition Worksheet
5. Final Condition Set Worksheet
6. Guidelines for Developing Performance Criteria
7. Sample Criterion Worksheet (2 Pages)
8. Criterion Worksheet
9. Guidelines for Developing Statistics and Statistic Criterion
10. Sample Criterion Worksheet (2 Pages)

HRTES

OPERATIONAL HPF-GROUP WORKSHEET

SYSTEM FUNCTION			
SPI			
HPF-GROUP #	1	WEAPON DELIVERY	
HPFs		MARK IF RELEVANT	NEW HPF NUMBER
1. Assemble system			
2. Emplace system			
3. Calibrate system components including boresighting and zeroing			
4. Acquire target(s) (This HPF is dealt with as a separate HPF-Group. Turn to page W5-3, to complete it.)			
5. Select ammunition			
6. Prepare ammunition for firing			
7. Communicate fire order and other intracrew instructions			
8. Fire weapon			
9. Dispose of spent casing(s)			
10. Guide weapon to target			
11. Perform misfire procedure			
12. Perform hangfire procedure			
13. Clear/swab/clean appropriate sections of system			
14. Disassemble system			

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HRTES

OPERATIONAL HPF-GROUP WORKSHEET

SYSTEM FUNCTION			
SPI			
HPF-GROUP #	3	WEAPON DELIVERY--GROUND TO GROUND MISSILES	
HPF's		MARK IF RELEVANT	NEW HPF NUMBER
1. Mate warhead to missile			
2. Load and secure missile on launcher			
3. Convert transport to launcher			
4. Position and emplace launcher			
5. Lay system for azimuth and elevation			
6. Install sighting components			
7. Calibrate system including boresighting and collimating			
8. Conduct missile system prefire checkouts			
9. Arm system			
10. Inspect system for defects			
11. Identify/determine target			
12. Identify/determine target coordinates			
13. Program missile			
14. Initiate firing sequence			
15. Fire system			
16. Guide missile to target			
17. Handoff missile to intermediate guidance			
(CONTINUED ON NEXT PAGE)			

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HRTES

OPERATIONAL HPF-GROUP WORKSHEET

SYSTEM FUNCTION		
SPI		
HPF-GROUP	# 5	WEAPON DELIVERY--MINES
HPF's		MARK IF RELEVANT NEW HPF NUMBER
1. Select appropriate location for mine installation		
2. Inspect mine/triggering device/fusing device		
3. Transport mine		
4. Prepare mine for installation		
5. Install mine (including the digging of a hole)		
6. Camouflage mine/triggering device		
7. Aim mine, if applicable		
8. Test circuit(s)		
9. Arm mine		
10. Fire mine, if applicable		
11. Disarm mine		

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HRTES

OPERATIONAL HPF-GROUP WORKSHEET

SYSTEM FUNCTION		
SPI		
HPF-GROUP #	6	TARGET INFORMATION GATHERING AND INTERPRETATION
HPFs		MARK IF RELEVANT NEW HPF NUMBER
1. Assemble system		
2. Position system in appropriate location		
3. Select type and number of sensors		
4. Position sensors in appropriate location		
5. Calibrate/align system components		
6. Detect target(s)		
7. Identify target(s)		
8. Determine number of targets		
9. Determine target(s) location/range		
10. Determine target speed		
11. Determine target direction		
12. Determine target formation/tactical situation		
13. Select and order targets based on the matching of priorities with target information gathered.		
14. Recognize countermeasures and take appropriate action		

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HRTES

OPERATIONAL HPF-GROUP WORKSHEET

SYSTEM FUNCTION		
SPI		
HPF-GROUP #	9	WEAPON FUNCTION MANAGEMENT
HPFs		MARK IF RELEVANT NEW HPF NUMBER
1. Determine type of target		
2. Determine speed/direction of target		
3. Determine target range at time of weapon delivery		
4. Determine weather conditions which impact weapon delivery and adjust for them		
5. Determine type of ammunition to be used based on all above factors		
6. Determine probable amount of ammunition required to kill target under existing/projected conditions		
7. Recommend action based on available supply of ammunition, future probable requirements for ammunition, and probable required amount to kill target at various ranges/speeds		

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HRTES

OPERATIONAL HPF-GROUP WORKSHEET

SYSTEM FUNCTION			
SPI			
HPF-GROUP #	10	REPRESENTATION OF TERRAIN/OBSTACLES/ INSTALLATIONS/WEATHER	MARK IF RELEVANT
HPFs			NEW HPF NUMBER
1. Indicate key terrain features which might affect outcome of the operation ¹			
2. Indicate man-made obstacles which might affect the outcome of the operation ²			
3. Indicate installations which might affect the outcome of the operation ³			
4. Indicate features of weather which might affect the outcome of the operation ⁴			
5. Identify important information which is missing			
6. Identify important information which is internally inconsistent or probably inaccurate			
7. Develop alternate information sources			
8. Prioritize information according to user(s) need and probability of its accuracy			
9. Prioritize list of information users for receipt of information based on their functions in this specific operation and their requirements			
1, 2, 3, 4 See page W5-13 for footnotes			

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10. REPRESENTATION OF TERRAIN/OBSTACLES/INSTALLATIONS/WEATHER

¹Your consideration of terrain features should include the following:

coastline configuration	soil composition
exits from beaches	water depth
avenues of approach	terrain slopes
cover and concealment	beach characteristics
observation and fields of fire	elevations
defiladed areas	accessibility of terrain features
areas suitable for avaiation landing	
positions for weapons	
spaces for maneuver	
points of maximum disruption	

²Your consideration of man-made obstacles should include the following:

- minefields
- tank traps
- water obstacles
- ditches
- destroyed/potentially destroyed bridges, tunnels, etc.

³Your consideration of installations should include the following:

airports	enemy air defense systems
heliports	enemy radar facilities
enemy depots	enemy satellite microwave receiving stations
enemy command posts	
enemy transportation facilities	
enemy communication facilities	
enemy power operation facilities/lines	
enemy C ³ positions	

⁴Your consideration of weather should include the following:

visibility data	humidity data
wind data	precipitation data
temperature data	

HRTES

OPERATIONAL HPF-GROUP WORKSHEET

SYSTEM FUNCTION		
SPI		
HPF-GROUP #	11	REPRESENTATION OF STATUS OF FORCES
HPFs	MARK IF RELEVANT	NEW HPF NUMBER
1. Indicate location(s) of forces		
2. Indicate composition (number and type) of forces		
3. Indicate availability of forces		
4. Indicate peculiarities/weaknesses of forces		
5. Indicate recent significant tactical events in which specific units were involved		
6. Indicate actions which forces are currently pursuing ¹		
7. Indicate the enemy commander(s)' previous behavior in similar situations		
8. Indicate combat effectiveness of forces		
9. Indicate relative combat power of enemy to friendly units		
10. Indicate relevant threat potentials of enemy forces		
11. Identify important missing information		
12. Identify important information which is internally inconsistent or probably inaccurate		
¹ See page W5-16 for footnote		
(CONTINUED ON NEXT PAGE)		

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11. REPRESENTATION OF STATUS OF FORCES

¹Your consideration of these actions should include:

direction of movement
speed of movement
apparent purpose(s) of movement

HRTES

OPERATIONAL HPF-GROUP WORKSHEET

SYSTEM FUNCTION		
SPI		
HPF-GROUP #	12	PROJECTION OF BATTLEFIELD OPERATIONS
HPFs	MARK IF RELEVANT	NEW HPF NUMBER
1. Determine observable indicators of possible changes in the operational situation		
2. Prioritize indicators of operational changes		
3. Assign intelligence collection tasks to maximize receipt of indicators according to their priorities		
4. Monitor intelligence collection and reassign tasks based on updated information		
5. Display pertinent information		
6. Identify important missing information		
7. Identify important information which is internally inconsistent or probably inaccurate		
8. Develop alternate sources of information		
9. Determine which model(s) of expected enemy behavior best fits collected information		
10. Assign confidence levels to the projection(s)		
11. Make recommendations about the effects of projected operations		
12. Prioritize information according to user(s) need and probability of accuracy		

(CONTINUED ON NEXT PAGE)

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HRTES

OPERATIONAL HPF-GROUP WORKSHEET

SYSTEM FUNCTION		
SPI		
HPF-GROUP #		
13	PROJECTION OF WEATHER CONDITIONS	
HPF's		MARK IF RELEVANT NEW HPF NUMBER
1. Collect relevant weather information for the applicable area(s)		
2. Develop alternative weather projections and their indicators		
3. Assign probabilities to weather projections		
4. Determine effects of alternate weather projections on operation(s)		
5. Prioritize indicators of weather projections		
6. Assign weather indicator collection tasks		
7. Monitor weather indicator collection and reassign tasks based on updated information		
8. Update projection probabilities		
9. Collect, order and display pertinent information		
10. Identify important missing information		
11. Identify important information which is internally inconsistent or probably inaccurate		
12. Develop alternate sources of information		
13. Prioritize information according to user(s) needs and probability of accuracy		
(CONTINUED ON NEXT PAGE)		

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HRTES

OPERATIONAL HPF-GROUP WORKSHEET

SYSTEM FUNCTION

SPI

HPF-GROUP #

13

PROJECTION OF WEATHER CONDITIONS
(CONTINUED)

MARK IF RELEVANT

NEW HPF NUMBER

HPFs

14. Prioritize list of information users for receipt of information based on their functions in this specific operation and their requirements

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HRTES

OPERATIONAL HPF-GROUP WORKSHEET

SYSTEM FUNCTION		
SPI		
HPF-GROUP #	14	SELECT THE MOST APPROPRIATE FRIENDLY UNIT(S) TO ENGAGE IN OPERATION
HPFs		MARK IF RELEVANT NEW HPF NUMBER
1. Determine the requirements the operation will make on the friendly unit		
2. Order these requirements based on commander's priorities		
3. Identify friendly unit(s) with the appropriate mix of attributes to match the prioritized requirements		
4. Determine which friendly units, with the correct attributes, can be removed from their present operations without unacceptable consequences.		
5. Determine the transportation systems required to move each friendly unit to the operational area		
6. Determine the availability of each transportation system required to move each friendly unit and the time required for it to perform its function		
7. Determine the logistics required by each friendly unit to perform its functions in the operation in question		
8. Determine the availability of the supplies and delivery systems to the operations area for the required logistics of each friendly unit		
9. Display all significant information and order it in some logical and helpful manner		

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HRTES

OPERATIONAL HPF-GROUP WORKSHEET

SYSTEM FUNCTION		MARK IF RELEVANT	NEW HPF NUMBER
SPI	HPF-GROUP #		
	16	CONTROL OF FRIENDLY FORCES ON THE BATTLEFIELD	
HPF's			
1.	Determine commanders' desired outcome and priorities		
2.	Determine the tactics to be followed		
3.	Select the most appropriate friendly unit(s) to engage in operation ¹ (See Select the Most Appropriate Friendly Unit(s) to Engage in Operation, page W5-21.)		
4.	Determine travel routes for friendly units		
5.	Determine departure and projected arrival times for friendly units		
6.	Prepare contingency plans and the situations in which each is to be implemented (See Projection of Battlefield Operations, page W5-17.)		
7.	Prepare plans, orders, maps and other required documents		
8.	Prepare materials for briefing commanders and staffs		
9.	Monitor units' compliance with orders and their progress		
10.	Identify critical situations which indicate significant changes in battlefield operations		
11.	Update plans/orders as battlefield situation changes		
¹ See page W5-24 for footnote			

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16. CONTROL OF FRIENDLY FORCES ON THE BATTLEFIELD

¹The following types of units should be considered in this selection process:

- (1) first echelon
- (2) reserve
- (3) intelligence
- (4) counter-intelligence
- (5) maintenance
- (6) logistics

HRTES

OPERATIONAL HPF-GROUP WORKSHEET

SYSTEM FUNCTION			
SPI			
HPF-GROUP #	20	BATTLEFIELD RECONNAISSANCE	
HPFs		MARK IF RELEVANT	NEW HPF NUMBER
1. Identify key environmental features			
2. Identify current weather conditions			
3. Identify key elements of threat force			
4. Identify essential information for evaluating NBC contamination hazard outer limits			
5. Identify/select routes			
6. Present information about routes which could influence movement			
7. Identify hazards to movement			
8. Identify early warning of enemy threat			
9. Report map changes			

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HRTES

OPERATIONAL HPF-GROUP WORKSHEET

SYSTEM FUNCTION			
SPI			
HPF-GROUP	#		
	24	VEHICLE MANEUVERING--GROUND VEHICLES	
HPF's		MARK IF RELEVANT	NEW HPF NUMBER
1. Observe environment for obstacles, landmarks, etc.			
2. Read and use instruments appropriate to vehicle maneuvering			
3. Perform the following, moving backward (B) and/or forward (F). Circle B or F as appropriate.			
3.1 Tight turn(s) B F			
3.2 Wide turn(s) B F			
3.3 Accelerating turn(s) B F			
3.4 Decelerating turn(s) B F			
3.5 Rapid acceleration B F			
3.6 Gradual acceleration B F			
3.7 Rapid deceleration (no stop) B F			
3.8 Gradual deceleration B F			
3.9 Sudden stop B F			
3.10 Maintain constant speed B F			

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HRTES

OPERATIONAL HPF-GROUP WORKSHEET

SYSTEM FUNCTION			
SPI			
HPF-GROUP #	25	VEHICLE MANEUVERING--HELICOPTERS	
		MARK IF RELEVANT	NEW HPF NUMBER
HPF's			
1.	Perform takeoff to hover		
2.	Perform instrument takeoff		
3.	Perform hover checks		
4.	Perform hovering turns		
5.	Perform hovering flight		
6.	Perform normal takeoff		
7.	Perform maximum performance takeoff		
8.	Perform straight and level flight		
9.	Perform climbs and descents		
10.	Perform turns		
11.	Perform instrument turns		
12.	Perform acceleration/deceleration		
13.	Perform traffic pattern flight		
14.	Perform high speed flight		
15.	Perform hovering autorotation		
16.	Perform standard autorotation		
17.	Perform standard autorotation with turn		
(CONTINUED ON NEXT PAGE)			

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HRTES

OPERATIONAL HPF-GROUP WORKSHEET

SYSTEM FUNCTION			
SPI			
HPF-GROUP	#	VEHICLE MANEUVERING--HELICOPTERS (CONTINUED)	MARK IF RELEVANT
HPF's			NEW HPF NUMBER
18. Perform holding procedures			
19. Perform unusual attitude recovery			
20. Perform before-landing check			
21. Perform shallow approach to a running landing			
22. Perform landing from hover			
23. Perform normal landing approach			
24. Perform shallow landing approach			
25. Perform steep landing approach			
26. Perform instrument approach			
27. Perform GCA approach			
28. Perform IFR helicopter recovery procedure			
29. Perform tactical instrument approach			
30. Perform go around			

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HRTES

OPERATIONAL HPF-GROUP WORKSHEET

SYSTEM FUNCTION		
SPI		
HPF-GROUP #	26	TACTICAL VEHICLE MANEUVERING-- HELICOPTERS
HPF's	MARK IF RELEVANT	NEW HPF NUMBER
1. Perform terrain flight takeoff		
2. Perform hover out of ground effect		
3. Perform terrain flight navigation		
4. Perform contour flight		
5. Perform NOE flight including masking and unmasking		
6. Perform confined area operations		
7. Perform slope operations		
8. Perform pinnacle/ridgeline operation		
9. Perform evasive maneuvers		
10. Perform low-level flight		
11. Perform circling approach from terrain flight		
12. Operate radar warning receiver		
13. Perform visual glide slope approach and landing		
14. Perform ski landing		
15. Perform amphibious operations		

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33. PREVENTION OF DETECTION/LOCATION OF SYSTEM

¹These countermeasures include:

- jamming
- smoke
- flares
- chaff
- powered decoys
- signature alteration
- electronic attack of threat-sensing equipment

²System camouflage includes:

- physical
- infrared
- radar signature reduction

HRTES

GUIDELINES FOR DEVELOPING MAINTENANCE HUMAN PERFORMANCE FUNCTIONS

System Performance Issues (SPI's) are major activities which must be performed by a system. Human Performance Functions (HPF's) are those human activities which are required to carry out each SPI of a system. There are two general types of HPF's: those required for the actual performance of an SPI--called Operational HPF's, and those required for the continued performance of an SPI--called Maintenance HPF's. You are being asked to aid in developing Maintenance HPF's for specific SPI's.

Maintenance HPF's for a given SPI may be scheduled or unscheduled. Scheduled and unscheduled Maintenance HPF's may be performed by system operators or by designated maintenance personnel.

A Maintenance HPF should start with an action verb and give a specific object. For example, "Purge Turret Hydraulic Lines" or "Clean Engine Intake Filters." The following list of action verbs should prove helpful to you in writing the HPF's.

Inspect _____
Lubricate _____
Fill/Drain _____
Purge _____
Paint _____
Clean _____

Change/Replace _____
Troubleshoot/Diagnose _____
Remove _____
Disassemble/Assemble _____
Install _____
Adjust/Align _____
Test _____

Each of the "Maintenance Worksheet" which you have been given contains the name of the system, the class in which that system falls, the system function, and the SPI for which you are to provide Maintenance HPF's. Read the

following instructions and complete the Worksheets. Use your expertise about the maintenance of this system class or specific system, and any other relevant documentation to develop the HPF's.

(1) For each SPI, record on the "Maintenance Worksheet" all those HPF's which meet either of the following:

(a) HPF is necessitated by a high probability of breakdowns in that part of the system which is involved in the performance of the SPI. Consider the probable conditions in which this system will be actually operated, including any specific conditions contained in the SPI statement.

(b) If the HPF is performed poorly, it will result in a breakdown or poor system performance of the SPI.

(2) For each HPF, indicate on the Worksheet:

(a) Who will perform it (i.e., maintenance personnel, system operators, or both.)

(b) What type of Maintenance HPF it is (i.e., scheduled, unscheduled, or both.)

(3) Return the completed forms to the sender.

HRTES

TEST CONDITION WORKSHEET

SYSTEM FUNCTION	
SPI	
HPF's PERFORMED UNDER THE SAME CONDITIONS	
RELEVANT CONDITION CATEGORIES	SELECTED CONDITION(S) FROM EACH CATEGORY

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HRTES

GUIDELINES FOR DEVELOPING PERFORMANCE CRITERIA

You have received a set of "Criterion Worksheets." Each one corresponds to a specific Human Performance Function (HPF) which will be measured in the Operational Test. In addition, you have received "Final Condition Set Worksheets" for the appropriate HPF's. To determine if an HPF trial has been performed successfully, it is necessary to define what a successful performance means, or to define what we call the performance criterion of the HPF. Usually, this can be done by determining the maximum acceptable time to perform the HPF and/or by specifying a minimum level of accuracy. HRTES distinguishes between three types of criteria: (a) time criterion; (b) accuracy criterion, and (c) combined time and accuracy criterion. It is expected that the third type will be used most frequently.

As an example: "The time for performing a specific HPF should not exceed 30 seconds is a time criterion." "Number of errors while performing this HPF should not exceed 10 errors is an accuracy criterion." "The HPF should be done in less than 10 seconds with no more than 5 errors is a combined time and accuracy criterion."

Development of a time criterion for an HPF is quite straightforward. If the MENS, ROC, or LOA provides you with an appropriate SPI time criterion, your task will then be to allocate that time to each of the HPF's of the SPI. Otherwise, each HPF time criterion will have to be developed according to your own expertise.

Development of a criterion which includes accuracy is more complicated. For each HPF, you will have to determine the various significant errors which can occur, and decide whether you want to distinguish between different kinds of errors in your criterion.

To develop an appropriate performance criterion for each HPF, you have to consider the condition set under which the HPF is going to be tested. If an HPF has more than one condition set, you may have to determine a different criterion for each condition set of the HPF.

Each of the "Criterion Worksheets" is attached to appropriate "Final Condition Set Worksheets." Both Worksheets contain the name of the system, the System Function, the SPI, and the HPF.

On the "Criterion Worksheet" the numbers corresponding to condition sets are recorded in the top row.

The following instructions will aid you in developing the performance criterion for each HPF under each of the condition sets:

- (1) Decide what type of criterion is most appropriate, i.e., time, accuracy, or combined time and accuracy.
- (2) If your criterion includes accuracy, you have to specify all the significant errors in the appropriate place on the Worksheet.

ERROR CLASSIFICATION FOR ACCURACY CRITERION DEVELOPMENT

If you already know which errors are important and should be used to define the accuracy criterion for each HPF, the following is unnecessary. However, if you find the identification of the appropriate errors difficult, applying the following classification scheme may prove helpful.

HRTES

TYPE OF HPF (TASK)	TYPE OF ERROR	EXAMPLE
Perceptual and Associated Mental Processes	1. Task or task segment omitted.	1.1 Target not detected. 1.2 Message/key word not heard.
	2. Noise (extraneous objects/information) or nothing identified as signal (object/information needed for HPF performance).	2.1 Rock identified as target. 2.2 Static identified as message.
	3. Signal identified as noise.	3.1 Target identified as rock. 3.2 Message identified as static.
	4. Signal recognized as such, but no identification or classification made.	4.1 Signal recognized as non-noise, but cannot be deciphered. 4.2 Message can be read, but not understood (rather than misunderstood).
	5. Signal misclassified or misunderstood. Misclassification can be performed in a number of categories. Each category produces a different possible error.	5.1 Friendly classified as enemy. 5.2 Enemy classified as friendly. 5.3 High risk classified as low risk. 5.4 Medium tank classified as tank destroyer. 5.5 T72 classified as T62. 5.6 Platoon Bravo classified as Platoon Alpha. 5.7 Moving target classified as stationary target. 5.8 One key word of message understood as other word which alters message meaning.
	6. Incorrect meaning attributed to signals which have been correctly classified/understood. These are errors of thinking and decision making based on perceptual input.	6.1 Incorrect target prioritization. 6.2 Enemy in attack thought to be in defense. 6.3 Error in location of potential enemy breakthrough point.

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HRTES

TYPE OF HPP (TASK)	TYPE OF ERROR	EXAMPLE
Manipulatory (Motor)	1. Task or task segment omitted.	1.1 Vehicle brake not applied. 1.2 Equipment not tightened following alignment.
	2. Incorrect control or object manipulated.	2.1 Incorrect input key activated. 2.2 Wrong ammunition loaded.
	3. Control or object manipulated incorrectly.	3.1 Distance from target to ammunition impact more than X. 3.2 Distance from desired vehicle path (in maneuver) to actual vehicle path more than X at specified measurement points. 3.3 Mean error of control manipulation, electrically measured, greater than X during maneuver. 3.4 Controls activated out of sequence.
Communication Output	1. Entire message or segment of message omitted.	1.1 Message not spoken or sent. 1.2 Identified key word not spoken or sent.
	2. Incorrect or inappropriate information communicated.	2.1 Incorrect location sent. 2.2 Shopping list sent.
	3. Garbled (not understandable) material communicated.	3.1 Entire message garbled. 3.2 Identified key word garbled.
	4. Message sent to inappropriate recipient.	4.1 Message sent to wrong friendly unit. 4.2 Message sent to enemy unit.
	5. Message sent in inappropriate format.	5.1 Message order wrong. 5.2 Message not coded properly. 5.3 Inappropriate symbols used.

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HRTES

You must be able to define if an error has occurred. The definition of some errors require no physical measurements for their identification; for example, loading the wrong type of ammunition. The definition of other errors is more arbitrary and requires physical measurement. In this case, you must specify the cutoff point which defines the error's occurrence. For example, in the HPF, "Aim Weapon," the distance between the hit and the target would be considered an error when it surpassed a specified size. Otherwise, it would not be defined as an error (i.e., hit outside one meter from the target would be an error).

- (3) If you selected a time, or time-accuracy criterion, record the maximum acceptable criterion in the appropriate space on the worksheet.
- (4) Now you are ready to write the actual performance criterion. You can write only one of the following criteria in each column of the Worksheets:

Time Criterion.

Accuracy Criterion.

Time-Accuracy Criterion.

- (a) Time Criterion: Copy the maximum acceptable criterion time into the "Performance Criterion Box."
- (b) Accuracy Criterion: Specify the maximum number or percentage of errors allowed in the performance of one trial of the HPF in each condition set. You may distinguish between different errors or consider them all together. Record this in the "Performance Criterion Box."

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(c) Time-Accuracy Criterion: Do (a) and (b) above, and record combination in the "Performance Criterion Box." See Sample "Criterion Worksheet.")

- (5) Do not fill in the bottom two rows of the Worksheets.
- (6) Return all materials to sender.

