SECURITY CLASSIFICATION OF THIS PAGE (When Date Entered) READ INSTRUCTIONS REPORT DOCUMENTATION PAGE BEFORE COMPLETING FORM 1. REPORT NUMBER 2. GOVT ACCESSION NO. 3. RECIPIENT'S CATALOG NUMBER ARI Research Note 84-120 4. TITLE (and Subtitle) 5. TYPE OF REPORT & PERIOD COVERED Final Report HUMAN RESOURCES TEST AND EVALUATION SYSTEM (HRTES) period ending May 1982 Comprehensive Workbook 6. PERFORMING ORG. REPORT NUMBER 7. AUTHOR(a) 8. CONTRACT OR GRANT NUMBER(a) Jonathan D. Kaplan, William H. Crooks, Mark S. Sanders and Rina Dechter DAHC 19-77-C-0055 10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS 9. PERFORMING ORGANIZATION NAME AND ADDRESS Perceptronics, Inc. 2Q262717A765 and 6271 Variel Avenue 2Q263743A775 Woodland Hills, CA 91367 11. CONTROLLING OFFICE NAME AND ADDRESS 12. REPORT DATE U.S. Army Research Institute for the Behavioral August 1984 and Social Sciences, 5001 Eisenhower Avenue, 13. NUMBER OF PAGES Alexandria, VA 22333-5600 370 15. SECURITY CLASS. (of this report) 14. MONITORING AGENCY NAME & ADDRESS(If different from Controlling Office) Unclassified

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18. SUPPLEMENTARY NOTES

This is the comprehensive version of HUMAN RESOURCES TEST AND EVALUATION SYSTEM (HRTES). It differs in many respects from the later HRTES TEST PROCEDURES AND SUPPLEMENT. This is Volume II of a two-volume set.

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:

29. 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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HUMAN RESOURCES TEST AND EVALUATION SYSTEM (HRTES) Comprehensive Workbook

Jonathan D. Kaplan, William H. Crooks, Mark S. Sanders, and Rina Dechter

Perceptronics, Inc.

Contracting Officer's Representatives Irving N. Alderman and Charles O. Nystrom

Battlefield Information Systems Technical Area Franklin L. Moses, Chief

SYSTEMS RESEARCH LABORATORY Jerrold M. Levine, Director



#### U. S. Army

Research Institute for the Behavioral and Social Sciences

August 1984

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ARI Research Note 84-120

18. (continued)

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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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," "Conditons," 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:

We suggest that the following

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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HRTES GUIDELINES FOR ASSIGNING HPF'S CRITERIA AND STATISTICS WITHIN THEIR OVERALL SPI CRITERION

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# HRTES 2. SYSTEM INDEX

#### CONTENTS

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



ITEMS TO BE INCLUDED	) IN TEST (Number	and Type):		
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OPERATOR AND MAINTAI	NER PERSONNEL (Nu	mber and Type)	:	
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DIAGRAM OF SYSTEM TO	BE TESTED:			
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### SYSTEM FUNCTION WORKSHEET FOR AIR DEFENSE WEAPONS

	SYSTEM FUNCTION RATINGS								
SYSTEM CLASS: AIR DEFENSE WEAPONS including: Short Range Missiles, Medium Range Missiles, Long Range Missiles, Air Defense Guns, High Energy Systems	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	ľ
Deny selected airspace/formation to attacking aircraft.								1,2,4 5,7	30 29
4. Destroy ground targets.								1,2,5 7	28 27 26
Protect operator/crew from enemy action.								2,3,7	25 24 23
									22 21 20
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									16 15 14
									13 12 11
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### SYSTEM FUNCTION WORKSHEET FOR ARMORED VEHICLES

OMOZENA CILADO		SYSTEM	1 FUNC	TION R	ATINGS		_		
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 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	SELECTION WEIGHT	← SPI CATEGORY REFERENCES	
Destroy fixed emplacements.								1,2,5	36 35
Destroy armored vehicles.								1,2,5 7	34 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 .
Serve as a platform for mounted attack.								1,2,5 7	22 21 . 20 <sub>-</sub> .
7. Transport troops/materiel.								2,5,7	19 18 17
8. Perform reconnaissance.								2,5,6 7	16 . 15 . 14
Protect crew/passengers/materiel from enemy action.								2,3	13 12 11
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### SYSTEM FUNCTION WORKSHEET FOR AVIATION SYSTEMS

	SYSTEM	I FUNC	TION R	ATINGS				
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	
					,	· · · · · · ·	1,2,5	36 35
							1,2,5 7	32
							1,2,5 7	29
							1,2,5 7	26
							1,2,5 7	23
							2,5,6 7	22 21 20
	}						2,5,6 7,8	19 18 17
							2,5,7	16 15 14
							2,5,7	13
							2,3	10 9 8
								7 6
								5 4 3
								2 1 0
		DESIGNED FOR SYSTEM FUNCTION PERFORMED WITH OTHER FUNCTIONS	DESIGNED FOR SYSTEM FUNCTION PERFORMED WITH OTHER FUNCTIONS PROBABILITY OF SYSTEM LOSS	SYSTEM FUNCTION SYSTEM FUNCTION PERFORMED WITH OTHER FUNCTIONS PROBABILITY OF SYSTEM LOSS UNSUCCESSFUL CONDUCT	DESIGNED FOR SYSTEM FUNCTION PERFORMED WITH OTHER FUNCTIONS PROBABILITY OF SYSTEM LOSS PROBABILITY OF UNSUCCESSFUL CONDUCT GENERIC SYSTEMS HAD PROBLEMS	l 1	DESIGNED FOR SYSTEM FUNCTION PERFORMED WITH OTHER FUNCTIONS PROBABILITY OF SYSTEM LOSS PROBABILITY OF UNSUCCESSFUL CONDUCT GENERIC SYSTEMS HAD PROBLEMS HAD PROBLEMS SPECIFIC SYSTEM HAD PROBLEMS SELECTION WEIGHT	1. DESIGNED FOR SYSTEM FUNCTIONS SYSTEM

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## SYSTEM FUNCTION WORKSHEET FOR BATTLEFIELD COMMUNICATIONS SYSTEMS

OVOTENA GLASO		SYSTEN	1 FUNC	TION R	ATINGS				
SYSTEM CLASS: BATTLEFIELD COMMUNICATION SYSTEMS including: Man-Portable Radios, Vehicle-Portable Radios, Visual Communications Systems, and Base Radio Systems.	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	
Transfer information and orders     between concerned units/individuals.								2,5,7	36 35
Protect system/crew from enemy action.								2,3,7	34 33 32
									31 30 29
									28 27 26
				·					25 24 23
									22 . 21 20
									19 18 17
									16 15 14
									13 12 11
									10 9
									8 7 6
									6 5 4 3
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### SYSTEM FUNCTION WORKSHEET FOR C<sup>2</sup>/C<sup>2</sup>I SYSTEMS

SYSTEM CLASS:  SYSTEM CLASS:									
SYSTEM CLASS:  C²/C²I SYSTEMS including: Field Artillery Fire Control, Tank Fire Control, Air Defense Fire Control  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	
Provide information on current battlefield conditions and situation.								4,7	36 35 34
Provide projections of probable future conditions and enemy behavior.								4,7	33 32
Control the behavior of friendly forces.								4,7	31 30 29
Manage friendly weapon operation.								4,7	28 27 26
5. Manage logistics.								4,7	25 24 23
Communicate information to appropriate units.								5,7	22 21 20
7. Protect system/crew from enemy action.								3,7	19 18 17
									16 15 14
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### SYSTEM FUNCTION WORKSHEET FOR COMBAT/TACTICAL SUPPORT EQUIPMENT

CVCTENA CLASS.		SYSTEN	1 FUNC	TION R	ATINGS		•		
SYSTEM CLASS: COMBAT/TACTICAL SUPPORT EQUIPMENT including: Combat Engineer Vehicles, Recovery Vehicles, Demolition Equipment, and Bridging Equipment.  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	
Destroy/remove obstacles/ roadblocks.								1,2,5	36 35 34
2. Construct obstacles/roadblocks.								1,2,5	33 32
3. Bridge obstacles.								2,5,7 9	29
4. Construct emplacement/shelters.								2,5,7 9	28 27 26
5. Transport command posts.								2,5,7 9	25 24 23
6. Transport damaged vehicles.								2,7	22 21 20
7. Destroy armored vehicles/ personnel.								2,5,7 9	19 18 17
Protect crew/material from enemy action.								2,3,7	16 15 14
									13 _ 12 _ 11
									10 9 8
									7 6 5
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## SYSTEM FUNCTION WORKSHEET FOR ELECTRONIC WARFARE & SURVEILLANCE SYSTEMS

		SYSTEM	1 FUNC	TION R	ATINGS		_			
SYSTEM CLASS: ELECTRONIC WARFARE AND SURVEILLANCE SYSTEMS including: Countermeasures Equipment and Sighting and Surveillance Equipment.	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		
Provide critical information on potential targets.								5,6,7	36 35 34	
Confuse/disrupt/disable enemy systems.									33 32 31	
Protect operator/crew from enemy action.								2,3,5 7	30 29	
4. Jam electronic signals.									28 27 26	
<ol><li>Produce false targets/target signatures.</li></ol>									25 24 23	
									22 21 20	 
									19 18 17	
									16 15 14	
	ļ 								13 12 11	
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									7 6 5	
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### SYSTEM FUNCTION WORKSHEET FOR GROUND TRANSPORTATION EQUIPMENT