SAMPLE

HRTES

CRITERION WORKSHEET

SYSTEM FUNCTION DESTROY AIRCRAFT		
SPI TARGET ACQUISITION IN FULL SUNLIGHT		
<input checked="" type="checkbox"/> OPER. HPF DETECT AND IDENTIFY TARGETS <input type="checkbox"/> MAINT.		
CONDITION SET # 1 # 3		
ERRORS	1) DETECTION WITHOUT TARGET 2) TARGET WITHOUT DETECTION 3) FRIENDLY VS. ENEMY ERROR 4) TARGET TYPE ERROR (FIGHTER, BOMBER, RECON, ETC.) 5) TARGET MODEL ERROR	SAME AS CONDITION SET #1
MAXIMUM ACCEPTABLE TIME	20 SECONDS	30 SECONDS
PERFORMANCE CRITERION	TRIAL FAILS IF: ANY 3 OR MORE OF ABOVE ERRORS ARE MADE, <u>OR</u> IF TRIAL TAKES MORE THAN 20 SECONDS	TRIAL FAILS IF: ERRORS 1 OR 2 OCCUR, <u>OR</u> ERRORS 3, 4, <u>AND</u> 5 ALL OCCUR, <u>OR</u> IF TRIAL TAKES MORE THAN 30 SECONDS
STATISTIC		
STATISTIC CRITERION		

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SAMPLE

HRTES

CRITERION WORKSHEET

<input checked="" type="checkbox"/> OPER. <input type="checkbox"/> MAINT.	SYSTEM FUNCTION <u>DESTROY AIRCRAFT</u>
	SPI <u>TARGET ACQUISITION IN FULL SUNLIGHT</u>
	HPF <u>SELECT TARGET AND TARGET ORDER</u>
	CONDITION SET # 2 CONDITION SET #
ERRORS	<ol style="list-style-type: none"> 1.) INCORRECT TARGET ORDER SELECTED. 2.) IMPROPRIATE AIRCRAFT SELECTED AS TARGETS.
MAXIMUM ACCEPTABLE TIME	<u>15 SECONDS</u>
PERFORMANCE CRITERION	TRIAL FAILS IF: <ol style="list-style-type: none"> 1.) RANK ORDER OF SELECTED TARGETS DOES NOT CORRELATE WITH CORRECT RANK ORDER AT LEAST 80%... OR 2.) 20% IMPROPRIATE A.C. SELECTED AS TARGETS, OR IF TRIAL TAKES MORE THAN 15 SEC.
STATISTIC	
STATISTIC CRITERION	

SYSTEM MERCURY AIR DEFENSE WEAPON SYSTEM TEST OF II DATE 25 MAR 61 PAGE _____
 NAME _____ TELEPHONE _____

HRTES

CRITERION WORKSHEET

SYSTEM FUNCTION		
SPI		
HPF		
<input type="checkbox"/> OPER.		
<input type="checkbox"/> MAINT.		
CONDITION SET <input type="text" value="#"/>		CONDITION SET <input type="text" value="#"/>
ERRORS		
MAXIMUM ACCEPTABLE TIME		
PERFORMANCE CRITERION		
STATISTIC		
STATISTIC CRITERION		

SYSTEM _____ TEST _____ DATE _____ PAGE _____
NAME _____ TELEPHONE _____

HRTES

GUIDELINES FOR DEVELOPING STATISTICS AND STATISTIC CRITERION

You have received "Criterion Worksheets" and "Final Condition Set Worksheets" for each HPF. In each, sets of conditions under which the HPF will be tested are specified. For each HPF under each condition set, the definition of one successful trial is already listed in the "Performance Criterion" row.

To evaluate the performance of an HPF, more than one trial should be performed and all the measure outcomes from such trials should be considered for evaluation. To do so, the outcomes have to be aggregated to produce what in HRTES is call a statistic.

Mainly, there are two ways for aggregating the outcomes: (a) by taking the average of all the measure outcomes for the specific HPF; and (b) by calculating the percentage of successful performances of the HPF. A successful trial is defined by the "performance criterion."

These are two basic statistics: the average, and the percentage can be expressed by the following formulas:

$$\text{AVERAGE} = \frac{\text{Sum of Total Outcomes}}{\text{Number of Trials}}$$

$$\text{PERCENTAGE} = 100 \times \frac{\text{Number of Successful Trials}}{\text{Number of Trials}}$$

To evaluate the performance of an HPF, it is necessary to have a criterion for each statistic that is employed. HRTES refers to this criterion as a statistic criterion. For example, a statistic criterion for a percentage statistic might be: "A minimum success percentage of 80%." A statistic criterion for an average statistic might be: "At most an average time of 30 seconds."

The procedure suggested is to first determine the appropriate statistic for each measure, and from it to define the statistic criterion. In most cases, percentage is preferable since it enables us to combine several measure dimensions into one. The average statistic may be used when an HPF is measured by only one kind of data, i.e., only time or only one type of error.

Another determination that should be made at this point is whether the aggregation procedure, percentage or average, should be made for an HPF under each separate condition set, or combined across all condition sets for the HPF in question. (This, of course, is not a problem when an HPF is tested under only one condition set.) There is a trade-off between the number of trials for the HPF and the information to be gained. If one wants to determine the effect of different condition sets on HPF performance, enough trials under each of the condition sets must be performed, and the statistics must be calculated and treated separately under each condition set. However, if one wants to evaluate the HPF in general, and is interested in including conditions only to insure representation and doesn't need to make reliable statements of the effects of each condition set on the HPF, then the aggregation should be made across condition sets, and thus will require fewer trials for the HPF.

For each HPF:

- (1) Determine the appropriate statistic (percentage or average) for each HPF, and record it in the "Statistic Row" of the Worksheet.

- (2) Determine whether the statistics will be aggregated across all condition sets of a given HPF or for each condition set separately. This decision will affect the following procedure.
- (3) Determine the statistic criterion for each statistic developed in (1), and record the information in the appropriate place on the "Statistic Criterion" row of the Worksheet.

If you have decided on separate aggregation for each condition set then you have to define a separate statistic criterion for each, and record it in the appropriate space in each "Condition Set" column. If you decided to aggregate across all condition sets for an HPF, record the statistic criterion in one column, and write "Across Conditions" in the other(s). (See "Sample Worksheet.")

- (a) When the statistic is a percentage, the criterion associated with it is the minimum percentage of HPF trials which are to be performed successfully to meet operational requirements. To determine this criterion you have to consider the definition of a successful performance of a trial for each condition set very carefully. There is a tradeoff between the performance criterion and the statistic criterion. If the performance criterion is extreme, you might consider a smaller percentage of success as a statistic criterion and vice versa.

(b) When the statistic is an average, the definition of statistic criterion is quite straightforward. If the statistic is aggregated for one condition set, the criterion, in most cases, is the same as the performance criterion. If you decided to aggregate over all condition sets, it is suggested that the statistic criterion will be the average of the performance criterion for the different condition sets.

(4) Return the completed Worksheets to the test planner.

SAMPLE

HRTES

CRITERION WORKSHEET

	SYSTEM FUNCTION <u>DESTROY AIRCRAFT</u>	
	SM <u>TARGET ACQUISITION IN FULL SUNLIGHT</u>	
<input checked="" type="checkbox"/> OPER. <input type="checkbox"/> MAINT.	HPF <u>DETECT AND IDENTIFY TARGET(S)</u>	
	CONDITION SET # 1	CONDITION SET # 3
ERRORS	1.) DETECTION WITHOUT TARGET. 2.) TARGET WITHOUT DETECTION. 3.) FRIENDLY VS. ENEMY ERROR. 4.) TARGET TYPE ERROR (FANTAIL, BAMBUR, RECON, ETC.) 5.) TARGET MODEL ERROR.	SAME AS CONDITION SET # 1
MAXIMUM ACCEPTABLE TIME	20 SECONDS	30 SECONDS
PERFORMANCE CRITERION	TRIAL FAILS IF: ANY 3 OR MORE OF ABOVE ERRORS ARE MADE, OR IF TRIAL TAKES MORE THAN 20 SECONDS.	TRIAL FAILS IF: ERRORS 1 OR 2 OCCUR, OR ERRORS 3, 4, AND 5 ALL OCCUR. OR IF TRIAL TAKES MORE THAN 30 SECONDS.
STATISTIC	PERCENTAGE OF SUCCESSFUL HPF TRIALS	PERCENTAGE OF SUCCESSFUL HPF TRIALS
STATISTIC CRITERION	STATISTIC FAILS IF: FEWER THAN 90% TRIAL SUCCESSES.	<u>ACROSS CONDITION SETS.</u>

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SAMPLE

HRTES

CRITERION WORKSHEET

SYSTEM FUNCTION		DESTROY AIRCRAFT
SM		TARGET ACQUISITION IN FULL SUNLIGHT
<input checked="" type="checkbox"/> OPER. <input type="checkbox"/> MAINT.		HPF
		SELECT TARGET AND TARGET ORDER
CONDITION SET # 2		CONDITION SET #
ERRORS	1) INCORRECT TARGET ORDER SELECTED 2) INAPPROPRIATE AIRCRAFT SELECTED AS TARGETS.	
MAXIMUM ACCEPTABLE TIME	15 SECONDS	
PERFORMANCE CRITERION	TRIAL FAILS IF: 1) RANK ORDER OF SELECTED TARGETS DOES NOT CORRELATE WITH CORRECT RANK ORDER AT LEAST 80%. OR 2) 20% INAPPROPRIATE AIRCRAFT SELECTED AS TARGETS OR IF TRIAL TAKES MORE THAN 15 SECONDS.	
STATISTIC	AVERAGE ERRORS & TIME	
STATISTIC CRITERION	STATISTIC FAILS IF: FEWER THAN 75% TRIAL SUCCESSFULS.	

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CONTENTS

1. Performance Data Collection Worksheet
2. Beginning and End Point Worksheet
3. Planning Data Collection Worksheet (8 pages)
4. Guidelines for the OT Training Data Collection Worksheet
5. OT Training Data Collection Worksheet
6. Guidelines for Collecting Data for Diagnosis During OT (2 pages)
7. HPF Difficulty Worksheet for OT Observers
8. HPF Difficulty Worksheet for OT Participants
9. Performance Difficulty Questionnaire for OT Observers
10. Performance Difficulty Questionnaire for OT Participants
11. Critical Incident Report
12. Opinion Summary Data Worksheet
13. Statistic Worksheet

HRTES

WORKSHEET FOR PLANNING DATA COLLECTION

Consider the Performance Criterion of the HPF's and ask:

(1) Are measures best taken by an:

Observer

Instrumentation

Combination of Both

If you selected Observer, or Combination of Both, continue with 2.

(2) Is there space for an observer without significantly disturbing the performance you want to measure?

YES

NO

If the answer to this question is no, you will probably have to collect your data with instrumentation; turn to Step 18.

(3) What sort of background (previous training, experience, MOS, etc.) will be required of the observer(s)?

HRTES

WORKSHEET FOR PLANNING DATA COLLECTION (Continued)

- (4) How many observers, with this background, will be required to measure the performance?

- (5) What is the source of observers with appropriate backgrounds?

- (6) How long, in advance of the OT, must you begin to arrange for the availability of these observers?

- (7) What date will this be?

- (8) What sort of training will be required for the observers?

HRTES

WORKSHEET FOR PLANNING DATA COLLECTION (Continued)

- (9) Who will provide this training? The answer to this question may be obvious if there are OT personnel who have been dedicated to observation training. If the answer is not obvious, you should consider repeating Steps 2-8 substituting the words "observer trainer" for the word "observer."

- (10) What sort of materials, equipment, and information will be required for the observer training?

- (11) Who will supply observer training material?

- (12) How much lead time is required for the development of observer training material?

HRTES

WORKSHEET FOR PLANNING DATA COLLECTION (Continued)

Date development must begin -

Date all material must be completed -

(13) Where will observer training take place?

(14) How long will observer training take?

(15) What kind of Data Collection Forms (Checklists, etc.) will be required?

(16) Who will produce these forms?

HRTES

WORKSHEET FOR PLANNING DATA COLLECTION (Continued)

- (17) By what date must these forms be completed?

If you selected Instrumentation or Combination of Both continue with Step 18.

- (18) What kind(s) of instrumentation is required to obtain the necessary data?

- (19) Is there space for the instrumentation without significantly disturbing the performance you want to measure?

YES

NO

If the answer to this question is no, and there is also inadequate space for an observer, you will have to either:

- (1) Switch to another variety of instrumentation,
or
- (2) Collect this information through debriefing.

HRTES

WORKSHEET FOR PLANNING DATA COLLECTION (Continued)

(20) Is there adequate power for the device?

YES

NO

If the answer to this question is no, you will have to either:

- (1) Switch to another variety of instrumentation,
or
- (2) Provide another source of power,
or
- (3) Use an observer to collect data,
or
- (4) Collect this information through debriefing.

(21) Is the instrumentation available to you? To answer this question adequately, you will first have to find out:

- (1) If it already exists

YES

NO

- (2) Where it can be obtained

(3) The lead time for obtaining it

(4) How long it takes to install it in your System

If the answer is no, you will have to

- (1) Switch to another variety of instrumentation,
or
- (2) Use an observer to collect data,
or
- (3) Collect this information through debriefing.

(22) Are installation and maintenance of the instrumentation going to require technicians dedicated to this project?

YES

NO

The answer to this question may be obvious if there are OT personnel who have already been dedicated to this function. If the answer is not obvious, you should consider repeating the most applicable of Steps 2-8 substituting the word technician for observer.

If you selected Combination of Both, all questions from 2-22 apply to you. In addition answer:

- (23) Is there enough space, for both the observer and the instrumentation, without significantly disturbing the performance you want to measure?

YES

NO

If the answer to this question is no, you will have to:

- (1) Switch to another form of instrumentation,
or
- (2) Remove either the observer or the instrumentation,
or
- (3) Collect this information through debriefing.

HRTES

GUIDELINES FOR COMPLETING OT TRAINING DATA COLLECTION WORKSHEET

You are asked to record the amount of time required for training. This package includes the Guidelines you are reading; a list of Human Performance Functions (these are the tasks which you trained); and the "OT Training Data Collection Worksheet." Immediately following OT Training, fill out the "OT Training Data Collection Worksheet." The following instructions will aid you in completing the Worksheet:

- (1) List the tasks (HPF's) you trained in the left-hand column of the Worksheet. Examine the enclosed list of tasks (HPF's and select those you have trained.
- (2) Potential training/practice methods are listed on the matrix edge. If you used a method not listed, add it.
- (3) Each cell should be filled in with the number of hours or fraction of hours used to train each task according to each training method.
- (4) Add across each row to determine the "sum" of total training and practice time for a given task.
- (5) Return the Worksheet to the sender to be included with other test documentation.

HRTES

The "Detailed Test Plan" for this OT divides the performance of the system to be tested into System Functions. It then divides each System Function into System Performance Issues (SPI's). It then divides each SPI into generalized tasks called Human Performance Functions (HPF's) which are performed under condition sets.

Following the completion of testing of a group of tasks (HPF's), it is necessary that data be taken as to the difficulty of performing those tasks. This should be done immediately following completion. There are two sources of this data: the actual participants in the OT (players), and the observers of the task performance.

This package contains (1) "Task (HPF) Difficulty Worksheets" for both participants (player) and observers, in which the task to be performed have been recorded; (2) "Performance Difficulty Questionnaires" for both participants and observers; and (3) "Critical Incident Reports." "Critical Incident Reports" should be distributed to all participants and observers to be completed when an accident or near-accident occurs. The use of the other contents of this package will be explained in the following guidelines:

- (1) Administer the "Task (HPF) Difficulty Worksheet" to each participant (player) and fill the appropriate one yourself immediately following completion of testing of each group of tasks (HPF's) performed together. This administration should take place as soon as possible. The longer the time between completion and administration, the more information that is lost.

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HRTES

GUIDELINES FOR COLLECTING DATA FOR DIAGNOSIS DURING OT

This administration consists of each participant and observer rating the difficulty of performance of each task on a 0-100 scale: A rating of 50 or above means that the rater considers the task reasonably difficult. When this is the case, it is necessary to find out the cause of the difficulty.

- (2) When a task is rated 50 or above by any participant (player) or observer, that individual then completes either the "Performance Difficulty Questionnaire" for that task. To prepare this questionnaire, fill in the information at the top of the first page and the appropriate conditions for #19.
- (3) Return all completed questionnaires, worksheets, and "Critical Incident Reports" to the sender.

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HRTES

PERFORMANCE DIFFICULTY QUESTIONNAIRE (FOR OBSERVERS) (CONTINUED)

NAME: _____ TASK _____
DATE: _____
CONDITION SET: _____ SPI: _____

SYSTEM FUNCTION: _____

You have just observed: _____

and have said that it was difficult to do. Answer the following questions, about this task by assigning rating scores to them.

1. UNDERSTANDING PROCEDURE

How difficult was understanding what participants (players) were supposed to do and how they were supposed to do it for the specific task listed above?

COMPLETELY SATISFACTORY 100	75	IN BETWEEN 50	25	COMPLETELY UNSATISFACTORY 0
Understanding was no problem, at all		It was moderately difficult to under- stand		It was so difficult that it was not possible to adequate- ly understand

2. READING/HEARING DISPLAYS

How well could participants (players) read and/or hear the displays which were required for the performance of this task?

COMPLETELY SATISFACTORY 100	75	IN BETWEEN 50	25	COMPLETELY UNSATISFACTORY 0
Readable/hearable without effort		Moderate effort needed for displays		Impossible to ade- quately read and/or hear displays

HRTES

PERFORMANCE DIFFICULTY QUESTIONNAIRE (FOR OBSERVERS) (CONTINUED)

3. UNDERSTANDING DISPLAYS

How well could participants understand the information which was presented by the displays during this task performance?

COMPLETELY SATISFACTORY			<input type="checkbox"/>	COMPLETELY UNSATISFACTORY
100	75	IN BETWEEN	25	0
Extremely easy to understand		50		Presentation of information so difficult that it could not be adequately understood
		Moderately difficult to understand		

4. USEFULNESS OF DISPLAY INFORMATION

How effectively did the display(s) used during this task deliver the right information and in a timely way?

COMPLETELY SATISFACTORY			<input type="checkbox"/>	COMPLETELY UNSATISFACTORY
100	75	IN BETWEEN	25	0
All information needed for this performance was provided at the right time		50		Information delivered was either completely inadequate, incorrect or so late as to be useless
		The majority of the required information was delivered, usually in time		

5. MANIPULATION DIFFICULTY

Check any problems encountered when trying to manipulate the control(s), or any other piece of equipment, during the performance of this task:

- Too hard to move, too much effort required.
- Movement required unreasonable amount of dexterity.
- Too many other things required at the same time.
- Too easy to make a mistake.
- Movement different than what is reasonable to expect.
- Movement requires unavailable tool(s).
- Other, specify _____

5. MANIPULATION DIFFICULTY (Continued)

How effectively could participants actually make the required movements with either the controls or any other piece of equipment involved in the performance of this task?

COMPLETELY
SATISFACTORY

100

75

IN BETWEEN

50

25

COMPLETELY
UNSATISFACTORY

0

Control/equipment movements required caused absolutely no difficulty of any kind

Movements required were so difficult that they could not be made adequately

6. REACH/ACCESSIBILITY

Check any problems encountered when trying to reach the control(s), or any other piece of equipment which had to be manipulated, during this task:

- Too far away to reach reasonably.
- Angle to it was such that it could not be reasonably reached.
- It was fully or partially blocked by another object.
- It was fully or partially blocked by another person.
- Reaching it forced exposure to hazardous or highly uncomfortable objects (excessively hot, excessively cold, sharp, etc.)
- Other, specify _____

How effectively could participants reach and get at the control(s) or any other piece of equipment which had to be manipulated for the performance of this task?

COMPLETELY
SATISFACTORY

100

75

IN BETWEEN

50

25

COMPLETELY
UNSATISFACTORY

0

Controls/other pieces of equipment were accessible without effort

Controls/other pieces of equipment were accessible with moderate effort

Not accessible from either my assigned position or any other position which did not interfere with my performance

7. CONTROL CONFIGURATION

Check any problems encountered with the configuration of the control(s), or any other piece of equipment which had to be manipulated, during this task:

- Too hard to find.
- Too hard to determine what it was.
- Too close to other control/equipment.
- Too far from other control/equipment used in same performance.
- Used without looking at it much, and it felt too much like others.
- Too hard to tell when it was activated or moved to correct position.
- Other, specify _____

How useful was the actual configuration of the control, or other piece of equipment which had to be moved, for performance of this task?

COMPLETELY SATISFACTORY 100	75	IN BETWEEN 50	25	<input type="checkbox"/> COMPLETELY UNSATISFACTORY 0
Configuration caused absolutely no diffi- culty of any kind		Configuration had prob- lems, but caused only moderate difficulty		Configuration so poor it made performance impossibly difficult

8. DECISION DIFFICULTY

How difficult was it to make the decisions which were required for performance of this task?

COMPLETELY SATISFACTORY 100	75	IN BETWEEN 50	25	<input type="checkbox"/> COMPLETELY UNSATISFACTORY 0
Required decisions were very easy to make		Required decisions were moderately difficult to make		Required decisions were so difficult that they could not be made adequately

HRTES

PERFORMANCE DIFFICULTY QUESTIONNAIRE (FOR OBSERVERS) (CONTINUED)

9. TARGET/TERRAIN VISIBILITY

How well could participants see targets or any other elements of the external environment which were required for performance of this task?

COMPLETELY SATISFACTORY 100	75	IN BETWEEN 50	25	<input type="checkbox"/>	COMPLETELY UNSATISFACTORY 0
Visibility was excellent. It was easy to see all required parts of the environment, including targets		Visibility was adequate. Enough could be seen to permit the performance			Visibility was unacceptable. Targets and/or critical parts of the environment could not be seen

10. WORKSTATION DESIGN FOR VISIBILITY

Check any visibility problems encountered during this task caused by the work station design:

- Not enough light on outside of workstation.
- Window/port not big enough.
- Window/port not in right place.
- Window/port too dirty or distorted.
- Equipment/people in the way of window/port.
- Not enough light inside work station.
- Too much glare.
- Important equipment behind other equipment or people.
- Viewing angle from seat to equipment not good.
- Other: _____

SYSTEM _____ TEST _____ DATE _____ PAGE _____

NAME _____ TELEPHONE _____

HRTES

PERFORMANCE DIFFICULTY QUESTIONNAIRE (FOR OBSERVERS) (CONTINUED)

10. WORKSTATION DESIGN FOR VISIBILITY (Continued)

The design of some parts of the work station probably had an impact on participant's ability to see. What was the effect of those parts of the work station on the performance of this task?

COMPLETELY SATISFACTORY 100	75	IN BETWEEN 50	25	<input type="checkbox"/> COMPLETELY UNSATISFACTORY 0
Visual parts of work station produced no difficulty of any kind		Visual parts of work station produced moderate difficulty in performance		Visual parts of work station so poor that performance impossibly difficult

11. NOISE

Check any noise problems encountered during this task.

- Could not hear radio or other device which had to be heard.
- Could not hear other crew members.
- Noise produced fatigue.
- Noise disturbed concentration.
- Noise produced discomfort.
- Noise gave away location.
- Other: _____

What was the effect of noise in the workstation on the performance of this task?

COMPLETELY SATISFACTORY 100	75	IN BETWEEN 50	25	<input type="checkbox"/> COMPLETELY UNSATISFACTORY 0
Noise produced no difficulty of any kind		Noise produced moderate difficulty in performance		Noise so extreme that performance impossibly difficult

SYSTEM _____ TEST _____ DATE _____ PAGE _____

NAME _____ TELEPHONE _____

HRTES

PERFORMANCE DIFFICULTY QUESTIONNAIRE (FOR OBSERVERS) (CONTINUED)

12. MOTION

Check any motion problems encountered during this task:

- Vibration affected accurate use of controls.
- Vibration affected accurate reading of displays.
- Constant vibration produced fatigue.
- Vibration affected detection/identification of objects outside the workstation.
- Acceleration too great for the kind of seat support.
- Acceleration prevented reaching control.
- Acceleration prevented seeing display.
- Motion produced sickness.
- Other: _____

What was the effect of motion at the workstation on the performance of this task?