		SYSTEM	1 FUNC	TION R	ATINGS					
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 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		
Transport command personnel.								2,5,7	36 35	
2. Transport troops.								2,5,7	34 33 32	
3. Transport materiel.								2,5,7	31 30 29	-
4. Serve as an ambulance.							_	2,5,7	28 27 26	
5. Protect operator/crew from enemy action.								2,3,7	25 24 23	
									22 21 20	
									19 18 17	<del>-</del> -
									16 15 14	
									13 12 11	
									10 9 8	
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### SYSTEM FUNCTION WORKSHEET FOR INFANTRY WEAPONS

SYSTEM CLASS:		SYSTEM	1 FUNC	TION R	ATINGS		ì	ę <u>s</u>	`
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 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 3	6 5 4
2. Destroy low flying enemy aircraft.									3
Destroy fixed emplacements.								1,7 3	
4. Destroy enemy troops.								1,7 2	7 6
5. Disrupt/suppress enemy activity.								1,7 2	5 4 3
6. Provide illumination.									21 O
7. Protect operator/crew from enemy action.								3,7 1	9 8 - 7 -
Conceal friendly forces by making smoke.								1,7	6 5 4
								] ]1	3 2 11
								1	0
									7 6 5
									3
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### SYSTEM FUNCTION WORKSHEET FOR ORDNANCE SYSTEMS

		SYSTEN	A FUNC	TION R	ATINGS				
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 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	
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	3C 29
Suppress/deny enemy activity, and deny terrain to enemy.								1,2,5 7	28 27 26
5. Provide illumination.								1,2,5 7	25 24 23
Conceal friendly forces by making smoke.								1,2,5 7	22 21 20
7. Protect crew/material from enemy action.								2,3,7	19 18 17 16 15 14 13 12 11
								-	9 8 7
									6 5 4 3 2
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### SYSTEM FUNCTION WORKSHEET FOR TARGET ACQUISITION AND/OR DESIGNATOR SYSTEMS

OVOTENA OLAGO	SYSTEM FUNCTION RATINGS SYSTEM CLASS:											
SYSTEM CLASS: TARGET ACQUISITION AND/OR DESIGNATOR SYSTEMS  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 REFÉRENCES				
Provide critical information on potential targets.								5,7,8	36 35 34			
2. Designate/illuminate target.								7,8	33 32			
Protect system/crew from enemy action.								3,7	30			
									28 27 26			
									25 24 23			
	·								22 21 20			
				-					19 18 17			
									16 15 14			
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#### 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	
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# HRTES GUIDELINES FOR SELECTING SYSTEM FUNCTIONS

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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.

- (!) 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 I received a sum of ratings of 24, then the number "I" would be recorded on line 24 in the last column.

## 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**

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SYSTEM FUNCTION WORKSHEET FOR AIR DEFENSE WEAPONS

	SYSTEM FUNCTION RATINGS								
SYSTEM CLASS: AIR DEFENSE WEAPONS including: Short Range Missiles, Medium Range Missiles, Long Range Missiles. Air Defense Guns, High Energy Systems	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	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.	z	1	2	1	Z	1	9	1,2,4 5,7	33
Deny selected airspace/formation to attacking aircraft.	5	z	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
Protect operator/ crew from enemy action.	3	Z	می	5	Z	2	17	2,3,	25 24 <u>T</u> 23
									22 21 20 19 <b>.3</b>
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#### 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 affributes 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."

I. <u>DESIGNED FOR SYSTEM FUNCTION</u>: To what extend 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 desi for Syst Function	em		Design incor- prates System Function			Designed speci- fically for System Function	

2. <u>PERFORMED WITH OTHER FUNCTIONS</u>: 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 Sys	tem		This Syste	m		Only this
Function		Fu	inction perf	ormed		System Func-
never pe	rformed	as	often as o	thers		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 increa			Some increase in probabili	-		at increase 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 increa		-	Some increas in probabili	=		at increase 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	i	2	3	4	5	6
No proble	ems	se	Some non- vere proble	ms		vere and/or uent problems

## RATING QUESTIONNAIRE FOR DETERMINING CRITICALITY OF SYSTEM FUNCTION (Continued)

6. <u>SPECIFIC SYSTEM HAS PROBLEMS</u>: 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 proble	ms	se	Some non- vere problem	ms		vere and/or uent problems

#### CONTENTS

- System Performance Issue (SPI) Worksheet
- 2. Guidelines for Selecting SPI's
- Sample System Performance Issue Worksheet
- SPI Rating Questionnaire
- SPI Cutoff Worksheet

#### SYSTEM PERFORMANCE ISSUE WORKSHEET

SYSTEM FUNCTION						_			
		<u>-</u>	SPI RA	TINGS	<del></del>			<del></del>	
SYSTEM FUNCTION SELECTION WEIGHT			STEM			), HT			
	HPF-GROUP REFERENCE	PERFORMED WITH OTHER SPI'S	PROBABILITY OF SYSTEM FUNCTION FAILURE	GENERIC SYSTEMS HAD PROBLEMS	SPECIFIC SYSTEMS HAD PROBLEMS	SUM OF RATINGS/ SELECTION WEIGHT	←—RELATIVE WEIGHT	DUCT	←-SELECTED SPI (*)
SPI'S FOR THIS SYSTEM FUNCTION	HPF.	1. PERFC OTHER	2. PROB FUNC	3. GENEI HAD P	4. SPECII HAD F	SELE SUN	←-REL/	←-PRODUCT	-SELE
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# HRTES GUIDELINES FOR SELECTING SYSTEM PERFORMANCE ISSUES

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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.

- (!) 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.")



#### 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

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SYSTEM PERFORMANCE ISSUE WORKSHEET

SYSTEM FUNCTION Z	Æ57	ROY	Air	CRA	FT				
SYSTEM FUNCTION SELECTION WEIGHT 24	4		SPI RA	TINGS					
SPI's FOR THIS SYSTEM FUNCTION	HPF-GROUP REFERENCE	4. PERFORMED WITH OTHER SPI'S	2. PROBABILITY OF SYSTEM FUNCTION FAILURE	3. GENERIC SYSTEMS HAD PROBLEMS	4. SPECIFIC SYSTEMS HAD PROBLEMS	SUM OF RATINGS/	RELATIVE WEIGHT	PRODUCT	SELECTED SP! (")
TARSET ACQUISITION	Z	6	6	6	5	23			
DELIVER AMMULITION ON TARGET	1	6	4	4	4	18			
ENGAGE SEVERAL TAKES	1	5	z	6	6	19			
NAVIGATION	27	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	Z	مى	7			
ESTABLISHMENT & MAINTEN- ANCE OF COMMUNICATIONS	21	2	Э	3	2	10			
PREVENTION OF INTERCEPTION /JAMMING	22	5	6	4	حى	20			
INFORMATION ROUTING	23	2	2	2	Z	8			
ABILITY TO BE TRANSPORTED	24	0	0	0	0	0			
DELIVERY OF CARGO	24	حى	6	5	5	19			
	<del></del>			GRAND	TOTAL	NEXT WORK: SHEET	OVI	ER.	

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NAME	TELEPHONE

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SYSTEM FUNCTION	DESTR	04 A	IRLA	CAFT	•			
SYSTEM FUNCTION SELECTION WEIGHT	21/	<u> </u>		TINGS		]		
SPI'S FOR THIS SYSTEM FUNCTION	HPF-GROUP REFERENCE	1. PERFORMED WITH OTHER SPIS	2. PROBABILITY OF SYSTEM FUNCTION FAILURE	3. GENERIC SYSTEMS HAD PROBLEMS	4. SPECIFIC SYSTEMS HAD PROBLEMS	SUM OF RATINGS/ SELECTION WEIGHT	←-RELATIVE WEIGHT	←-PRODUCT
LOADING / UULGADING	28	3	می	Z	Z	10		
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				GRAND	TOTAL	151		
SYSTEM MERCURY A.A. DEFEASC		•				25 <sup>-</sup> MAA		AGE

#### 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.

I. <u>PERFORMED WITH OTHER SPI's</u>: 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 SP			s SPI perfoi often an oti			Only this SPI is performed

2. <u>PROBABILITY OF SYSTEM FUNCTION FAILURE</u>: 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	l	2	3	4	5	6
No incre in proba		Some increase in probability				nt increase probability

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

3. <u>GENERIC SYSTEMS HAD PROBLEMS</u>: 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 Some Extent Extent					Very Great Extent	
0	1	2	3	4	5	6
No history of problems	;	History of some non-severe problems			se	History of evere and/or ent problems

4. <u>SPECIFIC SYSTEM HAD PROBLEMS</u>: 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 proble	ems	Some non- severe problems				Severy and/ or frequent problems		

# HRTES SPI CUTOFF WORKSHEET

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UNSELECTED SPI's	PRODUCTS	RELATED SYSTEM FUNCTION
	<u> </u>	
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#### **CONTENTS**