COMpletely SATISFACTORY 100	75	IN BETWEEN 50	25	<input type="checkbox"/> COMpletely UNSATISFACTORY 0
Motion produced no difficulty of any kind		Motion produced moderate difficulty in performance		Motion made the perfor- mance impossibly diffi- cult

SYSTEM _____ TEST _____ DATE _____ PAGE _____

NAME _____ TELEPHONE _____

HRTES

PERFORMANCE DIFFICULTY QUESTIONNAIRE (FOR OBSERVERS) (CONTINUED)

13. VENTILATION

Check any ventilation problems encountered during this task:

- Much too hot.
- Much too cold.
- Much too humid.
- Not enough fresh air flow.
- Exhaust fumes too strong.
- Gun/rocket fire products too strong.
- Bad odors produced nausea.
- Other: _____

What was the effect of ventilation in the work station on the performance of this task?

COMPLETELY SATISFACTORY 100		75	IN BETWEEN 50	25	<input type="checkbox"/>	COMPLETELY UNSATISFACTORY 0
Ventilation pro- duced no difference of any kind			Ventilation produced moderate difficulty in performance			Ventilation so inade- quate that performance impossible

SYSTEM _____ TEST _____ DATE _____ PAGE _____

NAME _____ TELEPHONE _____

14. WORKSTATION DIMENSIONS

Check any problems with the dimensions of the workstation encountered during this task:

- Work surface too small.
- Work surface in wrong place.
- Work surface at wrong height or angle.
- Not enough space to work because of equipment, or space allowed.
- Not enough space to work because of crowding with other crew members.
- Poor arrangement of equipment.
- Hatches too small.
- Hatches in wrong places.
- Other: _____

What effect did the dimensions of the work station have on the performance of this task?

COMPLETELY SATISFACTORY 100	75	IN BETWEEN 50	25	<input type="checkbox"/> COMPLETELY UNSATISFACTORY 0
Dimensions pro- duced no difficul- ties of any kind		Dimensions produced moderate difficulty in performance		Dimensions so poor that performance impossibly difficult

SYSTEM _____ TEST _____ DATE _____ PAGE _____

NAME _____ TELEPHONE _____

HRTES

PERFORMANCE DIFFICULTY QUESTIONNAIRE (FOR OBSERVERS) (CONTINUED)

15. SEATING

Check any seating problems encountered during this task:

- Seat too narrow.
- Seat at wrong height.
- Not enough back support.
- Seat back angle not right.
- Needs arm supports.
- Needs foot supports.
- Not enough head space.
- Not enough shoulder space.
- Not enough leg space.
- Not enough foot space.
- Seat does not absorb vibrations well enough.
- Seat uncomfortable and makes you tired.
- Seat needs to move or move more.
- Other: _____

What effect did the seating have on the performance of this task?

COMPLETELY SATISFACTORY		IN BETWEEN	<input type="checkbox"/>	COMPLETELY UNSATISFACTORY
100	75	50	25	0
Seating produced no difficulty of any kind		Seating produced moderate difficulty in performance		Seating so poor that performance impossibly difficult

SYSTEM _____ TEST _____ DATE _____ PAGE _____

NAME _____ TELEPHONE _____

16. SAFETY HAZARDS

Check any safety hazards encountered at the workstation during this task:

- Sharp, jagged, pointed object(s).
- Dangerous lack of head clearance.
- Dangerously hot material exposed.
- Source of electric shock exposed.
- Poisonous material exposed.
- Moving machinery exposed.
- So little light that accident could result.
- Glare so bright that accident could result.
- Dangerously high noise level.
- Dangerous lack of ventilation.
- Anchoring of equipment not adequate.
- Padding of equipment not adequate.
- Crew seat belts/restraints not adequate.
- Slippery walking or climbing surface.
- Handholds for lifting or climbing not adequate.
- Footholds for climbing not adequate.
- No adequate signal when equipment operation becomes dangerous.
- No adequate signal when outside situation becomes dangerous.
- Other: _____

Safety hazards can have two possible effects on performance--(1) they can produce actual injury which keeps performance from being adequate, and (2) they can produce worry about injury which keeps performance from being adequate. Complete the Safety Hazard scale on the next page.

SYSTEM _____ TEST _____ DATE _____ PAGE _____

NAME _____ TELEPHONE _____

HRTES

PERFORMANCE DIFFICULTY QUESTIONNAIRE (FOR OBSERVERS) (CONTINUED)

16. SAFETY HAZARDS (Continued)

What was the effect of safety hazards on the performance of this task?

COMPLETELY SATISFACTORY 100	75	IN BETWEEN 50	25	<input type="checkbox"/> COMPLETELY UNSATISFACTORY 0
Safety hazards pro- duced no difficulty of any kind		Safety hazards pro- duced moderate diffi- culty in performance		Safety hazards so extreme that perfor- mance impossible

17. TRAINING TIME

To what extent did participants spend adequate time training for this task?

COMPLETELY SATISFACTORY 100	75	IN BETWEEN 50	25	<input type="checkbox"/> COMPLETELY UNSATISFACTORY 0
Did not require any more training time at all		Got almost enough training time for this performance; a little more would have been helpful		Got <u>no</u> training time for the performance of this task

18. PRACTICE CONDITIONS

To what extent did participants practice for this task in _____

(condition) _____?

COMPLETELY SATISFACTORY 100	75	IN BETWEEN 50	25	<input type="checkbox"/> COMPLETELY UNSATISFACTORY 0
Had an adequate amount of practice of this task in this condition		Practiced this task in this condition, or a very similar one. Could have used more training time		Got <u>no</u> practice of this task in this condition

SYSTEM _____ TEST _____ DATE _____ PAGE _____

NAME _____ TELEPHONE _____

HRTES

PERFORMANCE DIFFICULTY QUESTIONNAIRE (FOR OBSERVERS) (CONTINUED)

19. TRAINER

How effective was the trainer in training this task?

COMPLETELY
SATISFACTORY

100

Trainer did as good a job training this task as was necessary

75

IN BETWEEN

50

Trainer did a responsible job of training this task

25

COMPLETELY
UNSATISFACTORY

0

Trainer was unable to teach this task

20. TRAINING METHOD(S)

How was this task trained?

- Lecture
- Film or other audio-visual method
- Reading printed material
- Paper and pencil workbook
- Practice in a simulator
- Watching someone doing it
- Doing it yourself with the actual hardware
- Other (specify): _____

How effective do you think this kind of training is for this task?

COMPLETELY
SATISFACTORY

100

The best method for training this task

75

IN BETWEEN

50

Could learn the task with this method, but it could have been improved a little

25

COMPLETELY
UNSATISFACTORY

0

Method provided no help in learning how to actually do this task

SYSTEM _____ TEST _____ DATE _____ PAGE _____

NAME _____ TELEPHONE _____

HRTES

PERFORMANCE DIFFICULTY QUESTIONNAIRE (FOR OBSERVERS) (CONTINUED)

21. WORKLOAD

To what extent was there too much work to do in the time allotted considering everything being done at the time of this task performance? This includes other activities that were being performed at the same time.

COMPLETELY SATISFACTORY 100	75	IN BETWEEN 50	25	COMPLETELY UNSATISFACTORY 0
Workload perfectly adequate during performance		Moderate performance difficulty caused by workload. Player fully loaded.		Totally inade- quate workload made task performance impossible

SYSTEM _____ TEST _____ DATE _____ PAGE _____

NAME _____ TELEPHONE _____

HRTES

PERFORMANCE DIFFICULTY QUESTIONNAIRE (FOR OBSERVERS) (CONTINUED)

TO THE TEST OBSERVER, OR OTHER APPLICABLE OT PERSONNEL:

If there are other places of information which you believe are applicable and important to this field test, write them here.

SYSTEM _____ TEST _____ DATE _____ PAGE _____

NAME _____ TELEPHONE _____

HRTES

PERFORMANCE DIFFICULTY QUESTIONNAIRE FOR PARTICIPANTS (PLAYERS)

NAME: _____ TASK (HPF): _____

DATE: _____

CONDITION SET: _____ SPI: _____

SYSTEM FUNCTION: _____

You have just completed: _____

and have said that it was difficult to do. Answer the following questions, about this task, by assigning rating scores to them.

1. UNDERSTANDING

How difficult was understanding what you were supposed to do and how you were supposed to do it for the specific task listed above?

COMPLETELY
SATISFACTORY
100

75

IN BETWEEN
50

25

COMPLETELY
UNSATISFACTORY
0

Understanding was
no problem, at all

It was moderately
difficult to under-
stand

It was so difficult
that it was not
possible to adequately
understand

2. READING/HEARING DISPLAYS

How well could you read and/or hear the displays which were required for the performance of this task?

COMPLETELY
SATISFACTORY
100

75

IN BETWEEN
50

25

COMPLETELY
UNSATISFACTORY
0

Readable/hearable
without effort

Moderate effort
needed for displays

Impossible to adequately
read and/or hear displays

SYSTEM _____ TEST _____ DATE _____ PAGE _____

NAME _____ TELEPHONE _____

HRTES

PERFORMANCE DIFFICULTY QUESTIONNAIRE FOR PARTICIPANTS (PLAYERS) (CONTINUED)

3. UNDERSTANDING DISPLAYS

How well could you understand the information which was presented by the displays during this task performance?

COMPLETELY SATISFACTORY 100 Extremely easy to understand	75	IN BETWEEN 50 Moderately difficult to understand	25	<input type="checkbox"/> COMPLETELY UNSATISFACTORY 0 Presentation of information so diffi- cult that it could not be adequately understood
--	----	---	----	--

4. USEFULNESS OF DISPLAY INFORMATION

How effectively did the display(s) used in this task deliver the right information and in a timely way?

COMPLETELY SATISFACTORY 100 All information needed for this performance was provided at the right time	75	IN BETWEEN 50 The majority of the required information was delivered, usually in time	25	<input type="checkbox"/> COMPLETELY UNSATISFACTORY 0 Information delivered was either completely inadequate, incorrect, or so late as to be useless
---	----	--	----	---

5. MANIPULATION DIFFICULTY

Check any problems encountered when trying to manipulate the control(s), or any other piece of equipment, during the performance of this task:

- Too hard to move, too much effort required.
- Movement required unreasonable amount of dexterity.
- Too many other things required at the same time.
- Too easy to make a mistake.
- Movement different than what is reasonable to expect.
- Movement requires unavailable tool(s).
- Other, specify:

SYSTEM _____ TEST _____ DATE _____ PAGE _____

NAME _____ TELEPHONE _____

HRTES

PERFORMANCE DIFFICULTY QUESTIONNAIRE FOR PARTICIPANTS (PLAYERS) (CONTINUED)

5. MANIPULATION DIFFICULTY (Continued)

How effectively could you actually make the required movements with either the controls or any other piece of equipment involved in the performance of this task?

COMPLETELY
SATISFACTORY
100

75

Control/equipment movements required caused absolutely no difficulty of any kind

IN BETWEEN
50

25

It was possible to make the required movements or controls/equipment with moderate difficulty



COMPLETELY
UNSATISFACTORY
0

Movements required were so difficult that they could not be made adequately

6. REACH/ACCESSIBILITY

Check any problems encountered when trying to reach the control(s), or any other piece of equipment which had to be manipulated, during this task:

- Too far away to reach reasonably.
- Angle to it was such that it could not be reasonably reached.
- It was fully or partially blocked by another object.
- It was fully or partially blocked by another person.
- Reaching it forced exposure to hazardous or highly uncomfortable objects (excessively hot, excessively cold, sharp, etc.)
- Other, specify: _____

How effectively could you reach and get at the control(s) or any other piece of equipment which had to be manipulated for the performance of this task?

STEM _____ TEST _____ DATE _____ PAG _____

AME _____ TELEPHONE _____

HRTES

PERFORMANCE DIFFICULTY QUESTIONNAIRE FOR PARTICIPANTS (PLAYERS) (CONTINUED)

6. REACH/ACCESSIBILITY (Continued)

COMPLETELY
SATISFACTORY

100

75

IN BETWEEN

50

25

COMPLETELY
UNSATISFACTORY

0

Controls/other pieces
or equipment were
accessible without
effort

Controls/other pieces
of equipment were
accessible with moder-
ate effort

Not accessible from either
my assigned position or
any other position which
did not interfere with
my performance

7. CONTROL CONFIGURATION

Check any problems encountered with the configuration of the control(s),
or any other piece of equipment which had to be manipulated, during
this task:

- Too hard to find.
- Too hard to determine what it was.
- Too close to other control/equipment.
- Too far from other control/equipment used in same performance.
- Used without looking at it much, and it felt too much like others.
- Too hard to tell when it was activated or moved to correct position.
- Other, specify: _____

How useful was the actual configuration of the control, or other piece
of equipment which had to be moved, for the performance of this task?

COMPLETELY
SATISFACTORY

100

75

IN BETWEEN

50

25

COMPLETELY
UNSATISFACTORY

0

Configuration caused
absolutely no diffi-
culty of any kind

Configuration had prob-
lems, but caused only
moderate difficulty

Configuration so poor
it made performance
impossibly difficult

SYSTEM _____ TEST _____ DATE _____ PAGE _____

NAME _____ TELEPHONE _____

HRTES

PERFORMANCE DIFFICULTY QUESTIONNAIRE FOR PARTICIPANTS (PLAYERS) (CONTINUED)

8. DECISION DIFFICULTY

How difficult was it to make the decisions which were required for the performance of this task?

COMPLETELY
SATISFACTORY

100

75

Required decisions were very easy to make

IN BETWEEN

50

Required decisions were moderately difficult to make

25

COMPLETELY
UNSATISFACTORY

0

Required decisions were so difficult that they could not be made adequately

9. TARGET VISIBILITY

How well could you see targets or any other elements of the external environment which were required for the performance of this task?

COMPLETELY
SATISFACTORY

100

75

Visibility was excellent. It was easy to see all required parts of the environment, including targets

IN BETWEEN

50

Visibility was adequate. Enough could be seen to permit the performance

25

COMPLETELY
UNSATISFACTORY

0

Visibility was unacceptable. Targets and/or critical parts of the environment could not be seen

SYSTEM _____ TEST _____ DATE _____ PAGE _____

NAME _____ TELEPHONE _____

HRTES

PERFORMANCE DIFFICULTY QUESTIONNAIRE FOR PARTICIPANTS (PLAYERS) (CONTINUED)

10. WORKSTATION DESIGN FOR VISION

Check any visibility problems encountered during this task caused by the workstation:

- Not enough light on outside of work station.
- Window/port not big enough.
- Window/port not in right place.
- Window/port too dirty or distorted.
- Equipment/people in the way of window/port.
- Not enough light inside workstation.
- Too much glare.
- Important equipment behind other equipment or people.
- Viewing angle from seat too equipment not good.
- Other, specify: _____

The design of some parts of your workstation probably had an impact on your ability to see. What was the effect of those parts of the workstation on the performance of this task?

COMPLETELY
SATISFACTORY
100

75

IN BETWEEN
50

25

Visual parts of workstation produced no difficulty of any kind

Visual parts of workstation produced moderate difficulty in performance



COMPLETELY
UNSATISFACTORY
0

Visual parts of workstation so poor that performance possibly difficult

SYSTEM _____ TEST _____ DATE _____ PAGE _____

NAME _____ TELEPHONE _____

HRTES

PERFORMANCE DIFFICULTY QUESTIONNAIRE FOR PARTICIPANTS (PLAYERS) (CONTINUED)

11. NOISE

Check any noise problems encountered during this task.

- Could not hear radio.
- Could not hear other crew members.
- Noise produced fatigue.
- Noise disturbed concentration.
- Noise produced discomfort.
- Noise gave away location.
- Other, specify: _____

What was the effect of noise in the workstation on the performance of this task?

COMPLETELY
SATISFACTORY
100

75

IN BETWEEN
50

25

COMPLETELY
UNSATISFACTORY
0

Noise produced no
difficulty of any
kind

Noise produced moder-
ate difficulty in
performance

Noise so extreme that
performance impossibly
difficult

12. MOTION

Check any motion problems encountered during this task.

- Vibration affected accurate use of controls.
- Vibration affected accurate reading of displays.
- Constant vibration produced fatigue.
- Vibration affected detection/identification of objects outside the workstation.
- Acceleration too great for the kind of seat support.
- Acceleration prevented reaching control.
- Acceleration prevented seeing display.
- Kind of motion nausea.
- Other, specify: _____

SYSTEM _____ TEST _____ DATE _____ PAGE _____

NAME _____

TELEPHONE _____

HRTES

PERFORMANCE DIFFICULTY QUESTIONNAIRE FOR PARTICIPANTS (PLAYERS) (CONTINUED)

12. MOTION (Continued)

What was the effect of motion at your workstation on the performance of this task?

COMPLETELY
SATISFACTORY
100

Motion produced
no difficulty
of any kind

75

IN BETWEEN
50

Motion produced moder-
ate difficulty in
performance

25

COMPLETELY
UNSATISFACTORY
0

Motion made the per-
formance impossibly
difficult

13. VENTILATION

Check any ventilation problems encountered during this task:

Much too hot.

Much too cold.

Much too humid.

Not enough fresh air flow.

Exhaust fumes too strong.

Gun/rocket fire products too strong.

Bad odors produced nausea.

Other, specify: _____

What was the effect of ventilation in the workstation on the performance of this task?

COMPLETELY
SATISFACTORY
100

Ventilation pro-
duced no difficulty
of any kind

75

IN BETWEEN
50

Ventilation produced
moderate difficulty
in performance

25

COMPLETELY
UNSATISFACTORY
0

Ventilation so inade-
quate that performance
impossible

SYSTEM _____

TEST _____

DATE _____

PAGE _____

NAME _____

TELEPHONE _____

HRTES

PERFORMANCE DIFFICULTY QUESTIONNAIRE FOR PARTICIPANTS (PLAYERS) (CONTINUED)

14. WORKSTATION DIMENSIONS

Check any problems with the dimensions of the workstation encountered during this task:

- Work surface too small.
- Work surface in wrong place.
- Work surface at wrong height or angle.
- Not enough space to work because of equipment, or space allowed.
- Not enough space to work because of other crew members.
- Poor arrangement of equipment.
- Hatches too small.
- Hatches in wrong places.
- Other, specify: _____

What effect did the dimensions of your workstation have on the performance of this task?

COMPLETELY
SATISFACTORY
100

75

Dimensions pro-
duced no diffi-
culties of any kind

IN BETWEEN
50

Dimensions produced
moderate difficulty
in performance

25



COMPLETELY
UNSATISFACTORY
0

Dimensions so poor
that performance
impossibly difficult

SYSTEM _____ TEST _____ DATE _____ PAGE _____

NAME _____ TELEPHONE _____

HRTES

PERFORMANCE DIFFICULTY QUESTIONNAIRE FOR PARTICIPANTS (PLAYERS) (CONTINUED)

15. SEATING

Check any seating problems encountered during this task:

- Seat too narrow.
- Seat at wrong height.
- Not enough back support.
- Seat back angle not right.
- Needs arm supports.
- Needs foot supports.
- Not enough head space.
- Not enough shoulder space.
- Not enough leg space.
- Not enough foot space.
- Seat does not absorb vibrations well enough.
- Seat uncomfortable and makes you tired.
- Seat needs to move or move more.
- Other, specify: _____

What effect did the seating have on the performance of this task?

COMPLETELY
SATISFACTORY

100

Seating produced
no difficulty of
any kind

75

IN BETWEEN

50

Seating produced moder-
ate difficulty in per-
formance

25

COMPLETELY
UNSATISFACTORY

0

Seating so poor that
performance impossibly
difficult

SYSTEM _____ TEST _____ DATE _____ PAGE _____

NAME _____ TELEPHONE _____

HRTES

PERFORMANCE DIFFICULTY QUESTIONNAIRE FOR PARTICIPANTS (PLAYERS) (CONTINUED)

17. TRAINING TIME

To what extent did you spend adequate time training for this task?

COMPLETELY
SATISFACTORY

100 75

Did not require any
more training time
at all

IN BETWEEN

50 25

Got almost enough train-
ing time for this per-
formance; a little more
would have been helpful

COMPLETELY
UNSATISFACTORY

0

Got no training time
for the performance
of this task

18. PRACTICE

To what extent did you practice for this task in _____

?

(condition)

COMPLETELY
SATISFACTORY

100 75

Had an adequate
amount of practice
of this task in
this condition

IN BETWEEN

50 25

Practiced this task
in this condition, or
a very similar one. Could
have used more training
time

COMPLETELY
UNSATISFACTORY

0

Got no practice of
this task in this
condition

19. TRAINER

How effective was the trainer in training this task?

COMPLETELY
SATISFACTORY

100 75

Trainer did as good
a job training this
task as was necessary

IN BETWEEN

50 25

Trainer did a respon-
sible job of training
this task

COMPLETELY
UNSATISFACTORY

0

Trainer was unable
to teach this task

SYSTEM _____ TEST _____ DATE _____ PAGE _____

NAME _____ TELEPHONE _____

HRTES

PERFORMANCE DIFFICULTY QUESTIONNAIRE FOR PARTICIPANTS (PLAYERS) (CONTINUED)

16. SAFETY HAZARDS

Check any safety hazards encountered at the workstation during this task:

- Sharp, jagged, pointed object(s).
- Dangerous lack of head clearance.
- Dangerously hot material exposed.
- Source of electric shock exposed.
- Poisonous material exposed.
- Moving machinery exposed.
- So little light that accident could result.
- Glare so bright that accident could result.
- Dangerously high noise level.
- Dangerous lack of ventilation.
- Anchoring of equipment not adequate.
- Padding of equipment not adequate.
- Crew seat belts/restraints not adequate.
- Slippery walking or climbing surface.
- Handholds for lifting or climbing not adequate.
- Footholds for climbing not adequate.
- No adequate signal when equipment operation becomes dangerous.
- No adequate signal when outside situation becomes dangerous.
- Other, specify: _____

Safety hazards can have two possible effects on performance--(1) they can produce actual injury which keeps performance from being adequate, and (2) they can produce worry about injury which keeps performance from being adequate. What was the effect of safety hazards on the performance of this task?

COMPLETELY
SATISFACTORY

100

Safety hazards produced no difficulty of any kind

75

IN BETWEEN

50

Safety hazards produced moderate difficulty in performance

COMPLETELY
UNSATISFACTORY

0

Safety hazards so extreme that performance impossible

SYSTEM _____ TEST _____ DATE _____ PAGE _____

NAME _____ TELEPHONE _____

HRTES

PERFORMANCE DIFFICULTY QUESTIONNAIRE FOR PARTICIPANTS (PLAYERS) (CONTINUED)

20. TRAINING METHOD

How was this task trained?

- Lecture.
- Film or other audio-visual method.
- Reading printed material.
- Paper and pencil workbook.
- Practice in a simulator.
- Watching someone doing it.
- Doing it yourself with the actual hardware.
- Other, specify: _____

How effective do you think this kind of training is for this task?

COMPLETELY
SATISFACTORY
100

75

IN BETWEEN
50

25

COMPLETELY
UNSATISFACTORY
0

The best method
for training
this task

Could learn the task
with this method, but
it could have been
improved a little

Method provided no
help in learning how
to actually do this
task

SYSTEM _____ TEST _____ DATE _____ PAGE _____

NAME _____ TELEPHONE _____

HRTES

PERFORMANCE DIFFICULTY QUESTIONNAIRE FOR PARTICIPANTS (PLAYERS) (CONTINUED)

21. WORKLOAD

To what extent was the work load adequate while this task was being performed? This should include considering all tasks which were performed at the same time as this task.

COMPLETELY SATISFACTORY 100	75	IN BETWEEN 50	25	COMPLETELY UNSATISFACTORY 0
Workload perfectly adequate during performance		Moderate performance difficulty caused by workload. You were fully loaded		Totally inadequate workload made task performance impossible

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PERFORMANCE DIFFICULTY QUESTIONNAIRE
FOR PARTICIPANTS (PLAYERS) (CONTINUED)

TO THE TEST PARTICIPANT (PLAYER):

If there are other pieces of information which you believe are applicable and important about this field test, write them here.

SYSTEM _____ TEST _____ DATE _____ PAGE _____

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HRTES

CRITICAL INCIDENT REPORT

HPF

CONDITIONS

WHAT HAPPENED?

WHAT PRODUCED THIS PROBLEM?

HOW DID YOU DISCOVER THIS PROBLEM?

HOW DID YOU, OR WOULD YOU, SOLVE THIS PROBLEM?

WHAT DID IT, OR COULD IT, HAVE CAUSED?

- PARTICIPANT
- OBSERVER

SYSTEM _____ TEST _____ DATE _____ PAGE _____

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HRTES

OPINION SUMMARY DATA WORKSHEET

HPF											
SPI											
SYSTEM FUNCTION											
CONDITION SET #	DIFFICULTY SCORE										
OPINION SCALES	0	10	20	30	40	50	60	70	80	90	100
1. Understanding Procedures											
2. Display Readability/Hearability Measurement											
3. Display Information Understanding											
4. Usefulness of Display Information											
5. Manipulation Difficulty											
6. Reach/Accessibility											
7. Control Configuration											
8. Decision Difficulty											
9. Target/Terrain Visibility											
10. Workstation Design for Visibility											
11. Sound											
12. Motion											
13. Ventilation											
14. Workstation Dimensions											
15. Seating											
16. Safety											
17. Training Time											
18. Practice Condition											
19. Trainer(s)											
20. Training Method											
21. Workload											

SYSTEM _____ TEST _____ DATE _____ PAGE _____

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HRTES

STATISTIC WORKSHEET

SYSTEM FUNCTION

SPI

HPF

CONDITION SET(S)

OPER

TYPE OF STATISTIC

MAINT

UNITS

TRIALS	1	2	3	4	5	6	7	8	9	10	
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											
SUMS											GRAND SUM
SUMS/ TRIALS											

STATISTIC OUTCOME

LEVEL OF CONFIDENCE

UPPER CONFIDENCE LIMIT

LOWER CONFIDENCE LIMIT

SYSTEM _____ TEST _____ DATE _____ PAGE _____

NAME _____ TELEPHONE _____

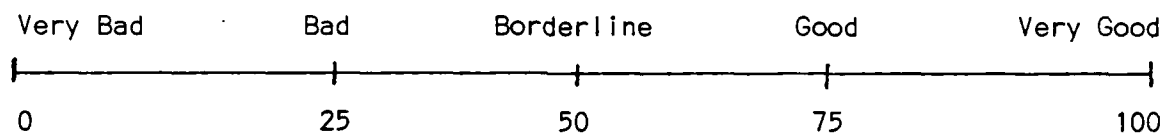
CONTENTS

1. Guidelines for Defining Value Functions (Including Example)
2. Value Function Worksheet
3. Sample Function Worksheet

HRTES

GUIDELINES FOR DEFINING VALUE FUNCTIONS

You have received a package of worksheets. Each package consists of a set of "Criterion Worksheets," "Value Function Worksheets," "Final Condition Sets Worksheets," and these Guidelines. Your task is to assist in developing Value Functions by which results from the field test will be evaluated. For each statistic, you will be asked to develop a Value Function. By means of these Value Functions the level of performance of the various HPF's will be evaluated. The value assigned to each statistic outcome is a number between 0 and 100. 0 - means very bad performance; 100 - means very good performance. The value scale will look as follows:



On the "Criterion Worksheet," is specified what constitutes one successful trial, the type of the statistic, and the statistic criterion.

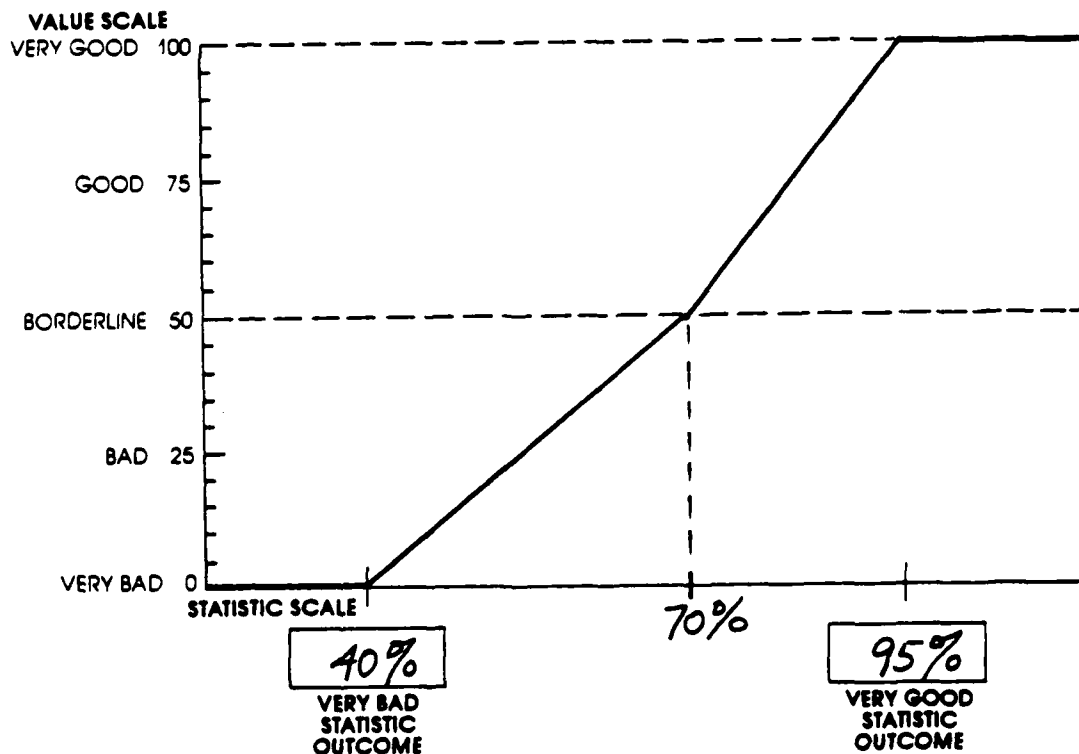
One point on each Value Function is determined in advance: the statistic criterion point. This is done by assigning to the statistic criterion of each HPF the value 50 (borderline). This preassignment may aid you in assessing other points on the Value Function. You will be asked to determine an outcome with a value of 0 (very bad) and an outcome with a value of 100 (very good) for each statistic. From those determinations and from the criterion point, an approximated Value Function for each statistic will be developed.

Before you go through the instructions, consider the following examples:

HRTES

GUIDELINES FOR DEFINING VALUE FUNCTIONS (Continued)

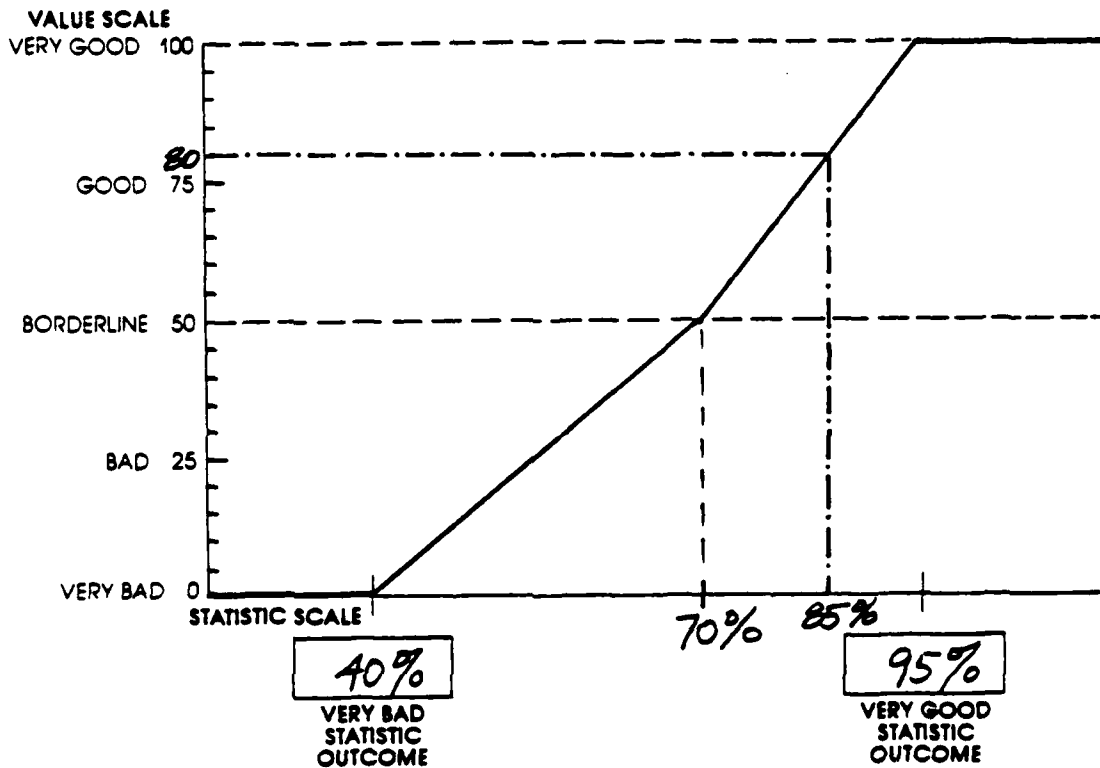
The HPF is "Target Detection and Identification." The statistic developed for this HPF is "Percentage of Successful Trials." The definition of the performance criterion of one trials and the condition sets are specified, and the statistic criterion is 70%. After considering the performance criterion and condition set, you and some other experts together decided that 40% of successful trials is very bad performance and 95% of successful trials is very good performance of this HPF. Plotting straight lines between the given points, the approximated Value Function would look as follows:



HRTES

GUIDELINES FOR DEFINING VALUE FUNCTIONS (Continued)

Using this Value Function, the value of the statistic outcome would be assessed. For example, the value of the outcome - 85% of successful trials would be 80, and would be determined as follows:



In the following paragraphs, specific Guidelines for selecting the "very good" and "very bad" outcome of each statistic are given:

- (1) Determine the "very good" outcome for the statistic and record it in the appropriate space on the Worksheet.

For each statistic, there is a range of plausible or conceivable performance which you consider to be very good. As the goodness of performance increases, usually the effectiveness of the system increases. This relationship between increased performance goodness and increased system effectiveness continues until a point is reached at which the increase in performance goodness produces only negligible additional system effectiveness. That point in the range of plausible performance is the "very good" outcome. In the previous example, 95% is the smallest percentage of success which you still considered to be very good.

Selecting the "very good" outcome - Determine the poorest outcome of the statistic in question, which you still consider to be very good. This statistic outcome is given the value of 100. This may be done using any strategy with which you feel comfortable. If you want some aid, the following is one possible strategy for selecting the "very good" outcome:

(a) For each statistic, identify some clearly unacceptable outcome according to the statistic type (percentage or average), and then identify successively better statistic outcomes. As you consider these better outcomes, ask yourself the following two questions:

- (1) Is this outcome plausible; could it really be expected to take place?
- (2) Does this outcome produce additional appreciable system effectiveness as compared with the last previous outcome I considered?

(b) If the answers to the two questions above are both "yes," you have not yet located the "very good" outcome. Identify the next better statistic outcome. If the answer to either of these two questions is no, the last previous performance outcome is the "very good" outcome.

- (2) Determine the "very bad" outcome, and record it in the appropriate space on the Worksheet.

For each statistic there is a range of plausible or conceivable performance which you consider to be very bad. As the goodness of performance decreases, usually the effectiveness of the system decreases. This relationship between decreased performance and decreased system effectiveness continues until a point may be reached at which the decrease in performance goodness produces only a negligible decrease in the system's effectiveness. That point, in the range of plausible performance, is the "very bad" outcome.

Selecting the "very bad" outcome - Determine the best outcome of the statistic in question which you still consider to be very bad. This statistic outcome is given the value of zero. Once again, use any strategy for selecting this outcome which seems reasonable to you. If you want some aid, the following strategy is one possible technique:

(a) For each performance, start at the "very good" outcome, which you recorded in (1a), and identify successively worse statistic outcomes which could be obtained from that statistic. As you identify these worse outcomes, ask yourself the following questions:

- (1) Is this outcome plausible; could it really be expected to take place?
- (2) Does this outcome product additional appreciable reduction in system effectiveness as compared with the last previous outcome I considered?

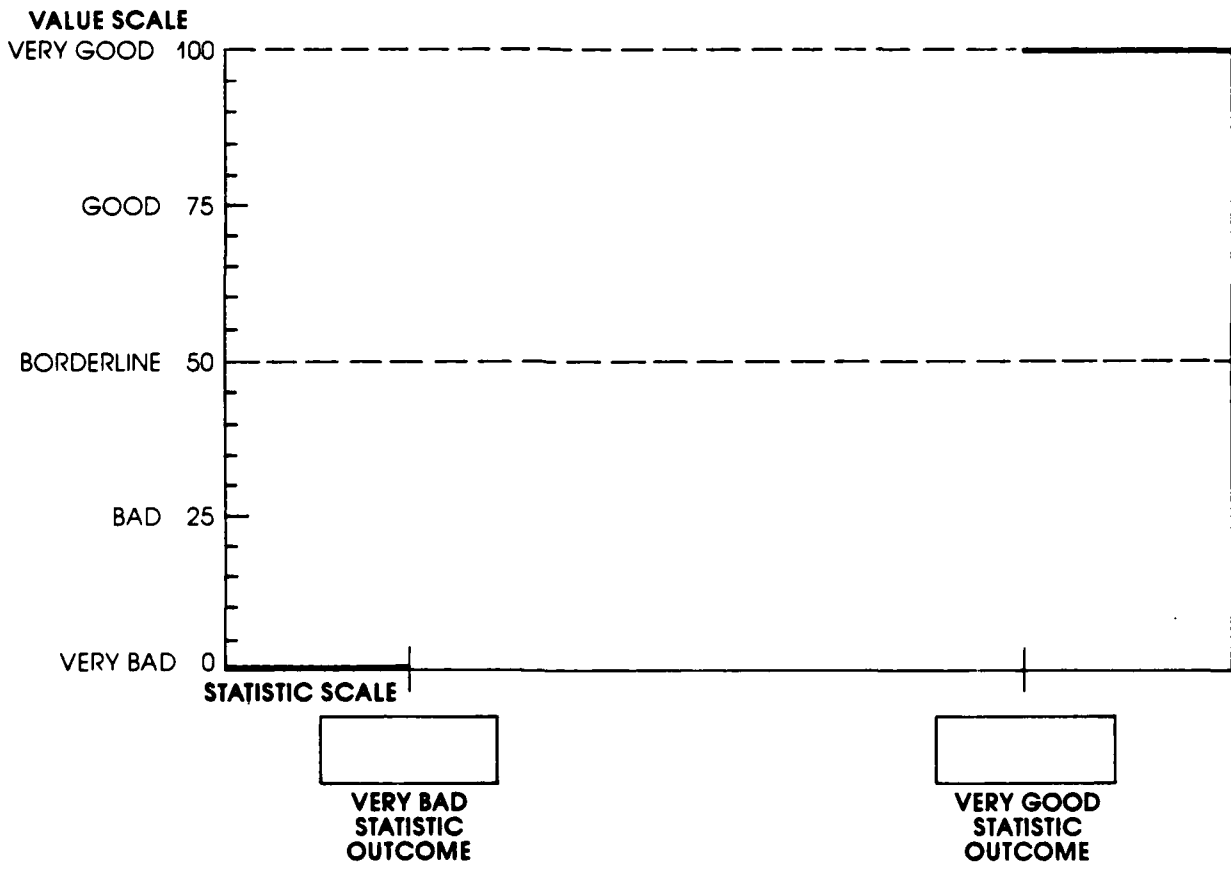
(b) If the answers to the two previous questions are both "yes," you have not yet located the "very bad" outcome. Generate the next worse statistic outcome. If the answer to either of these two questions is no, the last previous performance outcome is the "very bad" outcome.

(3) Return the completed Worksheets to sender.

HRTES

VALUE FUNCTION WORKSHEET

SYSTEM FUNCTION	
SPI	
HPF	
CONDITION SET	
<input type="checkbox"/> OPER.	STATISTIC
<input type="checkbox"/> MAINT.	



STATISTIC CRITERION

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SAMPLE

HRTES

VALUE FUNCTION WORKSHEET

SYSTEM FUNCTION	DESTROY AIRCRAFT
SPI	ACQUIRE TARGET(S) IN FULL SUNLIGHT
HPF	DETECT AND IDENTIFY TARGETS
CONDITION SET	3
<input checked="" type="checkbox"/> OPER. <input type="checkbox"/> MAINT.	STATISTIC PERCENTAGE

VALUE SCALE	
VERY GOOD 100	
GOOD 75	
BORDERLINE 50	
BAD 25	
VERY BAD 0	

STATISTIC SCALE	40%	70%	95%
	VERY BAD STATISTIC OUTCOME		VERY GOOD STATISTIC OUTCOME

STATISTIC CRITERION	70%
---------------------	-----

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HRTES

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GENERAL INSTRUCTIONS FOR TRAINING MEASURES

DESCRIPTION: An operational test (OT) has been completed recently. For the specifics of this OT see "HPF Diagnostic Worksheet", page W8-4 of this submission. Various operator and maintainer tasks were measured during this OT. One or more of these tasks was evaluated as having been performed inadequately. In the Human Resources Test and Evaluation System (HRTES), operator and maintainer tasks have been defined at a general level which is not dependent upon the specific types of equipment involved. To avoid confusion with traditional tasks they have been named Human Performance Functions (HPF's). The "HPF Diagnostic Worksheet" on page W8-4 that lists the specifics of the operational test also lists the HPF's which were performed inadequately.

Operational testing and evaluation personnel have determined that those HPF's that are listed are of significant importance to the overall evaluation of the system that was tested. They need to know why these HPF's were performed inadequately. One possible reason is that the training of these HPF's was in some way inadequate. To aid in determining if this was the case, HRTES contains the following training measures:

MEASURE NAME	MEASURE FUNCTION	PAGE W8:
1. Training Time Allocation	Adequacy of training time of HPF.	9-21
2. Practice Conditions Adequacy	Adequacy of practice of HPF.	22-24
3. Compatibility of Training Methods and Required Skills	Adequacy of method used to train HPF.	25-39
4. Adequacy of personnel who trained HPF	Adequacy of Operational Test Trainers.	40-43

Each of these measures has its own specific instructions and worksheets. The first measure has an alternative training time measure.

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GENERAL INSTRUCTIONS FOR TRAINING MEASURES

Your first problem will be to decide which of these measures to take of each HPF. During the OT, players and observers filled in questionnaires in which they gave their opinions of the difficulty of each HPF and the reasons for significant difficulty. If the questionnaires indicated significant difficulty, they were reduced and used to fill out an "Opinion Summary Data Worksheet." Scales 17-20 of this Worksheet correspond to the training measures listed earlier. If any player or observer thought that performing a given HPF was difficult and that HPF is one of those being diagnosed now, you will have an "Opinion Summary Data Worksheet" for it with this submission. In this case, the scale scores listed may be helpful to you in deciding which training measures to take. If a score indicates significant difficulty, it is reasonable to take the corresponding training measure for that HPF. It is, of course, possible that players and observers were not able to judge whether there was something about training which was inadequate and produced inadequate HPF performance. Therefore, these scores, if they are available, can only be a guide for you to use as you think best. However, it is possible that players and observers did not believe that an HPF was difficult. In this case, you will have no "Opinion Summary Data Worksheet" for that HPF, and you will have to fall back on your own resources to decide which of these training measures to take.

This submission should also include copies of: "Evaluation Tree," "OT Training Data Collection Worksheets," and "HPF Difficulty Worksheets." The specific instructions for the various training measures will call for one or more of these additional documents. The final document you should have is "Summary Worksheet for Training Diagnosis" which will be described in the following general procedure.

GENERAL PROCEDURE:

- (1) Read through the specific instructions for the training measures and familiarize yourself with their worksheets.

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GENERAL INSTRUCTIONS FOR TRAINING MEASURES

- (2) Examine the "HPF Diagnostic Worksheet" to familiarize yourself with information about the OT and the specific HPF's which are to be diagnosed.
- (3) Examine the "Opinion Summary Data Worksheet" for each HPF (if there is one). Use their scores as an aid to selecting parallel training measures. If you do not have one or more such worksheets, use your best judgment for deciding which measures to take of each HPF.
- (4) When you are finished taking the measures you have selected for each HPF, make as many copies of the "Summary Worksheet for Training Diagnosis as you need for the HPF's you have diagnosed (one per HPF).
- (5) Fill in the information at the top and extreme bottom of each worksheet.
- (6) Record the Indices of Adequacy for each training measure you have taken for each HPF being diagnosed. This is to be done in the appropriately labeled boxes on the worksheets.
- (7) If you have not taken a specific training measure for a given HPF, and if you have an "Opinion Summary Data Worksheet" for that HPF, use the appropriate questionnaire scale score as an Index of Adequacy. Record this questionnaire based score(s) in the appropriately labeled box.
- (8) If you have not taken a specific training measure for a given HPF, and if you do not have an "Opinion Summary Data Worksheet" for that HPF, record an "X" in the appropriate box.

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GENERAL INSTRUCTIONS FOR TRAINING MEASURES

- (9) Next to each Index of Adequacy record an "EXP" or "QUEST" in the third column of the worksheet. "EXP" is recorded next to an Index which was based on an expert measure you have taken. "QUEST" is recorded next to an Index which was based on a questionnaire scale from the "Opinion Summary Data Worksheet" for that HPF.
- (10) Record the specific training problem(s) which caused any Index of Adequacy to be significantly below 100. This is to be done in the first column of the worksheet.
- (11) Compute the mean of Indices of Adequacy for each HPF diagnosed. If you have recorded an "X" in any box, leave it out of the computation. Record the mean in the Training box at the extreme right of the worksheet.
- (12) When you have completed the training measures and the "Summary Worksheet for Training Diagnosis" return all materials to the sender.

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TRAINING MEASURE #1 MEASURE OF TRAINING TIME ALLOCATION (ALTERNATIVE 1)

DESCRIPTION: This measure compares the length of time devoted to training the HPF that is being diagnosed with the length of time devoted to training a baseline HPF. To use this measure the following requirements must be met:

- (1) You must have access to a task list for a functionally similar system.
- (2) This list must contain a similar task (or HPF). Usually this will be the system being replaced by the one which has been tested.
- (3) You have no reason to suspect that the baseline task is significantly more difficult to perform than the HPF being diagnosed.
- (4) You have access to data which includes the length of time devoted to training this baseline task.
- (5) You have no reason to suspect that this baseline task was performed in an unsatisfactory manner.
- (6) You have no reason to suspect that the personnel who performed the baseline task had inferior aptitudes to those who performed the HPF being diagnosed.
- (7) The training of the HPF being diagnosed has not improved in a way that would require less training time than the baseline task.

If you have this information, the task can be used as a baseline for training time. Under these circumstances it would be plausible to assume that the HPF being diagnosed should have received at least as much training time as the baseline task. However, this required information will probably not be available in the early tests in which HRTES is used. As HRTES continues to be used, this required data should become available.

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PROCEDURE:

- (1) Determine if you can meet all seven requirements for the use of this measure. If not, read alternative #2. If you can meet them, copy "Worksheet for Training Time Allocation Measure (Alternative 1)" on page W8-11 for each HPF to be diagnosed.
- (2) Fill in the required information on your copy of the worksheet.
- (3) Divide the training time of the HPF being diagnosed by the training time of the baseline task (or HPF), and record it. If the resulting quotient is greater than 1.0, record it as 1.0. A number larger than this provides no additional diagnostic information.
- (4) Multiply the resulting quotient by 100, and record it on the worksheet. This is what HRTES refers to as the Index of Adequacy for this measure of training time. The further this Index is below 100, the greater the likelihood that insufficient time was devoted to training the HPF.

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HRTES

WORKSHEET FOR TRAINING TIME ALLOCATION MEASURE (ALTERNATIVE 1)

HPF BEING DIAGNOSED: _____

SIMILAR BASELINE SYSTEM: _____

BASELINE HPF/TASK: _____

TRAINING TIME FOR DIAGNOSED HPF: _____

TRAINING TIME FOR BASELINE HPF: _____

DIAGNOSED HPF/BASELINE HPF (1.0 MAXIMUM) = _____

INDEX OF ADEQUACY FOR TRAINING TIME = _____
(MULTIPLY QUOTIENT ABOVE BY 100)

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HRTES

TRAINING MEASURE #1 MEASURE OF TRAINING TIME ALLOCATION (ALTERNATIVE 2)

DESCRIPTION: The amount of time spent training an HPF ought to be related to its criticality and difficulty. This measure requires the determination of the criticality and difficulty of an HPF that is being diagnosed and of five randomly selected HPF's that were successfully performed. Criticality of the HPF's is derived from weights on the "Evaluation Tree" which has been included in this submission. Difficulty of the HPF's has already been estimated by operational test players and observers and is recorded on "HPF Difficulty Worksheets" which have been included in this submission.

Once you have determined the criticality (C) and difficulty (D) of each of the six HPF's, you calculate the training time per unit of criticality X difficulty (T/CXD) for each. You then compare this statistics for the HPF being diagnosed with the mean of this statistic for the five successfully performed HPF's. If the training time of the HPF being diagnosed was insufficient, there should be a significant difference between its statistic and the mean statistics. If such a significant difference does not exist, you cannot assume a training time insufficiency. In this measure a significant difference is defined as one standard deviation.