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

CONDITION CATEGORY  1. WEATHER: I	LLUMINATI	ON	
	SELECTE	D SYSTEM PER	FORMANC
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)			
SYSTEM	TEST	DATE	PA
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SYSTEM FUNCTION									
CONDITION CATEGORY									
CONDITION CALLOCK!	2.	WEATHER:	TEN	1PERATI	JRE				
			1	SELEC	TED SYS	STEM PE	RFORM.	ANCE IS	SUES
					:				
					:				
TEMPERATURE									
High (specify)		-							
Low (specify)							-		
Normal (specify)									
		· · · · · · · · · · · · · · · · · · ·							
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### CONDITION RATING WORKSHEET

SYSTEM FUNCTION									
CONDITION CATEGORY	3. W	EATHER:	PREC	JDIT#	TION				-
ļ	J. W					STEM PE	PFORM	ANCE IS	SUES
								1102	
			1						
PRECIPITATION									
Rain	<del></del>	<del>-</del>							
Fog		<del></del>							
Falling/Blowing Snow		<del></del>		-					
Sleet									
Sand Storm									
No Precipitation									
Other (specify)									
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W4-4

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SYSTEM FUNCTION								
CONDITION CATEGORY								
	4. W	EATHER:	WIND					
			SEL	ECTED SY	STEM PE	RFORM.	ANCE IS	SUES
WIND								
High Head Wind (specify)								
High Tail Wind (specify)								
	<u> </u>							
Significant Swirling Wind Gu	sts							
Cross Wind (specify)	•	· · ·						
No Wind								
	, <u> </u>							
Other (specify)		<del></del>					-	
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SYSTEM FUNCTION								
CONDITION CATEGORY	E WEAT		UDITY					
	5. WEATH	IER: HUN	SELEC	TED SYS	STEM PE	RFORM	ANCE IS	SUES
HUMIDITY								<del></del>
High (specify)			<u> </u>	-				<u>_</u>
		<del></del>					-	·
1 (16)								
Low (specify)				•				· <u> </u>
Normal (specify)		<del></del>						
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SYSTEM FUNCTION					
CONDITION CATEGORY	6 TEDDAIN	CDOUND CI	ODE		
L	6. TERRAIN:	GROUND SL		ERFORMANCE ISS	UES
GROUND SLOPE					
Flat	<u> </u>				
Low Positive Hilly (specify)					
	·-·				
Low Negative Hilly (specify)					
High Positive Mountainous (sp	ecify)				
	7				_
High Negative Mountainous (sp	ecify)				•
Other (specify)	<del></del>				
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SYSTEM FUNCTION									
CONDITION CATEGORY	7.	TERRAIN:	GRO	UND SU	JRFACE				
•	<b></b>			SELEC	TED SYS	STEM PE	RFORM	ANCE IS	SUES
		· · · · · · · · · · · · · · · · · · ·							
GROUND SURFACE									
Sandy									
Rocky									
Loam (Deep Soil)									
Paved (specify type and carry	ying	level)							
Broken Paved									
Broken Ground									
Plowed Fields									
Bare Packed									
Vegetation Covered									
Other (specify)									
					<u> </u>	1			

### **CONDITION RATING WORKSHEET**

SYSTEM FUNCTION								
CONDITION CATEGORY	8.	TERRAIN:	GROUND	AND WA	TER SU	REACE		
Į.				ECTED SY			ANCE IS	SUES
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GROUND AND WATER SURFACE					ļ	ļ	ļ	
Light Mud	· <u>-</u>				ļ	ļ	 	
Heavy Mud						ļ		
Dry								
Water Covered							ļ	
Ice Covered								
Snow Covered								
Other (specify)	- ; -	· · · · · · · ·						
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SYSTEM			7505	D	A 7.5		PAGE	

CENTAL CONSTRUCTION OF THE PROPERTY OF THE PRO

SYSTEM FUNCTION								
CONDITION CATEGORY	9. TERRAIN	v: OBS	TACLES					
·					TEM PE	RFORM	ANCE IS	SUES
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OBSTACLES								
Dense Vegetation								
Light Vegetation	·							
Hedge Rows								
Rivers (specify depth, width	)							
								·
Manmade Structures (specify)								
Traps (specify)								
No Obstacles								
Other (specify)								
AV								
SYSTEM	<del></del>		TEST	DA	TE		PAGE	

### CONDITION RAILING WORKSHEET

<del></del>	(PE specify by type or size)
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PE	PE

### CONDITION RATING WORKSHEET

SYSTEM FUNCTION					•	
CONDITION CATEGORY						
	11. TARGET: NL	JMBER SELEC	TED EVET	EM DEDEOG	MANCE	ente.
		SELEC	IED SYSII	EM PERPO	RMANCE IS	SUES
NUMBER		-				
Single Target						
Multiple Simultaneous Target	s (specify)					
Multiple Sequential Targets	(specify)					
Combination of Multiple Simu and Multiple Sequential Targe	ltaneous ets (specify)					
Noise - Number/% of Targets Background (specify)	Within Nontarget					
Other (specify)	· · · · · · · · · · · · · · · · · · ·					
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SYSTEM		TEST	DATI	E	PAGE	

### **CONDITION RATING WORKSHEET**

SYSTEM FUNCTION					_				
CONDITION CATEGORY									
CONDITION CATEGORY	12.	TARGE"	r: LO	CATION					
				SELEC	TED SY	STEM PE	RFORM	ANCE IS	SUES
LOCATION			<del></del>						
Minimum Range (specify)									
Maximum Range (specify)									
Normal Range (specify)									
Azimuth and Elevation Target	(spec	ify)							
						<b> </b>			
Other (specify)		<u> </u>							
Office (Specify)	<del></del>		<del></del>						
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SYSTEM				TEST	D/	ATE.		PAGF	
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SYSTEM FUNCTION				
CONDITION CATEGORY	13. TARGET:	SPEED		
		SELEC	TED SYSTEM PE	RFORMANCE ISSUES
SPEED				
Maximum Speed (specify)				
Minimum Speed (specify)				
Cruising Speed (specify)				
Radical Alterations of Speed	(specify)			
Stationary				
Other (specify)				·
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SYSTEM FUNCTION										
CONDITION CATEGORY	1.4	TADOST	D.I.G.	OF OT LO		POT LON			<del></del>	
	14.	TARGET	: DIF				RFORM	ANCE ISSUES		
DIRECTION OF MOTION										
Closing (specify angle)										
Retreating (specify angle)		<del></del>				ļ				
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Crossing (specify direction)				ļ					ļ	
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Complex Maneuver (specify)				ļ		<del> </del>		ļ		
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Other (specify)		<del></del>								
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### **CONDITION RATING WORKSHEET**

SYSTEM FUNCTION									
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CONDITION CATEGORY	15.	TARGET:	COI	NCEALM	ENT				
				SELEC	TED SYS	STEM PE	RFORM	ANCE	SUES
					'				
						1			
CONCEALMENT		<del></del>							
Concealed by Physical Means	(speci	fy)							
Concealed by Electronic Mean	s (spe	cify)							
Partially Concealed (specify	)								
Concealed by Smoke									
Unconcealed									
Other (specify)					<u> </u>				
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### CONDITION RATING WORKSHEET

SYSTEM FUNCTION									
CONDITION CATEGORY	16. PERSONNEL:	WORKI	OAD		·	<del></del>			
		SELECTED SYSTEM PERFORMANCE ISSUES							
WORKLOAD									
WORKLOAD									
When Personnel are only perfo									
When Personnel perform all acmight occur at the same time	this SPI is								
being performed (specify)									
Other (specify)									
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SYSTEM FUNCTION								
CONDITION CATEGORY	17.	PERSON	UNIF!	DUDAT	 - PDEC	EEDING	WORK	
	1/•				 		ANCE IS	SUES
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DUDATION OF DESCRIPTION AND A		<del></del>			 	-		
DURATION OF PRECEEDING WORK		· ·						
Following No Work  Following an Extended Period	of Ma	sek (en	o i fu l		 			<del></del>
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Following a Normal Period of	Work	(speci	·y)					
Other (specify)								
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SYSTEM FUNCTION						_ <del></del>	
CONDITION CATEGORY							
CONDITION CAILSON	18.	PERSONNEL	: PROT	ECTIVE G	EAR		
			SELEC	CTED SYSTE	M PERFORI	MANCE IS	SUES
PROTECTIVE GEAR						+ +	
While wearing applicable prote	ectiv	e clothing	/				
gear (specify)			_	+			
While wearing normal clothing,	/gear	(specify)				1	
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Other (creatifu)			-	<del>                                     </del>			
Other (specify)		<del></del>					
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SYSTEM FUNCTION	
CONDITION CATEGORY 19: PERSO	NNEL: PHYSICAL STRENGTH
	SELECTED SYSTEM PERFORMANCE ISSUI
PHYSICAL STRENGTH	
With Personnel With Minimum Strength	
With Personnel With Normal Strength	
With Personnel With Optimum Strength	
Other (specify)	

SYSTEM FUNCTION							
CONDITION CATEGORY	<u></u>						
	20:	PERSONNE					
			SELEC	TED SYSTE	M PERFORM	MANCE IS	SUES
PERCEPTUAL ABILITY		<del></del>					
With Personnel With Minimal F Ability(s) (specify)	Percept	ual					
With Personnel With Normal Pe Ability(s) (specify)	erceptu	ıal					
With Personnel With Optimum F	Percept	ual					
Ability(s) (specify)			_				
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TELEPHONE.