PROCEDURE:

- (1) Examine the "Evaluation Tree" which is part of this submission. It was used to determine the value of human and human-machine performance in the OT. It consists of levels of nodes connected by branches. At least the following levels should be present on the "Evaluation Tree":

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GENERAL INSTRUCTIONS FOR TRAINING MEASURES

- (a) System Level (at the top of the tree);
- (b) System Function Level (the second level);
- (c) System Performance Issue or SPI Level (the third level);
- (d) Human Performance Function Group or HPF-Group Level (the fourth level);
- (e) Human Performance Function or HPF Level (the fifth level);
- (f) There may be one or two levels below the fifth level.
They are not used in this measure.

Notice that each node consists of a main rectangle containing 1-3 numbers and a smaller square, which sits on top of the rectangle, and contains one number. The number(s) in the main rectangle of each node is the performance value and is not used in this measure. The number in each small square is the criticality weight of that node in relation to other related nodes at that level of the "Evaluation Tree." These numbers will be used in this measure.

- (2) Select five successfully performed HPF's from the HPF Level of the tree. You can tell that they are successfully performed by the value numbers in the main rectangle of each node. If there is only one number in each rectangle, any HPF with a value number above 50 is successful. If there are three numbers in each rectangle, any HPF with a central and left-hand numbers above 50 are successful. To the greatest extent possible select these HPF's so that each one is connected by a branch to a different HPF-Group in the level immediately above. You now have a sample consisting of one unsuccessfully performed HPF (to be diagnosed) and five successfully performed HPF's.

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GENERAL INSTRUCTIONS FOR TRAINING MEASURES

(3) Compute the criticality of each of these six HPF's. This is done for each HPF by returning to the "Evaluation Tree" and performing the following:

- (a) multiply the criticality weight (in the small square) of each HPF selected by the criticality weight of its HPF-Group;
- (b) multiply each resulting product by the criticality weight of its System Performance Issue;
- (c) multiply each resulting product by the criticality weight of its System Function.

The final products are the criticality weights of each of the six HPF's.

(4) Make a copy of the "Training Time Allocation Measure Alternative 2 Worksheet," page W8-21 for each HPF to be diagnosed. Fill in the names of the HPF's and the criticality weight for each (in column 2). Write small; you will need space for a difficulty weight and a product in each cell of this column.

(5) Retrieve the "Opinion Summary Data Worksheets" for the six HPF's. In the box marked "Difficulty Score" you will find the difficulty weight of that HPF. Write these weights next to the criticality weights on the "Training Time Allocation Measure Alternative 2 Worksheet."

(6) It is possible that you do not have "Opinin Summary Data Worksheets" for some or all of the six HPF's. In this case, retrieve the "HPF Difficulty Worksheets" for each such HPF, and compute the mean difficulty for each.

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- (7) It is possible that you do not have the "HPF Difficulty Worksheets" for some or all of the six HPF's. In this case, copy the "HPF Difficulty Rating Worksheet," page W8-19, write in the six HPF's, and rate them for difficulty on the scale given. If you feel another individual may be better at this than you, also copy the Guidelines, page W8-17, and have them use the worksheet and guidelines to determine HPF difficulty.
- (8) One way or the other, you now have six HPF's, and each one has a criticality and difficulty weight. Multiply these two weights for each HPF, and record the products in the appropriate cells of the "Training Time Allocation Measure Alternative 2 Worksheet."
- (9) Retrieve the "OT Training Data Collection Worksheets" completed by the Trainers during this operational test. Copy the training time for each HPF from this worksheet on to your "Training Time Allocation Measure Alternative 2 Worksheet."
- (10) Divide each HPF's training time by its criticality X difficulty product, and record the resulting quotient on the worksheet.
- (11) Compute the standard deviation of the last (fourth) column for only the successfully performed HPF's. Enter it in the standard deviation box.

Standard Deviation Formula:

$$SD = \frac{\sum (X - \bar{X})^2}{N-1}$$

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Where:

X = the values in column 4 of the worksheet for the successfully performed HPF's.

\bar{X} = column 4 mean of the successfully performed HPF.

N = number of successfully performed HPF's listed on the worksheet.

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HRTES

GUIDELINES FOR THE HPF DIFFICULTY RATING WORKSHEET

The purpose of this procedure, and the accompanying worksheet, is to determine your estimate of the performance difficulty of a series of tasks which were performed during an operational test.

EXPLANATION:

An OT, of the system listed on the attached worksheet, has taken place. In this OT, a series of generalized tasks were performed. In HRTES, these are called Human Performance Functions of HPF's. When an HPF has been judged to have been performed inadequately and to be a significant HPF, the causes for this inadequate performance are diagnosed. One possible cause is that insufficient training time was provided, considering the HPF's criticality and its difficulty. To determine this, it is necessary to compare the criticality and difficulty of performance of adequately and inadequately performed HPF's with the amount of training time devoted to them.

Your task is to rate each listed HPF, or task, on a performance difficulty scale from 1-100. This package consists of: the guidelines you are currently reading and one or more "HPF Difficulty Rating Worksheets." There is one worksheet for each group of HPF's containing one HPF which was performed inadequately. You are being asked to complete all the worksheets and return them to the sender.

INSTRUCTIONS:

- (1) Rate each of the HPF's (or tasks) on the following scale from 1--100. You can assign any number from 1-100.

1	25	50	75	100
HPF extremely <u>easy</u> to perform		HPF moderately diffi- cult to perform		HPF extremely <u>difficulty</u> to perform

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- (2) Record your ratings in the appropriate cells of the Rating column
- (3) When all worksheets are completed, return to sender.

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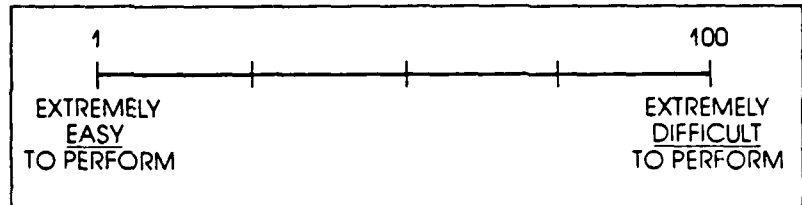
NAME _____ TELEPHONE _____

HRTES

HPF DIFFICULTY RATING WORKSHEET EXAMPLE FOR MEASURE ALTERNATIVE 2

SYSTEM UNDER TEST

Mercury Air Defense Weapon System



TASKS (HPF'S)	RATING
1. Detect and identify target.	80.
2. Select target and target order.	30.
3. Perform misfire procedure.	70.
4. Fire weapon.	10.
5. Perform ground vehicle maneuvers (specified).	60.
6. Fuel ground vehicle	10.

SYSTEM Mercury Air Defense Weapon System TEST OT 11 DATE 6/14/81 PAGE

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HRTES

TRAINING MEASURE #2 MEASURE OF THE ADEQUACY OF PRACTICE CONDITIONS

DESCRIPTION: The amount and nature of practice is likely to have a considerable affect on the adequacy of HPF performance. If an HPF were performed inadequately under a given condition or set of conditions, and if you discovered that it had not been trained under these conditions, you might suspect that this practice had been inadequate. Further, you might suspect that such an inadequate practice was a cause of the inadequate performance of the HPF. This measure is based on expert opinion of the adequacy of practice which took place for the HPF being diagnosed. The individual who produces this expert opinion should know:

- (1) what conditions were in force during HPF practice;
- (2) the amount of time devoted to practicing various HPF's;
- (3) the number of practice trials for each HPF; and
- (4) how the practice was carried out in terms of realism.

You will need to use the "Evaluation Tree" in this measure.

PROCEDURE:

- (1) Make one copy of the "Practice Condition Worksheet," page W8-24, for every HPF you are going to diagnose using this measure.
- (2) Examine the "Evaluation Tree" giving particular attention to the lowest level of the tree. This is the Statistics Level. At this level each HPF has an individual node either for all the conditions under which it was performed, or under one condition that was varied. Using these nodes, determine the conditions under which each HPF to be diagnosed was performed inadequately (value score below 50).

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- (3) For each HPF, determine how many conditions are to be rated, and make the appropriate number of copies of the "Practice Condition Worksheet."
- (4) Each worksheet should have the name of the HPF being diagnosed and one condition under which it was performed inadequately.
- (5) Complete all "Practice Condition Worksheets," by answering the questions and determining the appropriate rating.
- (6) If more than one condition was in force for an inadequately performed HPF, make an additional copy of the blank "Practice Condition Worksheet." Write "Mean" in the "Condition Box."
- (7) Compute the mean ratings of all conditions rated for each HPF being diagnosed. Record this in the "Rating Box" of the Mean Worksheet. This is the Index of Adequacy of Practice Conditions for this HPF. The further it is below 100, the less adequate the total practice for this HPF.
- (8) If any condition received a rating of zero because both questions 1 and 2 were answered "NO," it should be specifically noted on the Mean Worksheet. Even though adequate practice of a number of other conditions may raise the final Index, the presence of any zero could point to the actual cause of inadequate performance. Therefore, when the overall Index is reported, the total absence of a condition in practice or its "good replacement" should also be reported as a possible cause.

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HPF

CONDITION

- 1 Was the above HPF practiced under the above condition? YES NO
- 2 If the answer to number 1 was "NO," was there a condition that was a good substitute? YES NO

If the answer to this question is "YES," list the substitute condition here →

- 3 If the answer to either questions 1 or 2 was "YES," fill out the rating form below, and return the complete worksheet to sender.

If the answer to both questions 1 and 2 was "NO," ignore the rating form below, and return it to sender

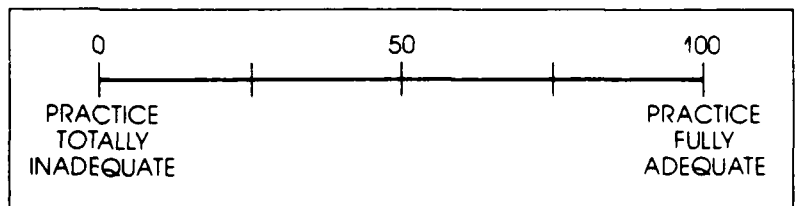
PRACTICE CONDITION RATING FORM

Rate the quality of the practice of HPF under this condition (or substitute condition).

This rating should include your consideration of the adequacy of:

- (1) Practice time.
- (2) Number of practice trials.
- (3) Realism of practice.
- (4) Realism of practice hardware/software.

Your rating is to be made on the scale, as indicated here. Any number between 0 and 100 can be given.



ENTER YOUR RATING HERE →

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TRAINING MEASURE #3 MEASURE OF COMPATIBILITY OF TRAINING METHODS AND SKILLS REQUIRED FOR THE HPF

DESCRIPTION: When someone performs an HPF, he or she is simply exercising one or more skills. The level of the skills will have a significant effect on the HPF's level of performance. Skill level is the outcome of a combination of training and the characteristics of the individual. Training to enhance skill level is, itself, a combination of previous formal and informal training and current training directed toward the specific system being tested.

All training methods are not equally good at training all types of skills. Each type of skill has one or more particularly applicable training methods. The less appropriate the training method used, the higher the probability that the skill will not be enhanced. If an HPF being diagnosed required skills which were trained by inappropriate methods, you would have reason to suspect that these skills were not adequately enhanced. Further, you might suspect that this was a cause of inadequate HPF performance. To aid you in understanding this measure, two complete sets of examples have been included on pages W8-30 through W8-35 of this submission.

PROCEDURE:

- (1) Retrieve the "OT Training Data Collection Worksheets" for the HPF's being diagnosed.
- (2) Make one copy of "Training Methods Worksheets #1, #2, and #3" for each HPF to be diagnosed by this measure.

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- (3) Fill in the names of the HPF's being diagnosed, etc., on each set of these worksheets. From this point on, these procedures will apply to each HPF being diagnosed.
- (4) Examine the appropriate "OT Training Data Collection Worksheet" for the HPF. Copy the percentages of training time devoted to each training method from the above worksheet to the right-hand column of Worksheet #1.
- (5) Examine Worksheet #2 for the HPF being diagnosed, and determine which of the six global skill types listed are required for the performance of this HPF.
- (6) When you have decided which skill types are required, estimate the percentage of each required skill that must be present in the performance of this HPF. These percentages must sum to 100. Record the percentages in the appropriate column of Worksheet #2.
- (7) Next, you must estimate the utility of each each training method that was actually used in the training of each required skill (for this HPF). Training methods not actually used and skills not required will not play a part in this utility rating procedure. There are two alternative methods for making this estimate of training method utility for skills:
 - (a) Complete the "Utility Estimate Worksheet," page W8-39, for the system which was tested in the OT. This will be time consuming and somewhat difficult, but it will represent your thinking (or the thinking of some other individual who you get to complete this worksheet).

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- (b) Obtain utility ratings from Table 8-1, on page W8-29 of this submission. The utility ratings in this table were made by training experts, and were based on synthesis of a large body of applicable research.
- (8) One way or the other, you now have determined the utility of each training method, actually used, for training each required skill. Enter these utility ratings in the appropriate cells of Worksheet #1 for the HPF being diagnosed. Only enter the utility ratings for those skills actually required (from Worksheet #2), and for those training methods actually used.
- (9) Copy the percentages required for the performance of the skills (from Worksheet #2) into the appropriate cells of the bottom row of Worksheet #3. Skills which received no rating or a zero percentage are to be left blank.
- (10) Return to Worksheet #1. Multiply each number in the right-hand column of this worksheet by each of the ratings by each of the ratings in the row to which that first number belongs. You are now multiplying the percentages of training time of each training method by the utility rating of each skill required for the performance of the HPF.
- (11) Record the products of the multiplication in procedure 10 in the appropriate cells of Worksheet #3. You may find it helpful to examine the various example worksheets at this point.
- (12) Sum the products in each column of Worksheet #3, and record each column's sum in the second to the last row of this worksheet ("Sum of Column" row).

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- (13) Compute the correlation coefficient between the last two rows of Worksheet #3. These are the "Sum of Column" row and the "% of HPF Involving Skill" row. If you have to do this computation by hand, use the following formula:

Computational Formula for Correlation Coefficient:

$$r = \frac{N \sum XY - (\sum X) (\sum Y)}{\sqrt{[N \sum X^2 - (\sum X)^2][N \sum Y^2 - (\sum Y)^2]}}$$

Where:

r = correlation coefficient.

N = number of skills listed in Worksheet #3.

X = column sum (second to last row in Worksheet #3).

Y = percent of HPF involving skill (last row of Worksheet #3).

\sum = sum over the skills in Worksheet #3.

- (14) Record the resulting correlation coefficient in the appropriate box of Worksheet #3. This will be either a positive or negative number from 0 to 1.0. The closer it is to 1.0, the more appropriate were the training methods and times allotted to them in the training of the HPF.
- (15) Multiply the correlation coefficient by 100, and record the resulting product in the Index of Adequacy box of Worksheet #3.

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TABLE 8-1
EXPERTS' UTILITY ESTIMATES

TRAINING METHODS	SKILLS					
	KNOWLEDGE	UNDERSTANDING	VERBAL/WRITTEN	PSYCHOMOTOR	PERCEPTUAL	DECISION MAKING
ORAL/WRITTEN DRILL PRACTICE	1.0	.5	.1	.1	.1	.1
LECTURE	.7	.7	.3	.1	.1	.1
INDIVIDUAL DISCUSSION	.7	1.0	.9	.3	.3	.8
GROUP DISCUSSION	.4	.9	.7	.2	.1	.7
READING TEXTS	.8	.7	.3	.1	.1	.1
EXPERT DEMONSTRATION/VISUAL AIDS	.5	.7	.2	.2	.7	.3
PROGRAMMED INSTRUCTION	.8	.8	.5	.4	.2	.3
GAMES	.3	.6	.8	.8	.7	.5
SIMULATION	.2	.6	1.0	.9	.8	.8
HANDS ON PRACTICE--REAL HARDWARE	.5	.6	1.0	1.0	1.0	.6

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HRTES

TRAINING METHODS WORKSHEET #1

FIRST EXAMPLE

HPF	SKILLS						
Detect and identify target							
TRAINING METHODS	KNOWLEDGE	UNDERSTANDING	VERBAL/WRITTEN	PSYCHOMOTOR	PERCEPTUAL	DECISION MAKING	% OF HPF TRAINING TIME USING THIS METHOD
ORAL/WRITTEN DRILL/PRACTICE							
LECTURE	.7				.1	.1	40
INDIVIDUAL DISCUSSION							
GROUP DISCUSSION							
READING TEXTS	.8				.1	.1	20
EXPERT DEMONSTRATION/VISUAL AIDS	.5				.7	.3	20
PROGRAMMED INSTRUCTION							
GAMES							
SIMULATION							
HANDS ON PRACTICE — REAL HARDWARE							

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HRTES

TRAINING METHODS WORKSHEET #2

FIRST EXAMPLE

HPF

Detect and identify target

Enter the percentage of each of the following skills required for the performance of HPF above.

The performance of all skills must sum to 100.

SKILLS	% REQUIRED FOR PERFORMANCE
KNOWLEDGE	40
UNDERSTANDING	
VERBAL/WRITTEN	
PSYCHOMOTOR	
PERCEPTION	40
DECISION MAKING	20
SUM	100

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TRAINING METHODS WORKSHEET #3

FIRST EXAMPLE

HPF		SKILLS					
Detect and identify target							
TRAINING METHODS		KNOWLEDGE	UNDERSTANDING	VERBAL/WRITTEN	PSYCHOMOTOR	PERCEPTUAL	DECISION MAKING
ORAL/WRITTEN DRILL/PRACTICE							
LECTURE		28				4	4
INDIVIDUAL DISCUSSION							
GROUP DISCUSSION							
READING TEXTS		16				2	2
EXPERT DEMONSTRATION/VISUAL AIDS		10				14	6
PROGRAMMED INSTRUCTION							
GAMES							
SIMULATION							
HANDS ON PRACTICE — REAL HARDWARE							
CORRELATION COEFFICIENT .65		SUM OF COLUMN		54		20	12
INDEX OF ADEQUACY 65		% OF HPF INVOLVING SKILL		40		40	20

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HRTES

TRAINING METHODS WORKSHEET #1

SECOND EXAMPLE

HPF	SKILLS						% OF HPF TRAINING TIME USING THIS METHOD
TRAINING METHODS	KNOWLEDGE	UNDERSTANDING	VERBAL/WRITTEN	PSYCHOMOTOR	PERCEPTUAL	DECISION MAKING	
Detect and identify target							
ORAL/WRITTEN DRILL/PRACTICE	1.0				.1	.1	40
LECTURE							
INDIVIDUAL DISCUSSION							
GROUP DISCUSSION							
READING TEXTS							
EXPERT DEMONSTRATION/VISUAL AIDS							
PROGRAMMED INSTRUCTION							
GAMES							
SIMULATION	.2				.8	.8	20
HANDS ON PRACTICE — REAL HARDWARE	.5				1.0	.6	40

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HRTES

TRAINING METHODS WORKSHEET #2

SECOND EXAMPLE

HPF

Detect and identify target

Enter the percentage of each of the following skills required for the performance of HPF above.

The performance of all skills must sum to 100.

SKILLS

% REQUIRED FOR PERFORMANCE

KNOWLEDGE	40
UNDERSTANDING	0
VERBAL/WRITTEN	0
PSYCHOMOTOR	0
PERCEPTION	40
DECISION MAKING	20
SUM	100

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HRTES

TRAINING METHODS WORKSHEET #1

HPF	SKILLS						% OF HPF TRAINING TIME USING THIS METHOD
	KNOWLEDGE	UNDERSTANDING	VERBAL/WRITTEN	PSYCHOMOTOR	PERCEPTUAL	DECISION MAKING	
TRAINING METHODS							
ORAL/WRITTEN DRILL/PRACTICE							
LECTURE							
INDIVIDUAL DISCUSSION							
GROUP DISCUSSION							
READING TEXTS							
EXPERT DEMONSTRATION/VISUAL AIDS							
PROGRAMMED INSTRUCTION							
GAMES							
SIMULATION							
HANDS ON PRACTICE — REAL HARDWARE							

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HRTES

TRAINING METHODS WORKSHEET #2

HPF

Enter the percentage of each of the following skills required for the performance of HPF above.

The performance of all skills must sum to 100.

SKILLS	% REQUIRED FOR PERFORMANCE
KNOWLEDGE	
UNDERSTANDING	
VERBAL/WRITTEN	
PSYCHOMOTOR	
PERCEPTION	
DECISION MAKING	
SUM	

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HRTES

UTILITY ESTIMATE WORKSHEET

Estimate the utility of each listed Training Method in the matrix below for the training of each skill, according to the current technology. Your Utility ratings should fall between 0 and 1.0. Zero means that this method has absolutely no utility for training this skill. 1.0 means that this method is the best possible for training this skill. The Utility ratings do not have to sum to 1.0 for a given skill.

Return to sender upon completion.

TRAINING METHODS	SKILLS					
	KNOWLEDGE	UNDERSTANDING	VERBAL/WRITTEN	PSYCHOMOTOR	PERCEPTUAL	DECISION MAKING
ORAL/WRITTEN DRILL PRACTICE						
LECTURE						
INDIVIDUAL DISCUSSION						
GROUP DISCUSSION						
READING TEXTS						
EXPERT DEMONSTRATION/VISUAL AIDS						
PROGRAMMED INSTRUCTION						
GAMES						
SIMULATION						
HANDS ON PRACTICE — REAL HARDWARE						

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TRAINING MEASURE #4

MEASURE OF THE ADEQUACY OF OPERATIONAL TEST TRAINERS

DESCRIPTION: One of the major variables of training which can produce sub-criterion performance of a Human Performance Function (HPF) is inadequate trainer functioning. Trainers' styles vary considerably. This variation makes it difficult to take meaningful measures of trainer functioning by observation. Two other alternatives remain:

- (1) measuring attitudes toward trainer performance (carried out in HRTES questionnaires); and
- (2) measuring and evaluating trainer background experiences.

This latter measure is based on the supposition that the level of a trainer's background will have a significant effect on ability to effectively train an HPF.

In this measure, you develop a list of background experiences which are desirable for training an HPF which is being diagnosed. You, or some other training expert you select, rates each of these background experiences on a utility scale. You also determine, or obtain, estimates of the minimum amount of time required for each of these background experiences. You then determine which of these background experiences the appropriate trainer(s) had and the amount of time for each one. Finally, you compare actual trainer experiences with those which were selected as being desirable for training the given HPF.

PROCEDURE:

- (1) Make one copy of the "Index of Trainer Adequacy Worksheet," page W8-43, for each HPF to be diagnosed using this measure. The rest of these procedures apply to only one HPF at a time.

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HRTES

However, much of the information developed for the first HPF should be applicable to all the others being diagnosed.

- (2) In the first column of the worksheet, list the specific background experiences which a trainer should have to effectively train the HPF being diagnosed. This should include: experiences as a trainer, if any; specific operational or maintenance experiences, if any; specialties held, if any; and educational experiences, if any.
- (3) For each background experience listed estimate the minimal amount of time required in the second column of the worksheet. These amounts of time should be listed as months.
- (4) Rate each listed background activity on the following scale. Select any number from 0-100. It is understood that since you have already stated that these activities are required, you will never rate any of them "0." The lower anchors of this scale are presented to make clearer the meaning of the scale. When you have rated a given background activity record the rating in the third column of the worksheet.

NONE		MODERATE		ABSOLUTELY REQUIRED
1	25	50	75	100
No utility for training this HPF		Moderately useful for training this HPF		Absolutely required for training this HPF

- (5) Multiply the time and utility weight of each background experience. Record the resulting product in the fourth column of the worksheet.
- (6) Add the products in the fourth column of the worksheet, and record the resulting sum in the Sum (A) box of the worksheet.

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- (7) Determine if the trainer(s) of the HPF being diagnosed had each of these background experiences (or others which were functionally identical). If the trainer(s) did not have a given experience, record a zero. If a trainer did have an experience, determine how many months were devoted to it. If more than one trainer trained the personnel, who performed this HPF inadequately, compute the means of the months of the experiences. If the actual trainer time for any given background experience is greater than the minimum acceptable time (which has been recorded), record the minimum acceptable time. Do not record the actual trainer time. Without this truncation it would be possible for large amounts of experience in one area to entirely obscure a total absence in another. If the actual trainer time is less than the minimum acceptable time, record it directly.
- (8) Multiply the utility weight of each background experience (from the second column) by the actual trainer time of that experience (from the fifth column). Record the resulting products in the sixth column of the worksheet.
- (9) Add these products, and record the resulting sum in the Sum (B) box on the worksheet.
- (10) Divide Sum (B) by Sum (A). Multiply the resulting quotient by 100. Record the resulting product in the Index box of the worksheet. This is the Index of Adequacy of Trainer Background for the HPF. If the trainer's background is entirely appropriate for training this HPF, the Index will be approximately 100. The less adequate the background, the further the Index will be below 100.

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HRTES

SUMMARY WORKSHEET FOR TRAINING DIAGNOSIS

HPF: _____
 CONDITIONS (if applicable): _____
 SPI: _____
 SYSTEM FUNCTION: _____

SPECIFIC TRAINING PROBLEMS CONTRIBUTING TO INDICES	TRAINING MEASURE INDICES OF ADEQUACY	EXP OR QUEST	TRAINING INDEX OF ADEQUACY
---	---	--------------------	----------------------------------

1 TRAINING TIME ALLOCATION	<input type="checkbox"/>		TRAINING <input type="checkbox"/>
2 PRACTICE CONDITIONS ADEQUACY	<input type="checkbox"/>		
3 TRAINING METHODS ADEQUACY	<input type="checkbox"/>		
4 OT TRAINER ADEQUACY	<input type="checkbox"/>		

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HRTES

GENERAL INSTRUCTIONS FOR HUMAN FACTORS ENGINEERING (HFE) MEASURES

DESCRIPTION: An operational test (OT) has been completed recently. For the specifics of this OT, see "HPF Diagnostic Worksheet," page W8-4 of this submission. Various operator and maintainer tasks were measured during this OT. One or more of these tasks was evaluated as having been performed inadequately. In the Human Resources Test and Evaluation System (HRTES) operator and maintainer tasks have been defined at a general level which is not dependent upon the specific types of equipment involved. To avoid confusion with traditional tasks they have been named Human Performance Functions (HPF's). The "HPF Diagnostic Worksheet" on page W8-4 that lists the specifics of the operational test also lists the HPF's which were performed inadequately.

Operational testing and evaluation personnel have determined that those HPF's that are listed are of significant importance to the overall evaluation of the system that was tested. They need to know why these HPF's were performed inadequately. One possible reason is that the human-machine interface, or the actual procedure itself, was inadequate in some way, and this inadequacy was a cause of the level of performance. To aid in determining if this was the case, HRTES contains the following HFE measures:

MEASURE NAME	MEASURE FUNCTION	PAGE W8:
1. Understandability of Procedure	Adequacy of complexity of HPF procedure.	54-57
2. Difficulty of Decisions	Difficulty of making decisions required by HPF.	58-66
3. Display Information Adequacy and Timeliness	Presentation of required information on time by displays used in HPF.	67-71
4. Display Readability/Hearability	Adequacy of presentation characteristics of information required in HPF.	72-77

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MEASURE NAME	MEASURE FUNCTION	PAGE W8:
5. Display Information Understandability	Understandability of information required for HPF as presented by displays.	78-82
6. Control Accessibility	Accessibility of controls or other equipment manipulated in HPF performance.	83-86
7. Control Static Characteristics	Adequacy of control characteristics other than those for actual manipulation or accessibility (includes any equipment to be manipulated in HPF performance.	87-91
8. Control Dynamic Characteristics	Adequacy of control manipulation characteristics (includes any equipment to be manipulated in HPF performance	92-96
9. Workstation Dimensional Characteristics	Adequacy of physical dimensions of the workstation for HPF performance (does not include seat dimensions or dimensions involved in control accessibility.	97
10. Workstation Seating Characteristics	Adequacy of seating dimensions and other related characteristics for HPF performance.	98
11. Workstation/Environment Visual Characteristics	Adequacy of workstation characteristics which affect vision both within and outside the workstation for HPF performance.	99
12. Workstation/Environment Sound Characteristics	Adequacy of workstation and environmental sound characteristics which affect HPF performance.	100

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MEASURE NAME	MEASURE FUNCTION	PAGE W8:
13. Workstation Motion Characteristics	Adequacy of workstation motion characteristics which affect HPF performance.	101
14. Workstation/Environment Ventilation Characteristics	Adequacy of workstation/environment ventilation characteristics which affect HPF performance.	102
15. Workstation/Environment Safety Characteristics	Evaluation of safety hazards which might affect HPF performance.	103
16. Workload	Adequacy of workload during the performance of the HPF being diagnosed.	From Questionnaires

This section includes a set of "General Procedures" which applies to all of the listed HFE measures. Each of the first 8 measures has its own specific procedures which accompany the measure worksheet. Measures 9-15 have a common set of procedures. These procedures apply to each of these measures. They are listed in this section and are entitled "Common Procedures for Measures 9-15." Measure 16, "Workload" is entirely based on the "Workload Scale" found in the "Opinion Summary Data Worksheet" for the HPF being diagnosed.

Your first problem will be to decide which of these measures to take of each HPF. During the OT, players and observers filled in questionnaires in which they gave their opinions of the difficulty of each HPF and the reasons for significant difficulty. If the questionnaires indicated significant difficulty, they were reduced and used to fill out an "Opinion Summary Data Worksheet." Scales 1-16, and scale 21 of this worksheet correspond to the HFE measures listed earlier. If any player or observer thought that performing a given HPF was difficult and that HPF is one of those being diagnosed now, you will have an "Opinion Summary Data Worksheet" for it

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HRTES

with this submission. In this case, the scale scores listed may be helpful to you in deciding which HFE measures to take. If a score indicates significant difficulty (50 or below) it is reasonable to take the corresponding HFE measure for that HPF. It is, of course, possible that players and observers were not able to judge whether there was something which was inadequate and produced inadequate HPF performance. Therefore, these scores, if they are available, can only be a guide for you to use as you think best. However, it is possible that the players and observers did not believe that an HPF was difficult. In these case, you will have no "Opinion Summary Data Worksheet" for that HPF, and you will have to fall back on your own resources to decide which of these measures to take.

In addition to the "Opinion Summary Data Worksheets," this submission should include a copy of the "Summary Worksheet for HFE Diagnosis" that will be described in the following general procedure, and a copy of the previously described "HPF Diagnostic Worksheet."

GENERAL PROCEDURE (APPLIES TO ALL HFE MEASURES):

- (1) Read through the specific instructions for the HFE measures, and familiarize yourself with their worksheets.
- (2) Examine the "HPF Diagnostic Worksheet" to familiarize yourself with information about the OT and the specific HPF's that are to be diagnosed.
- (3) Examine the "Opinion Summary Data Worksheet" for each HPF (if there is one). Use their scores as an aid to selecting parallel HFE measures. If you do not have one or more such worksheets, use your best judgment for deciding which measures to take of each HPF.

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HRTES

- (4) When you have finished taking the measures you have selected for each HPF, make as many copies of the "Summary Worksheet for the HFE Diagnosis" as you need for the HPF's you have diagnosed (one per HPF).
- (5) Fill in the information at the top and extreme bottom of each worksheet.
- (6) Record the specific HFE indices of adequacy for the measures you have taken for each HPF being diagnosed. This is to be done in the appropriately labeled boxes on the worksheets.
- (7) If you have not taken a specific HFE measure for a given HPF, and if you have an "Opinion Summary Data Worksheet" for that HPF, use the appropriate questionnaire scale score as an Index of Adequacy. In the case of "Workload," this will always be the case. Record the questionnaire based score(s) in the appropriate labeled box.
- (8) If you have not taken a specific HFE measure for a given HPF, and if you do not have an "Opinion Summary Data Worksheet" for that HPF, record an "X" in the appropriate box.
- (9) Next to each specific index of adequacy record an "EXP" or "QUEST" in the third column of the worksheet. "EX" is recorded next to an Index which was based on an expert measure you have taken. "QUEST" is recorded next to an index which was based on a questionnaire scale from the "Opinion Summary Data Worksheet" for that HPF.
- (10) Record the specific HFE problem(s) which caused any specific index of adequacy to be significantly below 100. This is to be done in the first column of the worksheet. If necessary,

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append an addition sheet for this explanatory purpose, and reference it in the first column.

- (11) Compute the means of the specific indices of adequacy according to the branching structure on the worksheet. Means are to be computed of Indices: $1 + 2 + 3 + 4 + 5 + 6 + 7 + 8 + 9 + 10 + 11 + 12 + 13 + 14 + 15$. Measure 16, Workload, is simply transferred to the next box. If you have recorded an "X" in any box, leave it out of the computation. Record the resulting means in the appropriate boxes for Collective Indices.
- (12) If all of the specific indices are absent, for a given collective index, record an "X" in the box for that collective index.
- (13) Compute the mean of the collective indices. If you have recorded an "X" in any collective index box, leave it out of the computation. Record the mean in the Human Factors Engineering Box at the extreme right of the worksheet.
- (14) When you have completed the HFE measures and the "Summary Worksheet for HFE Diagnosis" return all materials to the sender.

COMMON PROCEDURES FOR MEASURES 9 THROUGH 14:

- (1) Make sufficient copies of the Measure Worksheet so that you have one for each HPF to be diagnosed.
- (2) Study the characteristics listed on the worksheet. If you think that a significant characteristic is missing, add it in the "Other" category.

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- (3) Decide if each characteristic on the worksheet is relevant to the performance of the HPF being diagnosed in this system. If it might have a significant effect on HPF performance in this system, it is relevant. In this case, record an "X" in the appropriate cell of the Relevance Column. If a characteristic is not relevant, record a "0" in the cell.
- (4) Rate each characteristic that you have selected on the criticality scale which follows. Select any rating from 1-100. Record the ratings in the appropriate cells of the Rating Column.

LOW CRITICALITY		MODERATE CRITICALITY		HIGH CRITICALITY
1	25	50	75	100
Just important enough to be measured. Criticality low for this HPF.		Criticality moderate for this HPF.		Criticality extremely high for this HPF.

- (5) Obtain appropriate measurements of each characteristic you have selected. This may be done in the following ways:
- (a) Obtaining appropriate measurements from previous OT's, DT's, HFE tests, or other reasonably reliable sources;
 - (b) Physically taking the necessary measurements from the actual system;
 - (c) Taking some version of the necessary measurements from system documentation.
- (6) Compare each measurement with the standard or specification which applies to it. This may be done in the following ways:

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- (a) Comparison with reasonably valid specifications such as those found in MIL STD-1472, HEDGE, and HFTEMAN-- this is, of course, preferable.
 - (b) Evaluation based on expert judgment--in the absence of an applicable standard, your judgment may be substituted.
-
- (7) If a given characteristic meets its standard, record a "1" in the appropriate cell of the 0/1 column. If it does not meet its standard (or your judgment), record a "0" in this cell.
 - (8) Record the source of each comparison in the appropriate cell of the Source Column. This should be information as to the source of the measurement itself and the standard. If there is insufficient space to record all the required source information, append a page and use the space to refer to it.
 - (9) Multiply the 0 or 1 for each characteristic by the 1-100 rating of its criticality. Record the resulting products in the appropriate cells of the Product Column.
 - (10) Add all the products, and record the resulting sum in the Product Sum Cell.
 - (11) Add all the 0 or 1 ratings in the Rating Column, and record the resulting sum in the Rating Sum Cell.
 - (12) Divide the Product Sum by the Rating Sum, and multiply the resulting quotient by 100. Record the resulting product in the Index Cell. This is the Index of Adequacy for this

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measure. If the measures of the significant characteristics just met their standards, the Index would be approximately 100. The less adequate the characteristics that are measured, considering their criticality, the farther below 100 will be the Index.

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HFE MEASURE #1 UNDERSTANDABILITY OF PROCEDURE

DESCRIPTION: When an HPF has been performed inadequately, one possible cause is that its procedure was too difficult for the performers. This measure requires an analysis of the performance of the HPF being diagnosed into its component performance elements. These elements are then used as the basis for a multi-attribute rating process. Therefore, to use this measure, one must either fully understand the procedure for this HPF, or have access to an individual who understands it and will decompose the procedure into its elements for you.

PROCEDURE:

- (1) Make sufficient copies of "Procedure Understandability Worksheets #1 and #2" for the HPF's to be diagnosed (pages W8-56 and W8-57).
- (2) Fill in the background data on each worksheet. The rest of these procedures will apply to only one HPF.
- (3) On Worksheet #1, list the elements required to perform the HPF being diagnosed. These elements should be analyzed to the smallest level of detail possible. This analysis should be made for the specific system tested in the OT.
- (4) On Worksheet #1, specify the sequence of performance of the listed elements. This is done by recording sequence numbers in the appropriate Performance Sequence Cells of the worksheet (first element performed is numbered 1, etc.). In general, these sequence numbers should be recorded in the left-hand column under the heading, "Performance Sequence." However,

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sometimes an element may be performed more than once in an HPF procedure. In this case, record the second sequence number for that element in the next column, the third number for that element in the third column, etc. If two elements are performed at the same time, give them the same sequence number.

- (5) When you have finished recording the elements and their sequence numbers, add the total number of elements. Record the sum in the box at the bottom of the worksheet.
- (6) On Worksheet #2, rate the HPF procedure which you have analyzed. Use all three scales, and assign any rating from 0-100 to each. Record the three ratings in the appropriate boxes of this worksheet. Two of the three scales are based on the material you developed in Worksheet #1.
- (7) Compute the mean of the three rating scales, and record it in the Mean Box at the top of Worksheet #2.

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PROCEDURE UNDERSTANDABILITY . WORKSHEET #1

HPF : _____

ELEMENTS REQUIRED FOR HPF PERFORMANCE

PERFORMANCE
SEQUENCE

TOTAL NUMBER OF REQUIRED ELEMENTS:

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PROCEDURE UNDERSTANDABILITY WORKSHEET #2

HPF: _____

Assign a rating of 0-100 to each of the following attributes of understanding of procedures for the HPF listed above.

MEAN RATING =
(INDEX)

1. What is the degree of similarity between the procedure for performing this HPF and the procedure for a similar HPF which the OT participants have actually performed, previously?

0 25 50 75 100

Totally unrelated to any previous procedure.

Moderately related to a previously performed procedure.

100% identical to previous procedure

2. What is the effect of this HPF's number of elements (shown on the preceding worksheet) on the difficulty of understanding the procedure?

0 25 50 75 100

Number so large, it makes understanding impossibly difficult.

Number of elements produces moderate difficulty in understanding procedure.

This number of elements would not increase the understanding difficulty at all.

3. What is the effect of the complexity of the sequence of performance of the HPF elements (shown on the preceding worksheet) on the difficulty of understanding the performance?

0 25 50 75 100

Sequence so complex, understanding of performance is impossible.

Sequence complexity produces moderate difficulty in understanding procedure

Sequence so simple and linear would not increase understanding difficulty at all.

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HFE MEASURE #2 DIFFICULTY OF DECISIONS

DESCRIPTION: One possible cause of inadequate HPF performance is that the required decisions were too difficult for the performers. This measure requires an analysis of the HPF being diagnosed into its decisions and those decisions into their alternative responses. These decisions and responses are then used as a basis for a multi-attribute rating process. Therefore, to use this measure one must either fully understand the HPF in the system that was tested, or have access to an individual who does.

PROCEDURE:

- (1) Make sufficient copies of "Decision Difficulty Rating Worksheet #1 and #2" for the HPF's to be diagnosed (pages W8-61 and W8-66)
- (2) Fill in the background data on each worksheet. The rest of these procedures will apply to only one HPF.
- (3) On Worksheet #1, list all the decisions which must be made to perform this HPF in this system. Then list them on Worksheet #2.
- (4) On Worksheet #1, for each listed decision, record the realistic alternative responses. These are the actual outcomes among which the individual making the decision must choose.
- (5) On Worksheet #1, for each decision, add the total number of alternative responses, and record the resulting sums.

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- (6) On Worksheet #1, add the total number of decisions required for the performance of the HPF, and record the resulting sum in the box at the top of the first page of the worksheet.
- (7) On Worksheet #2, apply "Rating Scales for Decision Difficulty Worksheet #2" to the material you have developed on Worksheet #1. The first scale of the Rating Scales applies to all decisions required for the HPF taken together. Record your rating for this first scale in the Rating for Scale One box at the top of Worksheet #2. All other rating scales apply to each decision listed on Worksheet #2. So, apply each rating scale (from 2-4) to each listed decision, and record the resulting ratings in the appropriate cells of Worksheet #2.
- (8) On Worksheet #2, for each decision, add the ratings of all scales plus the rating of scale one (scale one rating is located in the box at the top of the worksheet). Record the resulting sums in the appropriate cells of the left-hand column of the worksheet.
- (9) Add all the sums in the left-hand column of Worksheet #2. Divide this grand sum by the total number of decisions (from Worksheet #1) multiplied by six (the number of rating scales). Record this mean rating in the appropriate box at the bottom of Worksheet #2.
- (10) For clarity, the rating scales of this measure were designed so that the higher the rating the greater the difficulty. To make the Index of Adequacy comparable to other Indices, this direction must be reversed. Therefore, the final step in this computation is to subtract the product computed in step 9 from 100. Record the resulting number in the Index

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Box on the bottom of Worksheet #2. If this Index of Adequacy is approximately 100, decision difficulty for the HPF is entirely adequate. The farther below 100 in this Index, the less adequate is decision difficulty.

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DECISION DIFFICULTY RATING WORKSHEET #1

HPF: _____

First, list all the types of decisions which must be made to perform the HPF above in this system. Second, for each type of decision listed, specify alternative responses among which each decision selects. Third, record the total number of decisions required for this HPF and the number of alternative responses for each decision. Fourth, complete the rating scales, on the attached worksheet, which apply to the information you have just developed. If there is insufficient space on this worksheet, photocopy it.

TOTAL NUMBER OF DECISIONS REQUIRED FOR HPF:

DECISIONS REQUIRED FOR HPF

ALTERNATIVE RESPONSES TO EACH DECISION

SUM =

SUM =

SUM =

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DECISION DIFFICULTY RATING WORKSHEET #1 (CONTINUED)

DECISIONS REQUIRED FOR HPF

ALTERNATIVE RESPONSES TO EACH DECISION

SUM = _____

SUM = _____

SUM = _____

SUM = _____

SUM = _____

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DECISION DIFFICULTY RATING WORKSHEET #1 (CONTINUED)

DECISIONS REQUIRED FOR HPF

ALTERNATIVE RESPONSES TO EACH DECISION

SUM =

SUM =

SUM =

SUM =

SUM =

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RATING SCALES FOR DECISION DIFFICULTY WORKSHEET #2

HPF: _____

Rating scale number one applies to all decisions required for this HPF, taken together. All other rating scales apply to each required decision, independently. Record your rating from the rating scale number one in the box at the top of Worksheet #2, and all other ratings in the appropriate cells of the worksheet.

1. How difficult would it be to make the number of decisions required for the performance of this HPF in this system?

0	25	50	75	100
No difficulty at all.		Moderately difficult.		So difficult that it could not be done.

2. How significant would this decision be when made as part of the HPF in this system?

0	25	50	75	100
No significance at all.		Moderately significant.		Extremely significant. Affects mission success, system survivability.

3. Under realistic conditions, how much time will be likely to be available to make this decision and still permit the HPF to be performed successfully?

0	25	50	75	100
Time is not an issue at all. Any amount can be taken.		Moderate amount of time can be taken and the HPF can be performed successfully.		Only a <u>very</u> small amount of time can be taken.

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RATING SCALES WORKSHEET #2 (CONTINUED)

4. To what extent is this decision irreversible if made during the performance of this HPF in this system?

0 25 50 75 100

Not an issue.
Decision may be
reversed as many
times as desired.

Small number of
reversals possible.

Irreversibility
total. Decision
must stand as made.

5. How difficult would it be to make this decision considering the number of alternative responses possible?

0 25 50 75 100

No difficulty
at all.

Moderately
difficult.

So difficult that
this decision
could not be made
successfully.

6. How similar are the alternative responses which must be considered in making this decision?

0 25 50 75 100

No similarity at
all. Responses
are completely
different from
each other.

Moderately
similar.

Responses are
extremely similar.
Hard to separate.

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HFE MEASURE #3 ADEQUACY AND TIMELINESS OF DISPLAY INFORMATION

DESCRIPTION: One possible cause of inadequate HPF performance is that required information was not available in time for its use. This measure requires the identification of the information required for the performance of the HPF being diagnosed. In addition, it requires the judgment of whether each piece of required information is time sensitive. If a piece of information is so judged, it then requires the judgement of the maximum length of time that can occur before the useful appearance of that information. Therefore, to use this measure, one must thoroughly understand the information requirements for the HPF, have access to detailed documentation about these requirements, or have access to an individual who thoroughly understands these requirements.

PROCEDURE:

- (1) Make sufficient copies of "Display Information Adequacy and Timeliness Worksheet" (p. W8-71) for the HPF's to be diagnosed.
- (2) Fill in the background data on each worksheet. The rest of the procedures will apply to only one HPF to be diagnosed.
- (3) Record all the information which is absolutely required for the successful performance of the HPF being diagnosed. This includes information which would be produced visually or auditorily. It does not apply to one display only. It applies to all the displays which produce such required information.

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- (4) Next, determine if each piece of listed information is time sensitive and if the display which produces that information could be a significant factor when the information was presented. For example, target range may be a piece of information which is absolutely required. Further, it is likely to be time sensitive. However, if it is produced by a radio, the radio cannot affect presentation time (except by malfunctioning). In this case, target range produced by radio would not meet the time sensitivity criteria.
- (5) For each recorded information requirement that meets both of these criteria, record an "X" in the appropriate cell of the X Column.
- (6) For each information requirement with an adjacent "X" estimate the maximum length of time permissible between some fixed point in time and the appearance of that information. Frequently, the fixed point in time will be the start of the HPF. However, it really depends upon the data available.
- (7) Record each permissible time in the appropriate cell of the Time Column. It is possible that it will be impossible to make certain time estimates. If this cannot be done, replace its "X" with an "*".
- (8) Compare the information requirements listed on the worksheet with the information actually produced by the display(s) used in HPF performance. This may be done with the actual physical equipment, or detailed specifications of that equipment.

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- (9) If a given piece of required information is actually produced, record a "1" in the appropriate cell of the 1/0 column. If it is not produced, record a "0".
- (10) For each piece of information that has both a "1" (from step 9) and an "X" (meaning it is time sensitive), determine the length of time between the fixed start time (see step 6) and the appearance of that information. If you are unable to obtain this time data, record an asterisk "*" in the appropriate cell of the 1/0 TIME column.
- (11) If a piece of required information appears on or before the listed time limit, record a "1" in the appropriate cell of the 1/0 TIME column. If it does not, record a "0".
- (12) For each listed piece of required information, multiply the contents of its 1/0 and 1/0 TIME Cells. An 1/0 Cell can contain a "0", or a "1". An 1/0 TIME Cell can contain a "0", a "1", an asterisk "*", or nothing. Clearly, you only multiply zeroes and ones. For each piece of information, record the product of multiplying the zeroes and ones in the appropriate cell of the PRDCT column. If an 1/0 TIME Cell has an asterisk or nothing as its content, record the content of the parallel 1/0 Cell in the PRDCT column.
- (13) Add the contents of the PRDCT column, and record the resulting sum in the Sum box at the bottom of the worksheet.
- (14) Count the number of pieces of required information for the HPF. Divide the number in the Sum box (from step 13) by the total number of pieces of required information. Record the resulting quotient at the bottom of the worksheet.

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- (15) Multiply the quotient by 100, and record the resulting product in the Index box at the bottom of the worksheet. This is the Index of Adequacy of this measure. If it is approximately 100, all required information is present and has been presented soon enough to be useful. The further below 100 this Index, the less adequate and timely the information presented.

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HFE MEASURE #4 DISPLAY READABILITY/HEARABILITY

DESCRIPTION: HFE Measure #4 (Adequacy and Timeliness of Display Information) results in a list of pieces of information which are both absolutely required for HPF performance and presented by system display(s) in time to be used. Other information that is not absolutely required and that is also presented by displays may have some utility for HPF performance. However, such information is, by definition, not required for this performance. Therefore, the only significant reason for studying this non-required information is to determine the "clutter" and overload produced by the display(s).

Even if required information is presented (and presented in time for use), the nature of its presentation may vary in adequacy. If such information is presented, but in an entirely inadequate manner, it may be usable. The nature of presentation is, therefore, a possible cause of inadequate HPF performance.