### CONDITION RATING WORKSHEET

SYSTEM FUNCTION					
CONDITION CATEGORY					
CONDITION CALEGORY	21: PERSONN	EL: EXPER	RIENCE		
		SELEC	TED SYSTEM F	PERFORMANCE	ISSUES
		1			
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EXPERIENCE					
With Personnel With Minimum (specify)	xperience				
With Personnel With Normal Ex (specify)	perience				
(3936) 177					
With Personnel With Optimum E	xperience	-			-
(specify)					1
Other (specify)	<del></del>				
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SYSTEM FUNCTION					
l					
CONDITION CATEGORY	22: PERSONNEL:	APT I TUI	DES		
		SELECTE	D SYSTEM PE	RFORMANC	EISSUES
					1
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APTITUDES .					
With Personnel With Minimum Aptitudes (specify)	Applicable				
With Personnel With Normal Ap	pplicable				
Aptitudes (specify)					
With Bosses With Ostinus	A				
With Personnel With Optimum A Aptitudes (specify)	Applicable				
Other (specify)					
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### CONDITION RATING WORKSHEET

SYSTEM FUNCTION								
CONDITION CATEGORY [				·				
	23: PER	SONNEL:						
		1	SELEC	TED SYS	STEM PE	RFORM	ANCE IS	SUES
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PHYSICAL SIZE								
With Personnel of Minimum Siz	e (specif	y )						
With Personnel of Normal Size	(specify	)						
With Personnel of Maximum Siz	e (specify	y)				<del>                                     </del>		
						<u> </u>		
Other (specify)		<u> </u>				<u> </u>		
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### CONDITION RATING WORKSHEET

SYSTEM FUNCTION										
CONDITION CATEGORY [								·		
CONDITION CATEGORY	24:	TRAINING:	INSTITUTION							
			SELEC	TED SY	STEM PE	RFORM	ANCE IS	SUES		
				ļ -						
					]		·			
INSTITUTION										
With OJT-Trained Personnel										
With School-Trained Personnel										
With Combination OJT and Scho	∞I									
With Personnel Without Specif	ic Tra	aining								
With Factory-Trained Personne	: I									
Other (specify)										
		<del></del>								
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NAME.

SYSTEM FUNCTION								
CONDITION CATEGORY	25: TRAINING:	LATENCY						
		SELEC	TED SYSTEM P	ERFORMANCE ISSUES				
LATENOV								
LATENCY		ļ						
Following a Period of Time Wi- Training or Practice (specify	thout Specific )							
Immediately Following Training	9							
With the Normal Period of Late	ency (specify)							
Other (specify)								
	· · · · · · · · · · · · · · · · · · ·	<del> </del>						
SYSTEM		TEST	DATE	PAGE				

W4-26

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CONDITION CATEGORY  26: TRAINI  TEAM VS. INDIVIDUAL  With Personnel Who Have Had Only Individual Training  With Personnel Who Have Had Only Team Training  With Personnel Who Have Had a Combination Team and Individual Training (specify)	NG: TEAM \	/S. INDIVI		NCE ISSUES
With Personnel Who Have Had Only Individu Training  With Personnel Who Have Had Only Team Tra With Personnel Who Have Had a Combination	SELEC	CTED SYSTEM	PERFORMAN	NCE ISSUES
With Personnel Who Have Had Only Individu Training  With Personnel Who Have Had Only Team Tra With Personnel Who Have Had a Combination			1 1	
With Personnel Who Have Had Only Individu Training  With Personnel Who Have Had Only Team Tra With Personnel Who Have Had a Combination			1 1	
With Personnel Who Have Had Only Individu Training  With Personnel Who Have Had Only Team Tra With Personnel Who Have Had a Combination	ì			
With Personnel Who Have Had Only Individu Training  With Personnel Who Have Had Only Team Tra With Personnel Who Have Had a Combination				ĺ
With Personnel Who Have Had Only Individu Training  With Personnel Who Have Had Only Team Tra With Personnel Who Have Had a Combination				
With Personnel Who Have Had Only Individu Training  With Personnel Who Have Had Only Team Tra With Personnel Who Have Had a Combination				
With Personnel Who Have Had Only Individu Training  With Personnel Who Have Had Only Team Tra With Personnel Who Have Had a Combination	]			
With Personnel Who Have Had Only Individu Training  With Personnel Who Have Had Only Team Tra With Personnel Who Have Had a Combination				
With Personnel Who Have Had Only Team Tra With Personnel Who Have Had a Combination	ıal			
With Personnel Who Have Had a Combination			-	
				<del> </del>
Other (specify)				
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		<del>                                     </del>	++	
SYSTEM				

SYSTEM FUNCTION											
CONDITION CATEGORY								<del></del>			
	27: OPERATIONAL: CREW  SELECTED SYSTEM PERFORMANCE IS										
				SELEC	STED SY	STEM PE	RFORM	RFORMANCE ISSUES			
								1			
				<del> </del>	-						
CREW					ļ		<del> </del>		<u> </u>		
With Optimum Crew (specify)		<del></del>						ļ			
				<u> </u>							
With Normal Operational Crew	(spec	ify)		<u> </u>							
With Minimum Crew (specify)		·····	<del></del> \		<u> </u>	<u> </u>					
Other (specify)											
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### **CONDITION RATING WORKSHEET**

SYSTEM FUNCTION						- · <del></del>	
CÓNDITION CATEGORY [							
CONDITION CATEGORY	28:	OPERATION	AL: HA	RDWARE			
			SELEC	TED SYST	EM PERF	ORMANC	E ISSUES
							ļ
HARDWARE							
With Hardware Fully Up		<del>-</del>					
With Partial Breakdown (speci	fy)						
		· · · · · · · · · · · · · · · · · · ·					
With Hardware Fully Down		·					
Other (specify)							
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SYSTEM							
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### **CONDITION RATING WORKSHEET**

SYSTEM FUNCTION									
CONDITION CATECORY		<del></del>							
CONDITION CATEGORY	29:	OPERATIONA	AL: IN	FORMATIO	N INPUTS				
			SELEC	SELECTED SYSTEM PERFORMANCE ISSUE					
			İ						
INFORMATION INPUTS									
With Full Information Inputs									
With Partial Information Inputs (specify)									
With No Information Inputs									
Other (specify)									
	·								
		·							
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SYSTEM			TEST	DATE		PAGE			
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Tactics as Conditions: Army systems are employed according to the established factics 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.

### CONDITION RATING WORKSHEET

SYSTEM FUNCTION									
CONDITION CATEGORY	30:	TACTIO	S						
	L			SELEC	TED SYS	STEM PE	RFORM.	ANCE IS	SUES
									İ
				• 1					
			ł						
		<u> </u>							<del>-</del> -
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SYSTEM				TEST_	D/	ATE		PAGE	
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### CONDITION RATING WORKSHEET

SYSTEM FUNCTION							
CONDITION CATEGORY							
CONDITION CATEGORY	31: TACT	ICS: N	UMBER	OF SYS	TEMS E	MPLOYED	
			SELEC	TED SYS	TEM PER	FORMANC	EISSUES
NUMBER OF SYSTEMS EMPLOYED							
Single System							
Multiple System of Same Type	(specify)						
Multiple Systems of Differer types and numbers)	t Types (s	pecify					
	<del></del>						
Other (specify)	-						
<del></del>	<del></del>						
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SYSTEM	····		_TEST	DA	TE	P/	AGE
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### **CONDITION RATING WORKSHEET**

SYSTEM FUNCTION								
CONDITION CATEGORY [								
CONDITION CATEGORY	32: 1	TACTICS:	SPEED					
			SELEC	TED SYS	TEM PE	RFORM	ANCE IS	SUES
		····	_					
SPEED								
Maximum Speed (specify)					· · · · · ·			
Minimum Speed (specify)								
								2
Cruising Speed (specify)					-			
<del></del>								
Radical Alterations of Speed	(speci	fv)						
			_			-		
			-					
Stationary								
Other (specify)		,						
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SYSTEM	· <del></del>		TEST	D#	¥		PAGE	
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### CONDITION RATING WORKSHEET

SYSTEM FUNCTION				
CONDITION CATEGORY				
	33: TACTICS:	LOCATION		
		SELECTED SY	STEM PERFORM	ANCE ISSUES
LOCATION	<del></del>	+		
Specify				
· · · · · · · · · · · · · · · · · · ·				
	· · · · · · · · · · · · · · · · · · ·			
				·
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SYSTEM		TEST	ATE	PAGE
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W4-35

TELEPHONE

SYSTEM FUNCTION					-				
CONDITION OF TOOLS									
CONDITION CATEGORY	34:	TACTIC	S: C	IRECT	ION OF	MOTI	ON		
•				SELEC	TED SY	STEM P	ERFORM	ANCE IS	SUES
							1		
DIRECTION OF MOTION									
Closing (specify angle)									
Retreating (specify angle)			· · · · · · · · · · · · · · · · · · ·						
Crossing (specify angle)	· · · · · · · · · · · · · · · · · · ·								
Complex Maneuver (specify)									
Other (specify)									
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### CONDITION RATING WORKSHEET

SYSTEM FUNCTION											
CONDITION CATEGORY [	<del></del>										
COMMINION CATEGORY	35: TACTICS: CONCEALMENT										
		SELECTED SYSTEM PERFORMANCE ISSU									
CONCEALMENT											
Concealed by Physical Means	(specify)										
Concealed by Electronic Mear	s (specify)										
Partially Concealed											
Concealed by Smoke											
Unconcealed											
Other (specify)											
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# HRTES CONDITION RATING WORKSHEET

NAME.