This measure is based on the list of information developed in HFE Measure #3. It includes three worksheets. Worksheet #1 provides a format for assigning required pieces of information (from HFE Measure #3) to their originating displays. This is necessary since these pieces of information are measured independent of their displays in Measure #3. Worksheet #2 provides the format for measuring visual displays. Worksheet #3 provides the format for measuring auditory displays. In both Worksheets #2 and #3, the formats of required information provided by a single display are rated, measured, and compared to standards.

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PROCEDURE:

- (1) Make sufficient copies of "Display Readability/Hearability Worksheet #1" so that you have at least one for each HPF to be diagnosed. It may be necessary to make more than one copy per HPF, depending upon the amount of visual and auditory displays used.
- (2) Fill in the background data on each worksheet.
- (3) On each Worksheet #1 list all the visual and auditory displays which produce required information for the HPF being diagnosed. Also record the required information. This information should be available from the completed Measure #3.
- (4) Record "X's" in the appropriate cells of Worksheet #1 to indicate the display(s) that produce each piece of required information. The remainder of this procedure applies to any single HPF being diagnosed.
- (5) Examine your completed Worksheet #1, and determine how many visual displays are listed. Make as many copies of Worksheet #2 as you need for measuring visual displays (one worksheet per display). Do the same for auditory displays (copying Worksheet #3).
- (6) Fill in the background information on each worksheet.
- (7) For each Worksheet #2 and #3, apply the "Common Procedures for Measures 9 through 14" found on page W8-50. Since you have already made copies of the Measure Worksheets,

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it is not necessary to respond to the first step of the Common Procedures. When you apply the steps of the Common Procedures for a given display, refer to your "Display Readability/Hearability Worksheet #1." In general, the characteristics being rated, measures, and compared to standards should be applied to the Required Information which that display produces. Therefore, keeping Worksheet #1 in front of you should prove helpful in completing the Common Procedures.

- (8) If more than one display were rated in this Measure, compute the mean of the various Indices of Adequacy which resulted, and record this Mean Index in the appropriate box of Worksheet #1.

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HFE MEASURE #5 DISPLAY INFORMATION UNDERSTANDABILITY

DESCRIPTION: The purpose of this measure is to determine the adequacy of that subset of a display(s) presentation of required information which leads to the understanding of that information. This is in some contrast to HFE Measure #4 which deals with the subset of display presentation which leads to perception of required information. Apart from this distinction, this HFE Measure is basically quite similar to Measure #4. It can be used without direct reference to the specific pieces of information which are required for HPF performance. However it should result in more valid and reliable findings if it is based on a completed "Display Visibility/Hearability Worksheet #1" from HFE Measure #4. In this measure, you rate display understandability on a multi-attribute scale, specific to each HPF being diagnosed.

PROCEDURE:

- (1) Make sufficient copies of "Display Information Understandability Worksheet" so that you have one for each HPF to be diagnosed.
- (2) Fill in the background on each worksheet. Further procedural steps are for diagnosing one HPF.
- (3) If you have completed HFE Measure #4, retrieve the filled in "Display Visibility/Hearability Worksheet #1."
- (4) Record the names of the appropriate displays, used in HPF performance.

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- (5) Rate the understandability of the presentation of the required information for each display on the six scales found in "Rating Scales for Display Information Understandability Worksheet," (page W8-80.
- (6) Add all ratings for each display, and record the resulting sums in the appropriate cells of the Sum column.
- (7) Divide each sum (from Step 6) by six--the number of scales used. Record the resulting quotients in the appropriate cells of the Sum/6 Column. These are the Indices of Adequacy for each display used in the HPF. If a given display was completely adequate, its Index should be approximately 100. The less adequate the display, the further below 100 will be the Index.
- (8) If an HPF used only one display, the measure will now be complete. If the HPF used more than one display, compute the mean of the Indices (from Step 7). Record this Mean Index in the appropriate box at the bottom of the worksheet.

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RATING SCALES FOR DISPLAY INFORMATION UNDERSTANDABILITY WORKSHEET

1. How adequate is the level of simplicity (as opposed to complexity) of the vocabulary and/or symbols used by this display to impart information for this HPF?

TOTALLY
INADEQUATE

0

25

MODERATELY
COMPLEX

50

75

COMPLETELY
ADEQUATE

100

So complex they
will be impossible
to understand.

May cause
some problems.

Should cause
no difficulty.

2. How unfamiliar is the vocabulary and/or symbology used by this display, for this HPF, likely to be to the user population?

TOTALLY
UNFAMILIAR

0

25

MODERATELY
UNFAMILIAR

50

75

ADEQUATELY
FAMILIAR

100

No transfer of
training
possible.

Some transfer
possible.

Sufficient trans-
fer of training
should take place.

3. To what extent are the symbols and/or vocabulary used by this display, for this HPF, similar to others, known by the users, but having a different meaning?

TOTALLY
CONFUSING

0

25

MODERATELY
CONFUSING

50

75

COMPLETELY
ADEQUATE

100

Identical to other
symbols/vocabulary,
but with a radically
different meaning.

Moderate confusion
between this symbology/
vocabulary and meaning
of similar one.

Symbols/vocabu-
lary either
adequately
different from
other, or with
adequately
similar meaning.

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HRTES RATING SCALES (CONTINUED)

4. How adequate is the total amount of information presented, at any given time by this display, for the understanding of that information for this HPF?

TOTALLY
INADEQUATE
0

25

MODERATELY
INADEQUATE
50

75

COMPLETELY
ADEQUATE
100

So much information presented at once that it cannot be understood, or so little that the key relationships are lost.

Moderately understandable amount of information presented at one time.

Understandable amount of information presented at one time for understanding.

5. How adequate is the amount of time in which required information is presented by this display for this HPF, for the understanding of that information?

TOTALLY
INADEQUATE
0

25

MODERATELY
INADEQUATE
50

75

COMPLETELY
ADEQUATE
100

Presentation time totally much too short.

Presentation time a little too short.

Adequate amount of presentation time.

6. How adequate was the rate of presentation of information by this display, for this HPF, for the understanding of that information?

TOTALLY
INADEQUATE
0

25

MODERATELY
INADEQUATE
50

75

COMPLETELY
ADEQUATE
100

Presentation rate much to rapid.

Moderately inadequate presentation rate.

Presentation rate completely adequate.

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HFE MEASURE #6 CONTROL ACCESSIBILITY

DESCRIPTION: If the performance of an HPF requires the manipulation of a control (or some other piece of equipment), the adequacy of its accessibility may affect that performance. The harder it is to access a piece of equipment that must be manipulated, the greater the likelihood that the manipulation may be ineffective. The first problem in the measure is to identify those controls and other pieces of equipment that must be manipulated for the adequate performance of the HPF being diagnosed. The second problem is to determine whether each control or other piece of manipulated equipment is adequately accessible to its user. Therefore, to take this measure you must have access to the actual hardware, detailed specifications of that hardware, or similar HFE test results from an earlier test.

PROCEDURE:

- (1) Make sufficient copies of "Accessibility Adequacy Worksheet" so that you have one copy for each HPF to be diagnosed.
- (2) Fill in the background data on the worksheets. The remaining procedures will be directed toward a single HPF.
- (3) On the worksheet, list all the controls and other equipment that must be manipulated for adequate performance of the HPF being diagnosed. They should be listed at the most detailed level possible (for example, remove screws A and B, and then remove Component C).

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- (4) If possible, after listing the control/equipment list the title of the crew member who is supposed to perform the manipulation and the hand or foot with which the manipulation should be done.
- (5) Either take appropriate accessibility measurements for each control/equipment listed, or take measurements from detailed specifications or previous tests. In this measure, accessibility is determined by:
 - (a) Reach distance;
 - (b) Diameter/circumference of restricted reach envelope;
 - (c) Reach angle to work location of appropriate individual;
 - (d) Absence or presence of potentially obscuring object(s) or people.
- (6) Compare each measure with its appropriate standard (from MIL-STD-1472, HEDGE, HFTEMAN, etc.). In the absence of such objective standards, you may substitute your expert judgment, though this is substantially less desirable.
- (7) If a given control/equipment meets all accessibility standards (or your judgment) record a "1" in the appropriate cell of the 0/1 column on the worksheet. If it does not meet all such standards, record a "0".
- (8) Record the source of your standard and measurement in the appropriate cell of the Source column. If there is insufficient space in a cell, record the source information on an appended sheet, and reference it in the cell.

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- (9) If a given control/equipment is given a "0", it is suggested that you append a sheet, and describe the nature of the accessibility problem in some detail on this sheet.
- (10) Add the contents of the cells of the 0/1 column, and record the resulting sum in the Sum box.
- (11) Count the number of controls and pieces of equipment to be manipulated for the HPF. Record this number in the # Controls/Equipment box.
- (12) Divide the sum by the number of controls/equipment, and multiply the resulting quotient by 100. Record this product in the Index box. This is the Index of Adequacy of Accessibility. If all controls and other equipment to be manipulated are fully accessible, this index will be approximately 100. The less adequate their accessibility, the further below 100 will be the Index.

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NAME _____ TELEPHONE _____

HRTES

ACCESSIBILITY ADEQUACY WORKSHEET

HPF: _____

CONDITIONS: _____

CONTROLS/EQUIPMENT; JOB TITLE; HAND/FOOT 0/1 SOURCE

CONTROLS/EQUIPMENT; JOB TITLE; HAND/FOOT	0/1	SOURCE

CONTROLS/EQUIP

SUM

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HRTES

HFE MEASURE #7 CONTROL STATIC CHARACTERISTICS

DESCRIPTION: In HRTES static characteristics, dynamic characteristics, and accessibility have been separated into categories of measures of control and other equipment to be manipulated. Static characteristics are those that affect: location, identification, and individual activation of controls or other equipment to be manipulated in the performance of an HPF that is being diagnosed. When an HPF has been performed inadequately, one possible cause is that the control(s) or other equipment which had to be manipulated could not be: identified in time by touch or vision; or activated independently of adjacent controls. This measure uses the "Accessibility Adequacy Worksheet" from HFE Measure #6. On this previous worksheet you identified those controls and other equipment to be manipulated for the HPF. These same controls/equipment will now have their static characteristics measured and compared to objective or subjective standards. The steps of this measure are largely identical to those described in Common Procedures.

PROCEDURE:

- (1) Make sufficient copies of the Measure Worksheet so that you have one for each HPF to be diagnosed.
- (2) Fill in the background data.
- (3) Retrieve your completed copy of "Accessibility Adequacy Worksheet" from HFE Measure #6, and copy the controls and other equipment to be manipulated. If Measure #6 has not been completed, you will have to develop this list now. It consists of those controls and other pieces of equipment to be manipulated in the performance of the HPF that are absolutely necessary.

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- (4) Study the characteristics listed on the worksheet. If you think that a significant characteristic is missing, add it in the "Other" category.
- (5) For each control/equipment listed decide if each characteristic on the worksheet is relevant to the performance of the HPF being diagnosed in this system. If it might have a significant effect on HPF performance in this system, it is relevant. In this case record an "X" in the appropriate cell of the Relevance row. If a characteristic is not relevant, record a "0" in the cell.
- (6) Rate each characteristic that you have selected for each control/equipment on the criticality scale which follows. Select any rating from 1-100. Record the ratings in the appropriate cells of the Rating row.

LOW CRITICALITY	MODERATE CRITICALITY	HIGH CRITICALITY
1	25	50
75	100	
Just important enough to be measured. Criticality low for this HPF.	Criticality moderate for this HPF.	Criticality Extremely high for this HPF.

- (7) Obtain appropriate measurements of each characteristics you have selected. This may be done in the following ways:
 - (a) Obtaining appropriate measurements from previous OT's, DT's, HFE tests, or other reasonably reliable sources;
 - (b) Physically taking the necessary measurements from the actual system;
 - (c) Taking some version of the necessary measurements from system documentation.

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- (8) Compare each measurement with the standard or specification which applies to it. This may be done in the following ways:
 - (a) Comparison with reasonably valid specifications such as those found in MIL STD-1472, HEDGE, and HFTEMAN--this is of course, preferable;
 - (b) Evaluation based on expert judgment--in the absense of an applicable standard your judgment may be substituted.
- (9) If a given characteristic meets its standard, record a "1" in the appropriate cell of the 0/1 row. If it does not meet its standard (or your judgment), record a "0" in this cell.
- (10) Record the source of each comparison in the appropriate cell of the Source row. This should be information as to the source of the measurement itself and the standard. If there is insufficient space to record all the required source information, append a page and use the space to refer to it.
- (11) Multiply the 0 or 1 for each characteristic by the 1-100 rating of its criticality. Record the resulting products in the appropriate cells of the Product row.
- (12) Add all the products, and record the resulting sum in the Product Sum Cells.
- (13) Add all the 0 or 1 ratings in the Rating column, and record the resulting sum in the Rating Sum Cells.

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- (14) Divide each Product Sum by Its Rating Sum, and multiply the resulting quotient by 100. Record the resulting products in the Control Index Cells. These are the Indices of Adequacy for this measure of controls/equipment. If the measures of the significant characteristics just met their standards, a given Index would be approximately 100. The less adequate the characteristics that are measured, considering their criticality, the farther below 100 will be the Index.
- (15) Compute the mean of the Control Indices. Record it in the Mean Index box of the worksheet. This is the Index of Adquacy static characteristics of all controls and equipment to be manipulated in the performance of the HPF being diagnosed.

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NAME _____ TELEPHONE _____

HRTES

STATIC CHARACTERISTICS WORKSHEET

HPF: _____

CONDITIONS (if applicable): _____

CONTROLS AND OTHER EQUIPMENT
TO BE MANIPULATED FOR HARDWARE

CHARACTERISTICS	SIZE	SHAPE	COLOR/LABELING	FUNCTIONAL PLACEMENT	ORDER	SEPARATION	VISIBILITY	OTHER:	PRDCT SUMS: RATING	STATIC CONTROL INDICES
RELEVANCE										
RATING										
Q/1										
PRDCT										
RELEVANCE										
RATING										
Q/1										
PRDCT										
RELEVANCE										
RATING										
Q/1										
PRDCT										
RELEVANCE										
RATING										
Q/1										
PRDCT										
RELEVANCE										
RATING										
Q/1										
PRDCT										
RELEVANCE										
RATING										
Q/1										
PRDCT										
RELEVANCE										
RATING										
Q/1										
PRDCT										
SOURCE										

MEAN
INDEX

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HRTES

HFE MEASURE #8 CONTROL DYNAMIC CHARACTERISTICS

DESCRIPTION: In HRTES static characteristics, dynamic characteristics, and accessibility have been separated into categories of measures of controls and other equipment to be manipulated. Dynamic characteristics are those that affect control movement and sensing of that movement. This measure uses either the "Accessibility Adequacy Worksheet" from HFE Measure #6, or the "Static Characteristics Worksheet" from HFE Measure #7. On these previous Worksheets you identified those controls and other equipment to be manipulated for the HPF. These same controls/equipment will now have their dynamic characteristics measured and compared to objective or subjective standards. The steps of this measure are identical to those in HFE Measure #7 and similar to those described in Common Procedures.

PROCEDURE:

- (1) Make sufficient copies of the Measure Worksheet so that you have one for each HPF to be diagnosed.
- (2) Fill in the background data.
- (3) Retrieve your completed copy of "Accessibility Adequacy Worksheet" from HFE Measure #6, or "Static Characteristics Worksheet" from HFE Measure #7. Copy the controls and other equipment to be manipulated. If Measures #6 or #7 have not been completed, you will have to develop this list now. It consists of those controls and other pieces of equipment to be manipulated in the performance of the HPF that are absolutely necessary.

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- (4) Study the characteristics listed on the Worksheet. If you think that a significant characteristic is missing, add it in the "Other" category.
- (5) For each control/equipment listed decide if each characteristic on the Worksheet is relevant to the performance of the HPF being diagnosed in this system. If it might have a significant effect on HPF performance in this system, it is relevant. In this case record an "X" in the appropriate cell of the Relevant Row. If a characteristic is not relevant, record a "0" in the cell.
- (6) Rate each characteristic that you have selected for each control/equipment on the criticality scale which follows. Select any rating from 1-100. Record the ratings in the appropriate cells of the Rating Row.

LOW CRITICALITY	MODERATE CRITICALITY	HIGH CRITICALITY
1	25	50
75	100	
<u>Just</u> important enough to be measured. Crite- cality low for this HPF.	Criticality moderate for this HPF.	Criticality extremely high for this HPF.

- (7) Obtain appropriate measurements of each characteristic you have selected. This may be done in the following ways:
 - (a) Obtaining appropriate measurements from previous OT's, DT's, HFE tests, or other reasonably reliable sources.
 - (b) Physically taking the necessary measurements from the actual system.
 - (c) Taking some version of the necessary measurements from system documentation.
- (8) Compare each measurement with the standard or specification which applies to it. This may be done in the following ways:

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- (a) Comparison with reasonably valid specifications such as those found in MIL STD-1472, HEDGE, and HFTEMAN -- this is, of course, preferable.
 - (b) Evaluation based on expert judgement -- in the absence of an applicable standard your judgement may be substituted.
- (9) If a given characteristic meets its standard, record a "1" in the appropriate cell of the 0/1 Row. If it does not meet its standard (or your judgement), record a "0" in its cell.
- (10) Record the source of each comparison in the appropriate cell of the Source Row. This should be information as to the source of the measurement itself and the standard. If there is insufficient space to record all the required source information, append a page and use the space to refer to it.
- (11) Multiply the 0 or 1 for each characteristic by the 1-100 rating of its criticality. Record the resulting products in the appropriate cells of the Product Row.
- (12) Add all the products, and record the resulting sum in the Product Sum Cells.
- (13) Add all the 0 or 1 ratings in the Rating Column, and record the resulting sum in the Rating Sum Cells.
- (14) Divide each Product Sum by its Rating Sum, and multiply the resulting quotient by 100. Record the resulting products in the Control Index Cells. These are the Indices of Adequacy for this measure of controls/equipment. If the measures of the significant characteristics just met their standards, a given Index would be approximately 100. The less adequate the characteristics that are measured, considering their criticality, the farther below 100 will be the Index.

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(15) Compute the mean of the control Indices. Record it in the Mean Index Box of the Worksheet. This is the Index of Adequacy of Dynamic Characteristics of all controls and equipment to be manipulated in the performance of the HPF being discussed.

The procedures for taking HFE Measures 9 through 14 are identical. They are the "Common Procedures for Measures 9 through 14." These common procedures are found on Pages W8-50.

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HRTES

DYNAMIC CHARACTERISTICS WORKSHEET

HPF: _____

CONDITIONS (if applicable): _____

CONTROLS AND OTHER EQUIPMENT TO BE MANIPULATED FOR HARDWARE	CHARACTERISTICS	RESISTANCE	DIRECTION OF MOTION	FEEDBACK	CONTROL-DISPLAY RATIO	CONTROL-SYSTEM MOTION RATIO	SYSTEM LAG	CONTROL GRADATION LINEARITY	CONTROL GRADATION SIZE	CONTROL JITTER/VIBRATION	OTHER:	PRDCT	SUM: RATING	DYNAMIC CONTROL INDICES
	RELEVANCE RATING													
	0/1													
	PRDCT													
	RELEVANCE RATING													
	0/1													
	PRDCT													
	RELEVANCE RATING													
	0/1													
	PRDCT													
	RELEVANCE RATING													
	0/1													
	PRDCT													
	RELEVANCE RATING													
	0/1													
	PRDCT													
	RELEVANCE RATING													
	0/1													
	PRDCT													
	RELEVANCE RATING													
	0/1													
	PRDCT													
	RELEVANCE RATING													
	0/1													
	PRDCT													
	RELEVANCE RATING													
	0/1													
	PRDCT													
	RELEVANCE RATING													
	0/1													
	PRDCT													
	RELEVANCE RATING													
	0/1													
	PRDCT													
SOURCE														

MEAN INDEX

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NAME _____ TELEPHONE _____

HRTES

HFE MEASURE #10--WORKSTATION SEATING CHARACTERISTICS ADEQUACY WORKSHEET

HPF: _____

CONDITIONS (if applicable): _____

CHARACTERISTICS	RELEVANCE	RATING	O/I	PRDCT	SOURCE
HEAD CLEARANCE SITTING-VERTICAL					
HEAD CLEARANCE SITTING-LATERAL					
SHOULDER CLEARANCE-VERTICAL					
SHOULDER CLEARANCE-LATERAL					
KNEE CLEARANCE-VERTICAL					
KNEE CLEARANCE-LATERAL					
THIGH CLEARANCE-VERTICAL					
THIGH CLEARANCE-LATERAL					
HIP CLEARANCE-LATERAL					
KICK SPACE					
FOOT SUPPORT LENGTH					
FOOT SUPPORT WIDTH					
FOOT SUPPORT SLOPE (ANGLE)					
FOOT SUPPORT TO SEAT SURFACE					
SEAT SURFACE TO ARM SUPPORT					
ARM SUPPORT LENGTH					
ARM SUPPORT WIDTH					
ARM SUPPORT SLOPE (ANGLE)					
SEAT LENGTH					
SEAT WIDTH-HIP					
SEAT WIDTH-THIGH					
SEAT SLOPE-ANGLE					
SEAT SURFACE HEIGHT					
SEAT BACK LENGTH					
SEAT BACK WIDTH-SHOULDER					
SEAT/BACK SLOPE (ANGLE)					
SEAT MOTION CAPABILITY					
SEAT/BACK CONFORMANCE TO BODY					
SEAT/BACK SHOCK ABSORPTION					
OTHER:					
	RATING SUM:			PRDCT SUM	INDEX:

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HRTES

SUMMARY WORKSHEET FOR HUMAN FACTORS ENGINEERING DIAGNOSIS

HPF: _____

CONDITIONS (if applicable): _____

SPI: _____

SYSTEM FUNCTION: _____

SPECIFIC HFE PROBLEMS CONTRIBUTING TO INDECES	SPECIFIC HFE INDECES OF ADEQUACY	EXP or QUEST	COLLECTIVE INDECES	HFE INDEX OF ADEQUACY
	1 <input type="checkbox"/> UNDERSTANDABILITY OF PROCEDURES		DESIGN FOR COGNITION []	HUMAN FACTORS ENGINEERING []
	2 <input type="checkbox"/> DECISION DIFFICULTY			
	3 <input type="checkbox"/> DISPLAY INFORMATION ADEQUACY & TIMELINESS		DISPLAYS []	
	4 <input type="checkbox"/> DISPLAY READABILITY/ HEARABILITY			
	5 <input type="checkbox"/> DISPLAY INFORMATION UNDERSTANDABILITY			
	6 <input type="checkbox"/> CONTROL ACCESSIBILITY		CONTROLS/OTHER EQUIPMENT TO BE MANIPULATED []	
	7 <input type="checkbox"/> CONTROL STATIC CHARACTERISTICS			
	8 <input type="checkbox"/> CONTROL DYNAMIC CHARACTERISTICS			
	9 <input type="checkbox"/> WORKSTATION DIMENSIONAL CHARACTERISTICS		WORKSTATION/ ENVIRONMENT []	
	10 <input type="checkbox"/> WORKSTATION SEATING CHARACTERISTICS			
	11 <input type="checkbox"/> WORKSTATION VISUAL CHARACTERISTICS			
	12 <input type="checkbox"/> WORKSTATION SOUND CHARACTERISTICS			
	13 <input type="checkbox"/> WORKSTATION MOTION CHARACTERISTICS			
	14 <input type="checkbox"/> WORKSTATION VENTILATION CHARACTERISTICS		WORK LOAD []	
	15 <input type="checkbox"/> WORKSTATION SAFETY CHARACTERISTICS			
	16 <input type="checkbox"/> WORK LOAD	QUEST		

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HRTES

GENERAL INSTRUCTIONS FOR PERSONNEL SELECTION MEASURES

DESCRIPTION: An operational test (OT) has been completed recently. For the specifics of this OT, see "HPF Diagnostic Worksheet" on page W8-4 of this submission. Various operator and maintainer tasks were measured during this OT. One or more of these tasks was evaluated as having been performed inadequately. In the Human Resources Test and Evaluation System (HRTES) operator and maintainer tasks have been defined at a general level which is not dependent upon the specific types of equipment involved. To avoid confusion with traditional tasks, they have been named Human Performance Functions (HPF's). The "HPF Diagnostic Worksheet" on page W8-4 that lists the specifics of the operational test also lists the HPF's which were performed inadequately.