SYSTEM FUNCTION									
CONDITION CATEGORY	36:	TACTI	CS: C	CREW PI	ROTECT	ION			
			,	SELEC	TED SY	STEM PE	RFORM	ANCE IS	SUES
CREW PROTECTION		<del>-</del>							
Crew Fully Protected-Buttone	ed Up		<del></del>						
Crew Partially Protected (sp	pecify)								
Crew in Least Protected Conf (specify)	figurat	ion							
NBC Conditions									
Cther (specify)		<del></del>							
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SYSTEM				TEST		ATE		PAGE	

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TELEPHONE

#### **CONDITION RATING WORKSHEET**

SYSTEM FUNCTION			•						
CONDITION CATEGORY									
	37:	TACTICS	: AN	MOUNT	OF AU	TOMATI	C FUNC	CTIONI	NG
			Γ	SELEC	TED SY	STEM PE	RFORM	ANCE I	SSU
								<u> </u>	}
					<u> </u>				
AMOUNT OF AUTOMATIC FUNCTIONI	 чG								
fully Automatic									
Semi-Automatic (specify)									
Manual Mode								_	
other (specify)									
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		·							
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YSTEM									

W4-39

#### CONDITION RATING WORKSHEET

	(		<u></u>				
	CONDITION CATEGORY	38: TA	CTICS:	SYSTEM	WORKLO	AD	
				SELEC	TED SYST	EM PERFO	RMANCE IS
						1	
						}	
:							
						İ	
						[	
	· · · · · · · · · · · · · · · · · · ·						
	SYSTEM WORKLOAD						
	Overloaded (specify)		· ·				
			· · · · · · · · · · · · · · · · · · ·				
	100% Loaded (by weight or vo	olume)	· · · · · · · · · · · · · · · · · · ·				
-	Operationally Loaded (speci			<del>-  </del>			
	operationally Loaded (speci	· y /		+			
ŀ	Unloaded	·		-			
	Other (specify)		<u> </u>	_			
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ŀ		<del></del>					<del></del>
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#### CONDITION RATING WORKSHEET

SYSTEM FUNCTION									
CONDITION CATTOONY									
CONDITION CATEGORY	39:	OTHER	CONDI	TIONS					
				SELEC	TED SY	STEM PE	RFORM	ANCE IS	SUES
			1	"					
								!	
OTHER CONDITIONS									
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W4-41

# HRTES GUIDELINES FOR SELECTING CONDITIONS

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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.

CONTRACT TO SERVICE TO

- (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:

(I) 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 irrelevant Relevant, Relevant, but not critical and very critical

Use the "2" Rating sparingly! Only the most critical categories should be so designated. Condition categories rated "I" will also be included in the field test, but only those rated "2" will become part of the SP1.



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 "G," "1," or "2."
- (3) Each SPI now has relevant (rated "I" 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 "I" or "2") on the same scale as used above.
- (4) Return the completed rating Worksheets to the sender.

	SAMP	LE			<del></del> _
HRTES	CONDITION RA	TING WORK	SHEET		
SYSTEM FUNCTION	DESTROY,	AIRCRAFT			
CONDITION CATEGORY					
	1. WEATHER:	I LLUMINA		STEM PE	REOS
		TABSET ADDUISMOU	AEVENTION OF JAMMINE	ESTABLISHMENT OF CAMMUNICATION	BURASEMENT OF
FLLUMINATION		2	<b>→</b>	0	/
Full Sunlight		2			Z
Moonlight		/			1
Starlight		0			1
Dusk		0			1
Overcast, Moonless Night (P	litch Black)	2			2
Artificial Lighting (specif	<b>y</b> )	Ð			0
Fiares		1	}		/
Direct Glare		0			/
indirect Glare (Water, Sand	, Clouds, etc.	, \varTheta			1
Other (specify)					
	-				
SYSTEM CHEACURU AIR DEFEL	7515 WEARA ! SI	& T-1+00	-77 -		440
NAME	NE MAP (W)	TELEPH		ATE <u>42 /</u>	200

#### **SAMPLE**

SYSTEM FUNCTION DESTROY	9 IRCRAF	7				
CONDITION CATEGORY 2. WEATHER:	TEMPERATI	JRE				
	SELEC		STEM PE	RFORMA	NCE I	SSUES
	TABET ADUISITION	PROGETTA OF CHAMINE	CAMMUNICATION	BUNGENEVI OF SERENL TALGETS	Dewiery of caebo	DELIVELY OF AMMO
TEMPERATURE	1	0	0	0	0	1
High (specify)	2					2
Low (specify)	0					-0
Normal (specify)	Z					2
SYSTEM/MERCURY AIR DIFFOXE WEARD SYSTEM		- 7				

CONDITION RATING WORKSHEET - METHOD 2

WEATHE	R
1. ILLUMINATION	3. PRECIPITATION
Full Sunlight	Rain
Moonlight	Fog
Starlight	Falling/Blowing Snow
Dusk	Sleet
Pitch Black	Sand Storm
Artificial Light (specify)	No Precipitation
	As Occurs
Flares	Other (specify)
Direct Glare	
Indirect Glare	
As Occurs	4. WIND
Other (specify)	High Head Wind (specify)
	High Tail Wind (specify)
2. TEMPERATURE	
High (specify)	Swirling Gusts
	Cross Wind (specify)
Low (specify)	
	No Wind
Normal (specify)	As Occurs
	Other (specify)
As Occurs	
Other (specify)	
	5. HUMIDITY
	High (specify)
	Low (specify)
	Normal (specify)
	As Occurs
	Other (specify)

NAME\_\_\_\_\_\_TEST\_\_\_DATE\_\_\_\_PAGE

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CONDITION RATING WORKSHEET - METHOD 2 (CONTINUED)

6.	GROUND SLOPE		8.	GROUND + WATER
	Flat (specify)			Light Mud
1				Heavy Mud
}	Low Positive Hilly			Dry
	(specify)			Water Covered
)	Low Negative Hilly			Ice Covered
	(specify)			Snow Covered
	High Positive Mountain			As Occurs
1	(specify)			Other (specify)
1	III ale Mir. III Maria II			
	High Negative Mountain (specify)	,		
4	,		9.	OBSTACLES
ł	As Occurs			Dense Vegetation
Í	Other (specify)			Light Vegetation
}				Hedge Rows
				Rivers Width and Depth
7.	GROUND SURFACE			Manmade Structures (specify
<del> </del>	Sandy			
1	Rocky			Traps (specify)
1	Loam	-		
1	Paved			No Obstacles
1	Broken Paved			As Occurs
1	Broken Ground			Other (specify)
1	Plowed Fields			
7	Bare Packed			
1	Vegetation Covered			
	As Occurs			
7				

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CONDITION RATING WORKSHEET - METHOD 2 (CONTINUED)

10.	TYPE	[		
			13.	SPEED
	Type/Size (specify)			Maximum Speed (specify)
	As Occurs	H		Minimum Speed (specify)
	Other			0 1.1 - 0 1.2 1 16.3
		1		Cruising Speed (specify)
11.	NUMBER	H		Rad Alter of Speed (speci
$\neg$	Single Target			
	Multi Simul Targs			Stationary
	(specify)			As Occurs
	Multi Sequent Targs (specify)			Other (specify)
-	Comb Multi Simul +	لـــا		
	Sequent (specify)		14.	DIRECTION
				Closing (specify angle)
	Noise - Target/Nontarget Ratio (specif <b>y</b> )	H		Retreating (specify angle
$\vdash$	As Occurs			
	Other (specify)			Crossing (specify direct and angle)
		-		Complex Maneuver (specif
12.	LOCATION		ł	
]	Minimum Range (specify)	1	1	As Occurs
			1	Other (specify)
	Maximum Range (specify)			
	Normal Range (specify)			
H	Azimuth + Elevation (specify)			
$\vdash$	As Occurs			
H	Other (specify)			

SYSTEM \_\_\_\_\_\_\_\_TEST\_\_\_\_\_DATE\_\_\_\_\_PAGE

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CONDITION RATING WORKSHEET - METHOD 2 (CONTINUED)

	TARGET (CONTINUED)
15.	
	Concealed Physically (specify)
1	Concealed Electronically (specify)
4	Concealed Partially (specify)
-	Concealed by Smoke
7	Unconcealed
7	As Occurs
7	Other (specify)
ł	

SYSTEM	_TEST	_ DATE	_PAGE
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CONDITION RATING WORKSHEET - METHOD 2 (CONTINUED)

#### **PERSONNEL** 16. WORKLOAD 19. STRENGTH Full Operat Loading Minimum Strength Partial Operat Loading Normal Strength (specify) Optimum Strength As Occurs As Occurs Other (specify) Other (specify) 20. PERCEPTION 17. WORK DURATION Minimum Perception Following no Work Normal Perception Following Extended Work Optimum Perception (specify) As Occurs Other (specify) Following Normal Work (specify) As Occurs 21. **EXPERIENCE** Other (specify) Minimum Experience (specify) Normal Experience (specify) 18. PROTECT GEAR Wearing Protect Gear Optimum Experience (specify) (specify) As Occurs Wearing Normal Gear Other (specify) (specify) As Occurs Other (specify)

SYSTEM	TEST DATE	PAGE
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CONDITION RATING WORKSHEET - METHOD 2 (CONTINUED)

	PERSONNEL (CONTINUED)	
22.	APTITUDES	
	Minimum Aptitudes (specify)	
-	Normal Aptitudes (specify)	
$\dashv$	Optimum Aptitudes (specify)	
	As Occurs	
	Other (specify)	
23.	. SIZE	
	Minimum Size	
	Normal Size	
	Maximum Size	
	As Occurs	
	Other (specify)	
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CONDITION RATING WORKSHEET - METHOD 2 (CONTINUED)

	TRAINING	
24.	INSTITUTION	
	OJT-Trained	
	School-Trained	
7	Comb OJT + School	
7	No Specific Training	
7	Factory-Trained	
7	As Occurs	
	Other (specify)	
ال		
25.	LATENCY	
	Period W/O Training/Prac (specify)	
┨	Immed After Training	
-{	Normal Latency (specify)	
1	Normal Earthey Capacity,	
-	As Occurs	
1	Other (specify)	
26.	TEAM VS INDIV	
	Only Indiv Training	
1	Only Team Training	
	Comb of Indiv + Team (specify)	
d	As Occurs	
	Other (specify)	
J		

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CONDITION RATING WORKSHEET - METHOD 2 (CONTINUED)

	OPERATIONAL
27. CR	EW
0	ptimum Crew (specify)
N <sub>1</sub>	ormal Crew (specify)
М	inimum Crew (specify)
<b></b>	s Occurs
0.	ther (specify)
28. HAI	RDWARE
<del>}</del>	ully Up
<del> </del>	artial Breakdown (specify)
F	ully Down
<del></del>	s Occurs
01	ther (specify)
29. INF	FORMATION INPUTS
	ull Information Inputs
Pa	artial Info Inputs (specify)
No.	o Info Inputs
<b></b>	occurs
01	ther (specify)
$\sqcup$	
SYSTEM	TESTDATEPAGE

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\_\_\_\_TELEPHONE\_\_

CONDITION RATING WORKSHEET - METHOD 2 (CONTINUED)

TACTIC	es ·
30. TACTICS	33. LOCATION(S)
Specify Tactic(s) or Rate Tactical Conditions (#'s 31-38)	Specify Location(s)
	34. DIRECTION
	Closing Angle (specify)
31. # OF SYSTEMS	Retreating Angle (specify)
Single System  Multiple of Same Type (specify)	Crossing Angle, Direction (specify)
Multiple Systs of Diff Types (specify)	Complex Maneuver (specify)
<del>                                     </del>	As Occurs
As Occurs Other (specify)	Other (specify)
	35. CONCEALMENT
32. SPEED	Concealed Physically
Maximum Speed (specify)	Concealed Electronically (specify)
Minimum Speed (specify)	Partially Concealed (specify
Cruising Speed (specify)	Concealed by Smoke
Rad Alter of Speed (specify)	Unconcealed As Occurs
Stationary	Other (specify)
As Occurs Other (specify)	

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CONDITION RATING WORKSHEET - METHOD 2 (CONTINUED)

	TACTICS (CONTINUED)
36.	CREW PROTECTION
	Fully Protected-Buttoned Up
	Partially Protected Config (specify)
	Least Protected Config (specify)
	NBC Conditions
	As Occurs
	Other (specify)
37.	AUTOMATIC FUNCTION
	Fully Automatic
	Semi-Automatic (specify)
	Manual Mode
┝╌┤	As Occurs
H	Other (specify)
38	. SYSTEM LOADING
	Overloaded
	100% Loaded (WT/VOL)
	Operationally Loaded (specify)
П	Unloaded
	As Occurs
	Other (specify)

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	OTHE	ER CONDITION CATEGORIES	
39.	CONDITIONS		
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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 <u>individual conditions</u> 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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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 <u>amount or number of times</u> the system will perform or be maintained under this condition.
- (2) The extent to which the system is <u>designed specifically</u> to perform or be maintained under this condition.
- (3) The extent to which this condition is likely to <u>negatively</u> affect the performance or maintenance of the system.
- (4) The extent to which this condition has already been <u>associated</u> 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 <u>Important</u>. 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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GUIDELINES FOR SELECTING CONDITIONS - METHOD 2 (CONTINUED)

2 - <u>Critical</u>. 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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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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#### CONDITIONS X SPI MATCHING WORKSHEET