Operational testing and evaluation personnel have determined that those HPF's that are listed are of significant importance to the overall evaluation of the system that was tested. They need to know why these HPF's were performed inadequately. One possible reason is that the individual or individuals who performed inadequately has significant characteristics that interacted with the system hardware/software and that fell outside the fifth to ninety-fifth percentile envelopes for the appropriate population. In the case of measures of central nervous system functioning, one possible reason is that the individual or individuals fell below the fifth percentile for the characteristics in question.

It is not necessary to take any personnel selection measures if you can be sure that all the personnel who performed inadequate were "representative soldiers" in all their significant characteristics. Being a representative soldier implies that these individuals fell within the fifth to ninety-fifth percentiles for those significant characteristics which would affect HPF performance. Since system hardware and software were supposed to be designed for "representative soldiers" if the soldiers were representative, this could not be the cause of inadequate performance. However, the random selection of military units to act as players in an OT does not guarantee the representativeness of the soldiers involved.

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HRTES

Further, you must deal with the question of whether a "representative soldier" is supposed to represent the specific military population, or the appropriate age group of the general population.

If you decide to take one of more Personnel Selection Measures, HRTES contains the following:

MEASURE NAME	MEASURE FUNCTION	PAGE W8:
1. Background that Bears on Cognitive Functioning	Adequacy of those background characteristics which affect mental work.	117
2. Aptitude/Ability that Bears on Cognitive Functioning	Adequacy of those aptitude/ability characteristics which bear on cognitive functioning.	118
3. Vision for Display Use	Adequacy of vision characteristics.	119
4. Anthropometry for Visual Display	Adequacy of anthropometric characteristics required for visual display use.	120
5. Audition for Auditory Display Use	Adequacy of audition characteristics required for auditory display use.	121
6. Anthropometry for Auditory Display Use	Adequacy of anthropometric characteristics required for auditory display use.	122
7. Length/Reach Anthropometry for Accessibility	Adequacy of length-reach characteristics required for control/equipment assessibility.	123
8. Joint Motion for Accessibility	Adequacy of joint motion characteristics required for control/equipment accessibility.	124-125

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MEASURE NAME	MEASURE FUNCTION	PAGE W8:
9. Size Anthropometry for Accessibility	Adequacy of size characteristics required for control/equipment accessibility (in limited space).	126
10. Vision for Manipulation	Adequacy of vision characteristics required for detection and use of controls/equipment to be manipulated.	127
11. Anthropometry for Static Characteristics of Controls/Equipment to Be Manipulated	Adequacy of anthropometric characteristics required to interact with static characteristics of controls/equipment to be manipulated.	128
12. Strength for Manipulation	Adequacy of strength characteristics required for manipulation.	129
13. Range of Movement for Manipulation	Adequacy of range of movement characteristics required for manipulation.	130
14. Coordination for Manipulation	Adequacy of coordination characteristics required for Manipulation.	131
15. Anthropometry for Workstation/Environment Dimensions	Adequacy of anthropometric characteristics required for compatibility with workstation/environment dimensions.	132-133
16. Anthropometry for Seats	Adequacy of anthropometric characteristics required for compatibility with seating arrangements.	134-135
17. Vision for Workstation/Environment	Adequacy of vision characteristics required for compatibility with the workstation/environment.	136

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MEASURE NAME	MEASURE FUNCTION	PAGE W8:
18. Audition for Workstation/ Environment	Adequacy of audition characteristics required for compatibility with the workstation/environment.	137
19. Central Nervous System Functioning for Compatibility with Workstation Motion	Adequacy of central nervous system characteristics (other than vision and audition) required for compatibility with workstation motion.	138
20. Characteristics Required by Workstation Ventilation and Air Filtration	Adequacy of personnel characteristics required to interact with workstation/environment ventilation and air filtration.	139
21. Physiological Indices of Workload Tolerance	Adequacy of personnel characteristics that relate to workload tolerance.	140

This section includes a set of "Common Procedures" which apply to all of the listed Personnel Selection Measures. If you have also received the HRTES HFE Measures, you will notice that the Personnel Selection Measures "Common Procedures" are largely identical to the HFE Measures "General Procedures" plus their "Common Procedures."

Your first problem will be to decide which Personnel Selection Measures to take of each HPF to be diagnosed. During the OT, players and observers filled in questionnaires in which they gave their opinions of the difficulty of each HPF and the reasons for significant difficulty. If the questionnaires indicated significant difficulty, they were reduced and used to fill out an "Opinion Summary Data Worksheet" for that HPF. Scales 1-16 and scale 21 of this Worksheet correspond to the Personnel Selection Measures listed earlier just as they correspond to the HFE Measures. The reason for this parallelism is that performance difficulty can have been caused by an inadequate interface and/or inadequate user characteristics. For example, if an individual indicates a difficulty in reaching a control to

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manipulate it, that control could have been located inappropriately for the normal user population, or that individual could have arms which are shorter than the normal population's fifth percentile. This parallelism applies to all HFE and Personnel Selection Measures.

If any player or observer thought that performing a given HPF was difficult and that HPF is one of those being diagnosed now, you will have an "Opinion Summary Data Worksheet" for it with this submission. In this case the scale scores listed may be helpful to you in deciding which Personnel Selection Measures to take. If a score indicates significant difficulty (50 or below), it is reasonable to take the corresponding Personnel Selection Measure(s) for that HPF. In some cases several Personnel Selection Measures, taken together, correspond to one "Opinion Summary Data Worksheet" scale. It is, of course, possible that players and observers were not able to judge whether there was something which was inadequate and produced inadequate HPF performance. Therefore these scores, if they are available, can only be a guide for you to use as you think best. However, it is possible that the players and observers did not believe that an HPF was difficult. In this case you will have no "Opinion Summary Data Worksheet" for that HPF, and you will have to fall back on your own resources to decide which of these measures to take.

Since the scales of the "Opinion Summary Data Worksheet" and the Personnel Selection Measures do not always equal each other on a one scale to one measure relationship, the following table is presented.

OPINIONS SCALES	NUMBERS OF PERSONNEL SELECTION MEASURES
1. Understanding Procedures	1+2
2. Display Readability/Hearability Measurement	3+4 and/or 5+6
3. Display Information Understanding	1+2
4. Usefulness of Display Information	None

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OPINION SCALES	NUMBERS OF PERSONNEL SELECTION MEASURES
5. Manipulation Difficulty	12+13+14
6. Reach/Accessibility	7+8+9
7. Control Configuration	10+11
8. Decision Difficulty	1+2
9. Target/Terrain Visibility	17
10. Workstation Design for Visibility	17
11. Sound	18
12. Motion	19
13. Ventilation	20
14. Workstation Dimensions	15
15. Seating	16
16. Safety	None
17. Training Time	See Training Measures
18. Practice Condition	See Training Measures
19. Trainer(s)	See Training Measures
20. Training Method	See Training Measures
21. Workload	21

You can use these scale scores as an aid in deciding which Personnel Selection Measures to take. However, you cannot use them in place of Personnel Selection Measures. The reason for this is as follows:

- (1) Scale scores are parallel to both Personnel Selection and HFE Measures.

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- (2) If a given scale score were used to replace both its parallel Personnel Selection and HFE Measures, one would not be able to differentiate between Personnel Selection and HFE causes of inadequate performance.
- (3) One could use a given scale score to replace one of a parallel measure pair -- if the other parallel measure indicated no difficulty, or if the other parallel measure were considered fixed and therefore not taken.
- (4) It is considerably more likely that Personnel Selection will be considered fixed than will HFE. Further, personnel characteristics are more likely to require specific documentation as causes of inadequate performance than are HFE.
- (5) Therefore, scale scores can only be used as replacements for HFE Measures, not Personnel Selection Measures, and even this replacement is discouraged in HRTES.

In addition to the "Opinion Summary Data Worksheet," this submission should include a copy of the "HPF Diagnostic Worksheet" (described earlier) and a copy of the "Summary Worksheet for Personnel Selection Diagnosis" that will be described in the following "Common Procedures."

COMMON PROCEDURES (APPLICABLE TO ALL PERSONNEL SELECTION MEASURES):

- (1) Read through these common procedures and the Worksheets for the Personnel Selection Measures to familiarize yourself with them.
- (2) Examine the "HPF Diagnostic Worksheet" to familiarize yourself with information about the OT and the specific HPF's that are to be discussed.

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- (3) Examine the "Opinion Summary Data Worksheet" for each HPF (if there is one). Use their scores as an aid to selecting parallel Personnel Selection Measures. If you do not have one or more such Worksheets, use your best judgement for deciding which measures to take of each HPF.
- (4) Make sufficient copies of the Personnel Selection Measure Worksheets so that you have as many as you need for each HPF to be diagnosed.
- (5) Fill in the background information on each Worksheet. Procedures 6-16 are directed toward taking any single Measure of any HPF to be diagnosed.
- (6) Study the characteristics listed on the worksheet. If you think that a significant characteristic is missing, add it in the "Other" category.
- (7) Decide if each characteristic on the Worksheet is relevant to the performance of the HPF being diagnosed in this system. If it might have a significant effect on HPF performance in this system, it is relevant. In this case record an "X" in the appropriate cell of the Relevance Column. If a characteristic is not relevant, record a "0" in the cell.
- (8) If there is a column for designating specific part of body, complete it for each selected characteristic.
- (9) Rate each characteristics that you have selected on the criticality scale which follows. Select any rating from 1-100. Record the ratings in the appropriate cells of the Rating Column.

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HRTES

LOW CRITICALITY	MODERATE CRITICALITY	HIGH CRITICALITY
1 25	50 75	100
<u>Just</u> important enough to be measured. Criticality low for this HPF.	Criticality moderate for this HPF.	Criticality extremely high for this HPF.

- (10) Obtain appropriate measurements of each characteristic you have selected. This may be done in the following ways:
- (a) Obtaining appropriate measurements from previous OT's, DT's, HFE tests, or other reasonably reliable sources.
 - (b) Physically taking the necessary measurements from the actual system.
 - (c) Taking some version of the necessary measurements from system documentation.
- (11) Compare each measurement with the standard or specification which applies to it. This may be done in the following ways:
- (a) Comparison with reasonably valid specifications such as those found in MIL STD-1472, HEDGE, and HFTEMAN -- this is, of course, preferable.
 - (b) Evaluation based on expert judgement -- in the absence of an applicable standard your judgement may be substituted.
- (12) Remember, this procedure applies only to those individuals who performed the given HPF below criterion. If a given characteristic, for one individual, falls inside the fifth to ninety-fifth percentile envelope, or exceeds the appropriate standard, or your judgement, assign (do not record) a 1. If it does not, assign a 0. If only one individual performed this HPF inadequately, then the 1 or 0 assigned that individual's

SYSTEM _____ TEST _____ DATE _____ PAGE _____

NAME _____ TELEPHONE _____

HRTES

characteristic is recorded directly in the appropriate cell of the (0/1) column. However, if more than one individual performed this HPF inadequately, then you will have to compute the mean of the zeros and ones for this characteristic. Once this has been computed, record the mean of the zeros and ones assigned to the given characteristic in the appropriate cell of the (0/1) column.

- (13) Record the source of each comparison in the appropriate cell of the Source Column. This should be information as to the source of the measurement itself and the standard. If there is insufficient space to record all the required source information, append a page and use the space to refer to it.
- (14) Multiply the 0, 1, or mean for each characteristic by the 1-100 rating of its criticality. Record the resulting products in the appropriate cells of the Product Column.
- (15) Add all the products, and record the resulting sum in the Product Sum Cell.
- (16) Add all the 0 or 1 ratings in the Rating Column, and record the resulting sum in the Rating Sum Cell.
- (17) Divide the Product Sum by the Rating Sum, and multiple the resulting quotient by 100. Record the resulting product in the Index Cell. This is the Index of Adequacy for this measure. If the measures of the significant characteristics just met their standards, the Index would be approximately 100. The less adequate the characteristics that are measured, considering their criticality, the farther below 100 will be the Index.

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- (18) When you have finished taking the measures you have selected for each HPF, make as many copies of the "Summary Worksheet for Personnel Selection Diagnosis" as you need for the HPF's you have diagnosed (one per HPF).
- (19) Fill in the information at the top and extreme bottom of each Worksheet.
- (20) Record the specific Personnel Selection indices of adequacy for the measures you have taken for each HPF being diagnosed. This is to be done in the appropriately labeled boxes on the Worksheets.
- (21) If you have not taken a specific Personnel Selection Measure for a given HPF, record an "X" in the appropriate box of the Worksheet.
- (22) Record the specific characteristic(s) which caused any specific Index of Adequacy to be significantly below 100. This is to be done in the first column of the Worksheet. If necessary, append an additional sheet for this purpose, and reference it in the first column.
- (23) Compute the means of the specific Indices of Adequacy according to the branching structure on the Worksheet. Means are to be computed of Indices: 1+2; 3+4; 5+6; 7+8+9; 10+11; 12+13+14; 15-21. Record the resulting seven means in those boxes to which the branching structure leads. Next, compute the means of the following means from the previous step: (3+4)+5+6) and (7+8+9)+(10+11)+(12+13+14). Finally, take these two newly computed means, and compute the means of the following: (1+2); (3+4+5+6); (7-14); (15-21); and (22). Record the resulting means in those boxes on the Worksheet appropriate for them.

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(24) If all the specific indices are absent, for a given collective index, record an "X" in the box for that collective index. If you have recorded an "X" in any individual box, leave it out of the computation.

(25) When you have completed all the Personnel Selection Measures and the "Summary Worksheet for Personnel Selection Diagnosis" return all materials to sender.

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HRTES

PERSONNEL SELECTION MEASURE #1-- BACKGROUND THAT BEARS ON COGNITIVE FUNCTIONING ADEQUACY WORKSHEET

HPF: _____

CONDITIONS (if applicable): _____

CHARACTERISTICS	RELEVANCE	RATING	0/1	PRDCT	SOURCE
CIVILIAN EDUCATION LEVEL					
AMOUNT OF APPROPRIATE CIVILIAN EXPERIENCE					
LENGTH OF MILITARY SERVICE					
MILITARY RANK					
MOS					
MOS SKILL LEVEL					
AMOUNT OF APPROPRIATE MILITARY EXPERIENCE					
SPECIFIC MILITARY TRAINING IN SYSTEM TYPE					
QUALIFICATION LEVEL WITH SYSTEM					
TIME SINCE QUALIFICATION WITH SYSTEM					
OTHER:					
	RATING SUM:			PRDCT SUM	INDEX:

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HRTES

PERSONNEL SELECTION MEASURE #3-- VISION DISPLAY USE ADEQUACY WORKSHEET

HPF: _____

CONDITIONS (if applicable): _____

CHARACTERISTICS	REVERANCE	EYE: RT, LT, OR B.	RATING	0/1	PRDC	SOURCE
VISUAL ACUITY-NEAR (AT DISPLAY DISTANCE)						
VISUAL DISCRIMINATION (RETINAL PERIPHERY)						
COLOR DISCRIMINATION						
DEPTH DISCRIMINATION						
MOVEMENT DISCRIMINATION						
VISUAL SEARCH						
DARK ADAPTATION						
LIGHT ADAPTATION						
EYE DOMINANCE		X				
FATIGUE TOLERANCE FOLLOWING-LONG TERM USE OF DISPLAY(S)		X				
OTHER:						
RATING SUM					PRDC SUM=	INDEX

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 NAME _____ TELEPHONE _____

HRTES

PERSONNEL SELECTION MEASURE #8-- JOINT MOTION FOR ACCESSIBILITY ADEQUACY WORKSHEET

HPF: _____

CONDITIONS (if applicable): _____

CHARACTERISTICS	RELEVANCE	LIMB: RT, LT. OR B.	RATING	O/I	PRDCT	SOURCE
WRIST FLEXION						
WRIST EXTENSION						
WRIST ADDUCTION						
WRIST ABDUCTION						
FOREARM SUPINATION						
FOREARM PRONATION						
ELBOW FLEXION						
SHOULDER FLEXION						
SHOULDER EXTENSION						
SHOULDER ADDUCTION						
SHOULDER ABDUCTION						
SHOULDER MEDIAL ROTATION						
SHOULDER LATERAL ROTATION						
ANGULAR LIMITS OF WHOLE ARM HORIZONTAL MOTION (SPEC. HAND HEIGHT ABOVE SEAT)						
ANKLE FLEXION						
ANKLE EXTENSION						
ANKLE ADDUCTION						
ANKLE ABDUCTION						
KNEE FLEXION						
KNEE MEDIAL ROTATION						
Continued on Following Page						
	RATING SUM			PRDCT SUM=		INDEX

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HRTES

PERSONNEL SELECTION MEASURE #13-- RANGE OF MOVEMENT FOR MANIPULATION ADEQUACY WORKSHEET

HPF: _____

CONDITIONS (if applicable): _____

CHARACTERISTICS	RELEVANCE	LIMB: RT, OR LT.	RATING	0/1	PRDCT	SOURCE
WRIST FLEXION						
WRIST EXTENSION						
WRIST ADDUCTION						
WRIST ABDUCTION						
FOREARM SUPINATION						
FOREARM PRONATION						
ELBOW FLEXION						
SHOULDER FLEXION						
SHOULDER EXTENSION						
SHOULDER ADDUCTION						
SHOULDER ABDUCTION						
SHOULDER MEDIAL ROTATION						
SHOULDER LATERAL ROTATION						
ANKLE ADDUCTION						
ANKLE ABDUCTION						
ANKLE FLEXION						
KNEE ROTATION						
KNEE FLEXION						
OTHER:						
	RATING SUM			PRDCT SUM		INDEX

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HRTES

PERSONNEL SELECTION MEASURE #15-- ANTHROPOMETRY FOR WORKSTATION/ENVIRONMENT DIMENSIONS ADEQUACY WORKSHEET

HPF: _____

CONDITIONS (If applicable): _____

CHARACTERISTICS	RELEVANCE	RATING	O/I	PRDCT	SOURCE
STATURE					
SHOULDER HEIGHT (STANDING)					
SHOULDER BREADTH					
CHEST DEPTH					
CHEST BREADTH					
WAIST DEPTH					
ELBOW HEIGHT (STANDING)					
HIP BREADTH (STANDING)					
BUTTOCK-ABDOMEN BREADTH (STANDING)					
KNEE BREADTH <small>SPECIFY LEFT _____ OR BOTH _____</small> RIGHT _____					
HEAD CIRCUMFERENCE					
FOOT LENGTH <small>SPECIFY LEFT _____ OR RIGHT _____</small>					
FOOT BREADTH <small>SPECIFY LEFT _____ OR BOTH _____</small> RIGHT _____					
PRONE LENGTH					
PRONE HEIGHT					
CRAWLING LENGTH					
CRAWLING HEIGHT					
KNEELING LENGTH					
KNEELING HEIGHT (CROUCHING)					
KNEELING HEIGHT (UPRIGHT)					
CONTINUED ON FOLLOWING PAGE					
	RATING SUM:			PRDCT SUM	INDEX:

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HRTES

PERSONNEL SELECTION MEASURE #16-- ANTHROPOMETRY FOR SEATS ADEQUACY WORKSHEET

HPF: _____

CONDITIONS (if applicable): _____

CHARACTERISTICS	RELEVANCE	LIMB: RT, LT, OR B.	RATING	O/I	PRDCT	SOURCE
SITTING HEIGHT (ERECT)		X				
SITTING HEIGHT (RELAXED)		X				
SHOULDER HEIGHT (SITTING)						
ELBOW REST HEIGHT (SITTING)						
ELBOW-FINGERTIP LENGTH						
HEAD LENGTH		X				
BUTTOCK-KNEE LENGTH						
POPLITEAL HEIGHT						
BUTTOCK-POPLITEAL LENGTH						
BUTTOCK-HEEL LENGTH						
FOOT LENGTH						
BUTTOCK-HEEL LENGTH (DIAGONAL)						
HEAD BREADTH		X				
SHOULDER (BIDELTOID) BREADTH		X				
FOREARM-FOREARM BREADTH		X				
WAIST BREADTH (SITTING)		X				
HIP-HIP BREADTH (SITTING)		X				
THIGH CLEARANCE HEIGHT (SITTING)		X				
THIGH BREADTH (SITTING)						
KNEE-KNEE BREADTH (SITTING)		X				
Continued on Following Page						
	RATING SUM		PRDCT SUM		INDEX	

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HRTES

PERSONNEL SELECTION MEASURE #16--CONT.

HPF: _____

CONDITIONS (if applicable): _____

CHARACTERISTICS	RELEVANCE	LIMB: RT. LT. OR B.	RATING	O/I	PRDCT	SOURCE
FOOT-FOOT BREADTH						
WEIGHT						
OTHER:						
	RATING SUM			PRDCT SUM=		INDEX

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HRTES

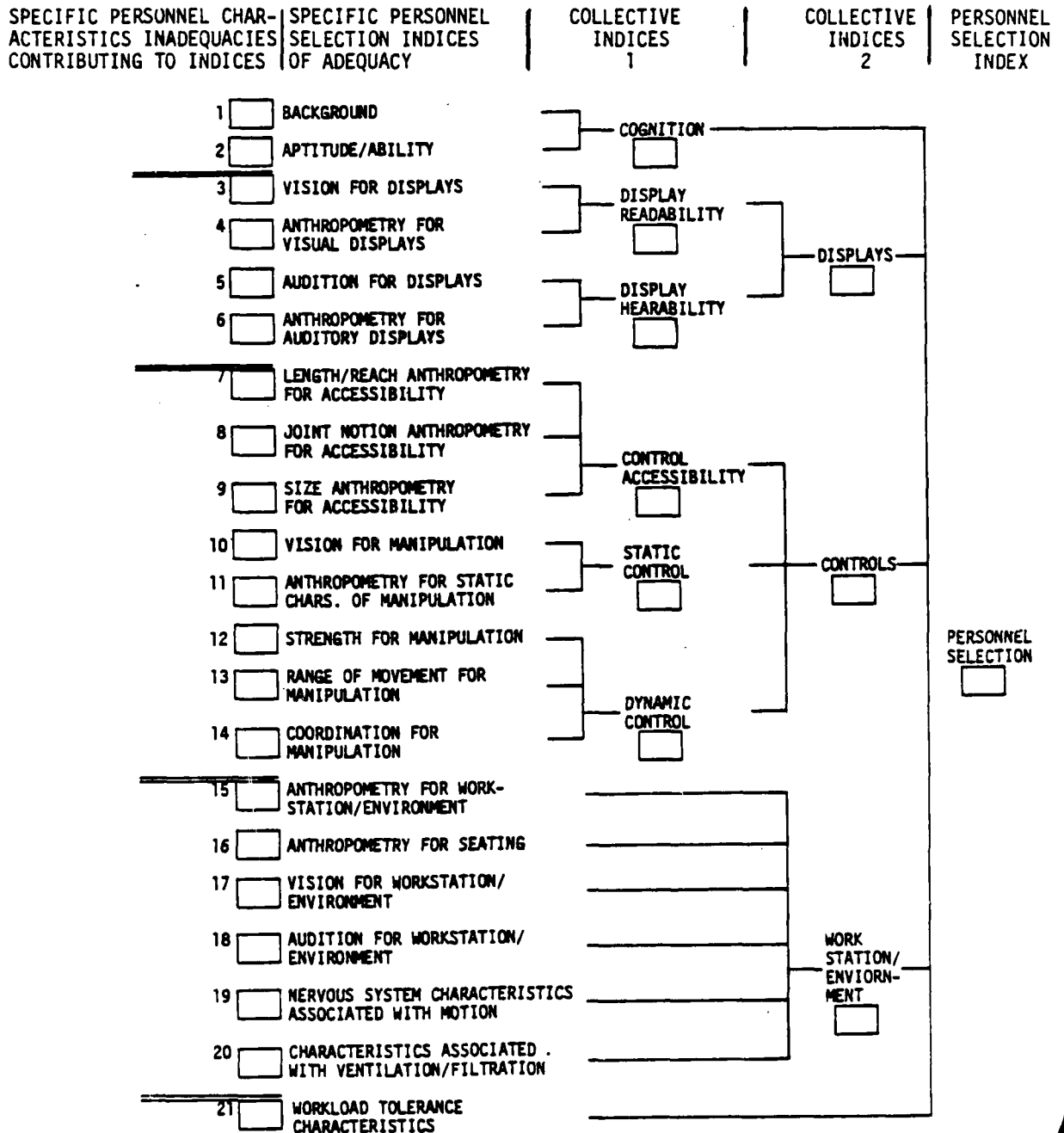
SUMMARY WORKSHEET FOR PERSONNEL SELECTION DIAGNOSIS

HPF: _____

CONDITIONS (if applicable): _____

SPI: _____

SYSTEM FUNCTION: _____



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