SYSTEM FUNCTION #																			T	
SPI #												1	1					1	1	1
1. WEATHER: ILLUMINATION	П											7	1		7				$\top$	7
Full Sunlight																				
Moonlight																				]
Starlight																				
Dusk												$\int$							$\perp$	
Pitch Black																	$\Box$		$\perp$	
Artificial Lighting																			$\prod$	]
Flares																			$\perp$	]
Direct Glare													Ī						T	7
Indirect Glare																				
As Occurs	Γ																		T	]
2. WEATHER: TEMPERATURE													1						T	7
High																				7
Low							Γ						7				T		T	7
Norma I				Γ			Γ						1	$\neg$			٦		T	7
As Jecurs							Γ												$\top$	7
3. WEATHER: PRECIPITATION		Г											7		$\neg$	$\neg$			T	7
Rain	Γ	Γ									7	T	1	$\neg$			_		Т	7
Fog															7			٦	Т	7
Falling/Blowing Snow							Γ					٦	7						T	7
Sleet													7						$\top$	7
Sand Storm				Γ															T	7
No Precipitation											٦		7		$\neg$				丁	7
As Occurs												1	7				$\exists$	$\neg$	$\top$	7
4. WEATHER: WIND													7			$\neg$		$\neg$	丁	7
High Head Wind											1	7	1					1	丁	7
High Tail Wind				Γ										7	7			7	$\top$	7
Swirling Gusts													7	7				$\dashv$	T	7
Cross Wind											٦		1	1				1	7	7
No wind											$\neg$			7			╗	1	$\top$	7
As Occurs												1		7					1	1
5. WEATHER: HUMIDITY			Γ	Γ			Γ				7	1	7	7		1		1	$\top$	7
High												1	1				$\neg$	_	7	7
Low							1				1	$\dashv$	7	7		1		$\dashv$	+	7
Normal			-								7	$\dashv$	7	1	_	7	7	1	$\top$	7
As Occurs		T										$\top$	7	7	7		7	$\exists$	$\dagger$	1⊿
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6. TERRAIN: GROUND SLOPE			$\vdash$	+	+-	$\vdash$	+	+	+	╀	╀	-	$\vdash$	+	╂┨	$\dashv$
Flat		+	$\vdash \vdash$	+-	╁╴	H	$\dashv$	+	+	十	╁╌	-	H	+	╁┤	
Low Positive Hilly	<del></del>	╁	╁┼	╁	╁	┼╌┤	+	┽	+	+-	╁╌	├-	H	+	╁┤	
Low Negative Hilly		+	$\vdash \vdash$	╁	╁	Н	+	┰	╁	╁╌	╁╌	-	H	╁	+	
	+	+-	H	+-	╁	$\vdash$	$\dashv$	+	+	+	╁	-	$\vdash$	+	╁┤	
High Positive Mountain High Negative Mountain	-+	+-	-	╫	╀╌	╁┤	+	+	+	+-	╁	-	$\vdash$	┽	╁┤	_
As Occurs			$\vdash$	+-	+-	$\vdash$	-+	+	+	╁	╁	-	H	+	+	
7. TERRAIN: GROUND SURFACE	-+	+-	$\vdash$	+-	╁	H	+	+	+	╁	╁	-	Н	+	+	
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Broken Paved		+-	-	+	╁	$\dashv$	+	+	+	+	┼-	-	$\vdash$	+	+	
Broken Ground		+	$\vdash$	+	+-	$\vdash$	4	+	+	╁	╀	├	$\vdash$		╁┤	_
Plowed Fields		+-	$\vdash$	+	+	-	+	+	+	╀	┼-	-	$\vdash$	+	+	_
Bare Packed			$\sqcup$	+	+	$\vdash$	$\dashv$	+	+	+		├-		+	+	_
Vegetation Covered		4-	$\Box$	4	1	$\vdash$	4	+	+	+	╀-	-	H	+	1-1	_
As Occurs		4	$\sqcup$	4	1	$\sqcup$	4	4	4	1	↓_	_	Н	- -	$\perp$	_
8. TERRAIN: GROUND + WATER		1	$\sqcup$	↓	$\perp$	$\sqcup$	4	4	1	4	↓_		Ш	4	1-1	_
Light Mud			$\sqcup$		<u> </u>	$\sqcup$	$\perp$	4	$\downarrow$	$\downarrow$	L		Ц	1	Ш	_
Heavy Mud			$\sqcup$	1	1		$\sqcup$	$\downarrow$	1	$\downarrow$	<u> </u>		Ц		$\square$	_
Dry			Ц	$\perp$	$\downarrow$	$\sqcup$	Ц	_	$\perp$	┸	<u> </u>	$oxed{oxed}$	Ц	_ _	$\sqcup$	_
Water Covered					$\downarrow$		Ц	4	$\perp$	$\perp$				$\perp$	$\perp$	_
Ice Covered			$\sqcup$		1	Ш		$\downarrow$	1	$\perp$	Ļ				$\sqcup$	_
Snow Covered					$\perp$					$\perp$	L					_
As Occurs									┙		L					
9. TERRAIN: OBSTACLES					L	Ш		$\perp$	$\perp$	L						
Dense Vegetation									m I					1		
Light Vegetation		T		T	Γ				Ŧ					$\Box$		
Hedge Rows			$\lceil \ \rceil$	T				$\top$	T	Γ				I		
Rivers		T														
Manmade Structures		T	П						Ţ		Π		П			
Traps		1	П	1	1			$\top$	T				П	1		
No Obstacles		T				$\Box$		$\top$	T	T				T		
As Occurs		T	П	T	T			T	T	T			П	1		
As Occurs  SYSTEM						755						<u></u>				
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	SPI #		T			1	$\prod$		$\top$	T	$\prod$	1	T	T	$\prod$	1	T
	10. TARGET: TYPE	+-	+		+	+	+	+	+	+-		+	+	╁	$\vdash$	+	+
	Type/Size	+	十		1	+	H	+	+	1	H	+	+	╁		十	t
-	As Occurs	+	+	$\vdash$	+	+	+			+	H	+	+	+		+	+
	11. TARGET: NUMBER	+	+	<del> -</del>	$\vdash$	+	+		$\dagger$	†	$\vdash$	+	$\dagger$	†		+-	t
-	Single Target	+	+			$\dagger$	H		$\dagger$	1	$\vdash$	+	$\dagger$	十		+-	T
	Multi Simul Targs	†	†		1	+	$\dagger \dagger$		$\top$	1		+	$\dagger$	十	-	+	T
	Muiti Sequent Targs	†	T			+			$\top$			$\top$	+	†		+	T
	Comb Multi Simul + Sequent	1	T			+	$\dagger \dagger$			1		+	$\dagger$	†		1	1
	Noise - Target/Nontarget Ratio	1	T			$\top$	$\sqcap$		1			1	T	T			T
	As Occurs	$\top$	1			+	$\top$		1	1	$\sqcap$	$\top$	1	1		$\top$	T
	12. TARGET: LOCATION	7	T		1		$\sqcap$		1	7		1	1		$\Box$	$\top$	T
	Minimum Range	$\top$	T			1			$\top$		П	7	1	T	П		
	Maximum Range	1	T			1	П		$\top$	T	П	$\top$	T	1	П	1	Γ
	Normal Range	7	T			1	П		1	$\top$						$\top$	Ţ
	Azimuth + Elevation .		T				П										Γ
	As Occurs		Ι														Γ
	13. TARGET: SPEED	$\int$	Ι											$\prod$			
	Maximum Speed	I	Γ			$\prod$						$\prod$				$\prod$	
	MinImum Speed												1.				
	Cruising Speed		T														
	Rad Alter of Speed		Γ				$\prod$					T					Γ
	Stationary															T	
	As Occurs		Ι														
	14. TARGET: DIRECTION		$I^-$			$\prod$											
	Closing																
	Retreating											Ι	$\perp$	$\prod$			
	Crossing										$\coprod$						L
	Complex Maneuver	$\prod$				$oldsymbol{\perp}$					П						
	As Occurs						$\coprod$										
	15. TARGET: CONCEALMENT		L	L			$\sqcup$										
	Concealed Physically	$\perp$	1		Ц	$\perp$	Ш		$\perp$								
<u> </u>	Concealed Electronically	_	$\downarrow$	_	Ц	$\downarrow$	ot		$\perp$	1	Ш	$\perp$	$\perp$				L
	Concealed Partially	$\perp$	$\perp$	L	Ш	_	$\perp$		$\perp$	$\perp$	Ц	$\perp$	_		Ш	$\perp$	L
	Concealed by Smoke	$\perp$	1	_		$\perp$	$\perp$		1	$\perp$		$\perp$	$\perp$	_	Ш	$\perp$	L
	Unconcea i ed	$\perp$	1_				$\sqcup$		$\perp$			$\perp$	$\perp$			1	L
	As Occurs		<u></u>						$\perp$				<u></u>				L
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SYSTEM FUNCTION #																					
SPI #	Γ																				
16. PERSONNEL: WORKLOAD	Γ																				7
Full Operat Loading	Γ	П		П			П														7
Partial Operat Loading	Γ							П													7
As Occurs	Г			П				П													7
17. PERSONNEL: WORK DURATION		П						П													7
Following No Work	Γ																			T	7
Following Extended Work	Γ							П					٦								7
Following Normal Work	Γ				Г		Г	П												T	7
As Occurs	Γ				Г			П				٦									7
18. PERSONNEL: PROTECT GEAR	Γ				Г			П												T	7
Weering Protect Gear	Γ							П													]
Wearing Normal Gear	Γ				Γ			П													
As Occurs	Γ																				
19. PERSONNEL: STRENGTH																					]
Minimum Strangth	Π		Г																		7
Normal Strangth					Γ			П												$\top$	7
Optious Strength			Г		Г		Γ													T	7
As Occurs	1																				7
20. PERSONNEL: PERCEPTION	T							П							T .					1	7
Minimum Perception	Γ			Г				П				П			Г					$\neg$	7
Normal Perception	T														Г					$\top$	7
Optimum Perception	T					П		П													7
As Occurs	T		Г	Г				П												$\top$	7
21. PERSONNEL: EXPERTENCE							Γ	П													7
Minimum Experience	T						Γ														7
Normal Experience	T		Γ	Г			Г									Г				T	7
Optimum Experience	Ι																				7
As Occurs	Ī			Γ											Г					T	7
22. PERSONNEL: APTITUDES	Τ		Γ																	T	7
Minimum Aptitudes							Π														7
Normal Aptitudes					Γ		Г													T	٦
Optimum Aptitudes		Γ	Г				Γ														7
As Occurs			Γ	Γ												Γ		П		1	7
23. PERSONNEL: SIZE			Г									П						П		1	7
Minimum Size					Γ		Γ			П		П				Г				$\top$	7
Normal Size												П	╗							7	7
Meximum Size	T	Γ			Γ			П												1	7
As Occurs	T	Γ						П								Γ		П		$\top$	٦
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ARREST PRODUCTION CONTRACTOR CONT

SYSTEM FUNCTION #																		1	_
SPI #							1	1	1		1	1	-				1	1	
24. TRAINING: INSTITUTION	T				Г		1	1	1	$\exists$	7	1	7	7			1	7	_
OJT-Trained	T						7		7			7	7					7	_
Schoo! Trained	Τ							T			T	7					٦	$\exists$	
Comb OJT + School	T						7	1			$\exists$	٦					1		_
No Spec Training	T						٦	1		$\neg$		$\neg$	7				7		_
Factory-Trained	Т									$\neg$	1		$\neg$						_
As Occurs	Τ	Γ						T			1						٦		_
25. TRAINING: LATENCY	T	Γ					$\exists$					٦	$\neg$	7				$\exists$	_
Period W/O Training/Prac	T		Γ					Ţ			J	7	J	7	]			1	_
Immed After Training	$\top$													7				7	_
Normal Latency	Τ										1		$\neg$					$\exists$	_
As Occurs	T	Π					٦	T	٦		7	$\neg$	$\neg$	$\neg$			$\neg$	7	Ī
26. TRAINING: TEAM VS INDIV	Τ	Π	Γ				$\neg$				1		7				$\neg$	$\exists$	Ī
Only Indiv Training	T		Γ					1				7	٦	٦		$\neg$		1	_
Only Team Training	T	Γ				П		1									7	$\exists$	_
Comb of Indiv + Team	T		Γ	Γ			П	7				7	7					$\dashv$	-
As Occurs	T	Ī		Г		П		7			7	$\neg$	٦				7	7	_

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SYSTEM FUNCTION #					T		Γ			1	T		T	
SPI /					1	$\top$				1	1			
27. OPERATIONAL: CREW	П								П	1	$\uparrow$	$\top$	$\uparrow$	
Optimum Crew						Ι								
Normal Crew													Ι	
Minimum Crew						T					$\int$		$\prod$	
As Occurs														
28. OPERATIONAL: HARDWARE													$\Gamma$	
Fully Up					T	Τ							Τ	
Partial Breakdown					$\top$	T	Γ					T	T	
Fully Down				П		T			П	$\neg$		T	T	$\Box$
As Occurs					$\top$		Τ						Τ	
29. OPERATIONAL: INFORMATION INPUTS						T	Γ			1		T	Γ	
Full information inputs					1	T			П	7	T		Ī	П
Partial Information Inputs									П	7		T		$\Box$
No information inputs						T	T		П		1		T	П
As Occurs						T	T			1	7	T		П

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SYSTEM FUNCTION #																			T	
SPI #	-	-	-	-	┝	-	-			-	+	$\dashv$	1	+	_	$\exists$	$\dashv$	$\dashv$	+	ᅱ
	$\perp$	L	L	L	L							_	_					_	$\downarrow$	_
30. TACTICS		L		L	L	L	L						_					$ \bot $	$\perp$	
		L	L	L	L	L	L							_					$\perp$	
	L		L	L	L	L	L			_			$\perp$					$\dashv$	$\perp$	_
		L	L	L	L	L				_		$\sqcup$	4						$\perp$	
							L		Ц									$ \bot $	$\perp$	
31. TACTICS: # OF SYSTEMS	$\perp$					L						$\Box$							$\perp$	
Single System	$oldsymbol{\perp}$				L	L	L					$\Box$	$\perp$						$\perp$	
Multiple of Same Type							L												$\perp$	
Multiple Systs of Diff Types	_	L		L									$\perp$					$\Box$	$\perp$	
As Occurs																			$\perp$	_
32. TACTICS: SPEED																			$\perp$	
Maximum Speed				L		L														
Minimum Speed						Ŀ													$\perp$	
Cruising Speed																				
Rad Alter of Speed												╛								
Stationary																				
As Occurs							Ĺ													_ !
33. TACTICS: LOCATION(S)										_									$\perp$	
																			$\perp$	
				L		L	_													
				L																
	$\perp$																			
34. TACTICS: DIRECTION				L			L													
Closing Angle			L	L																
Retreating Angle					L	L						_	$\perp$							
Crossing Angle, Direction				L	L			L											$\perp$	_
Complex Maneuver																				
As Occurs	$\perp$				L														$\perp$	
35. TACTICS: CONCEALMENT																				
Concealed Physically					L								$\int$					$ \bot $	$\perp$	
Concealed Electronically																				
Partially Concealed																				
Concealed by Smoke							Ĺ											$\prod$		
Unconceal ed																				
As Occurs													T					T		

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Partially Protected Config	Γ											
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37. TACTICS: AUTOMATIC FUNCTION	T											
Fully Automatic	T					·						
Semi-Automatic	Τ	Π										
Manual Mode												
As Occurs	Τ	Γ										
38. TACTICS: SYSTEM LOADING	T	Γ	$\prod$									
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100% Loaded (WT/VOL)												
Operationally Loaded												
Unloaded	T											
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39. OTHER CONDITION CATEGORIES: CONDITIONS																					
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#### SPI SUMMARY WORKSHEET

SYSTEM FU	INCTION		
SPI (STATEMENT)	SELECTION WEIGHT	CONDITION COMBINATIONS ATTACHED TO SPI STATEMENTS	FINAL SELECTION WEIGHTS
	}		
SYSTEM		TEST DATE	PAGE
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# HRTES 5. HUMAN PERFORMANCE FUNCTION GROUPS (HPF-Groups)

#### CONTENTS

- Set of Operational HPF-Group Worksheets
- 2. Guidelines for Developing Maintenance Human Performance Functio (HPF's)
- 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

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- 9. Guidelines for Developing Statistics and Statistic Criterion
- 10. Sample Criterion Worksheet (2 Pages)

# HRTES OPERATIONAL HPF-GROUP WORKSHEET

	SYSTEM FUNCTION		
	SPI		
HPFS	HPF-GROUP # 1 WEAPON DELIVERY	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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### **OPERATIONAL HPF-GROUP WORKSHEET**

	SYSTEM FUNCTION SPI		
HPF's	HPF-GROUP # 2 TARGET ACQUISITION	MARK IF RELEVANT	NEW HPF NUMBER
1.	Detect target(s)		•
2.	Identify target(s)		
3.	Select target(s) and target order		
4.	Orient weapon system in general firing position		
5.	Determine range of target		
6.	Aim weapon system. This involves a procedure which results in the system being adjusted for the azimuth and elevation of the target		
7.	Illuminate or designate target		
8.	Adjust aim, following miss		
9.	Shift to second target		
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### OPERATIONAL HPF-GROUP WORKSHEET

	SYSTEM FUNCTION		
1	SPI [		
HPF's	WEAPON DELIVERYGROUND TO GROUND MISSILES	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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### **OPERATIONAL HPF-GROUP WORKSHEET**

SYSTEM FUNCTION	
HPF-GROUP # 3 WEAPON DELIVERYGROUND TO GROUND MISSILES (CONTINUED)	MARK IF RELEVANT
18. Perform missile no-go procedure	T
19. Perform misfire procedure	
20. Perform hangfire procedure	_
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### **OPERATIONAL HPF-GROUP WORKSHEET**

	SYSTEM FUNCTION		
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	SPI		
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	HPF-GROUP # 4 WEAPON DELIVERYHAND GRENADES	MARK IF RELEVANT	NEW HPF NUMBER
HPF's		<u>≥</u>	_ <u>z</u> _
1.	Inspect grenade for defects		<del></del>
2.	Correct applicable defects		
3.	Attach to appropriate part(s) of person/harness/etc.		 
4.	Acquire target; include the judgment of distance to target		
5.	Aim grenade		
6.	Launch grenade		
7.	Adjust launch based on location of detonation in relation to target		
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### OPERATIONAL HPF-GROUP WORKSHEET

	SYSTEM FUNCTION		
r			
	SPI		
HPF's	HPF-GROUP # 5 WEAPON DELIVERYMINES	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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	SYSTEM FUNCTION		
	SPI		
HPF's	HPF-GROUP # 6 TARGET INFORMATION GATHERING AND INTERPRETATION	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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### **OPERATIONAL HPF-GROUP WORKSHEET**

<u></u>	
HPF-GROUP # 7 TARGET DESIGNATION	MARK IF RELEVANT
ipf's	MAI W
1. Assemble/disassemble system	
2. Calibrate/align system	
3. Select designator system position	
4. Acquire target (See Target Acquisition, page W5-3.)	
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### OPERATIONAL HPF-GROUP WORKSHEET

SYSTEM FUNCTION		
HPF-GROUP # 8 TARGET BEHAVIOR PREDICTION	MARK IF RELEVANT	NEW HPF NUMBER
HPF's	MARK IF	NEW HP
1. Predict maneuver of target(s)		
<ol> <li>Predict location of target(s) after given time interval, or predictime interval to arrive at given location (location includes range altitude, azimuth, elevation, etc.)</li> </ol>		
3. Predict attack of target(s) on friendly force		
4. Predict time/location for successful attack on target(s)		
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### **OPERATIONAL HPF-GROUP WORKSHEET**

	SYSTEM FUNCTION		
	SPI		
HPFS	HPF-GROUP # 9 WEAPON FUNCTION MANAGEMENT	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		٠.
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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	SYSTEM FUNCTION		
	SPI		
нргъ	HPF-GROUP # 10 REPRESENTATION OF TERRAIN/OBSTACLES/INSTALLATIONS/WEATHER	MARK IF RELEVANT	NEW HPF NUMBER
1.	Indicate key terrain features which might affect outcome of the operation $^{\scriptsize 1}$		
2.	Indicate man-made obstacles which might affect the outcome of the $\ensuremath{\text{operation}}^2$		-
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, <sup>4</sup> See page W5-13 for footnotes		
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### FOOTNOTE FOR OPERATIONAL HPF-GROUP WORKSHEET

### 10. REPRESENTATION OF TERRAIN/OBSTACLES/INSTALLATIONS/WEATHER

1 Your consideration of terrain features should include the following:

coastline configuration exits from beaches avenues of approach cover and concealment observation and fields of fire

soil composition
water depth
terrain slopes
beach characteristics
elevations

defiladed areas areas suitable for avaiation landing

accessibility of terrain features

positions for weapons spaces for maneuver

points of maximum disruption

 $^{2}\mathrm{Your}$  consideration of man-made obstacles should include the following:

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

 $^{3}$ Your consideration of installations should include the following:

airports
heliports
enemy depots
enemy command posts
enemy transportation facilities
enemy communication facilities

enemy air defense systems enemy radar facilities

enemy satellite microwave receiving

stations

enemy power operation facilities/lines enemy C<sup>3</sup> positions

 $^4$ Your consideration of weather should include the following:

visibility data wind data temperature data

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humidity data precipitation data

### OPERATIONAL HPF-GROUP WORKSHEET

	SYSTEM FUNCTION		
	SPI		
HPFs	HPF-GROUP #  11 REPRESENTATION OF STATUS OF FORCES	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 <sup>1</sup>		
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		-
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### **OPERATIONAL HPF-GROUP WORKSHEET**

	SYSTEM FUNCTION		
	SPI		
HPFS	HPF-GROUP # 11 REPRESENTATION OF STATUS OF FORCES (CONTINUED)	MARK IF RELEVANT	NEW HPF NUMBER
13.	Develop alternate sources of information		
14.	Prioritize information according to the user(s) needs and probability of its accuracy		
15.	Prioritize list of information user(s) for receipt of information based on their functions in this specific operation and their requirements		
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### FOOTNOTE FOR OPERATIONAL HPF-GROUP WORKSHEET

### 11. REPRESENTATION OF STATUS OF FORCES

1 Your consideration of these actions should include:

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

### OPERATIONAL HPF-GROUP WORKSHEET

	SYSTEM FUNCTION		
	, SPI		
HPFs	HPF-GROUP # 12 PROJECTION OF BATTLEFIELD OPERATIONS	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		
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	SYSTEM FUNCTION		<u> </u>
HPF's	HPF-GROUP # 12 PROJECTION OF BATTLEFIELD OPERATIONS (CONTINUED)	MARK IF RELEVANT	NEW HPF NUMBER
13.	Prioritize list of information users for receipt of information based on their functions in this specific operation and their requirements		
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### OPERATIONAL HPF-GROUP WORKSHEET

	SYSTEM FUNCTION		
HPF's	HPF-GROUP # 13 PROJECTION OF WEATHER CONDITIONS	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		
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### OPERATIONAL HPF-GROUP WORKSHEET

SYSTEM FUNCTION SPI	
HPF-GROUP  # 13 PROJECTION OF WEATHER CONDITIONS (CONTINUED)  PF's	MARK IF RELEVANT
<ol> <li>Prioritize list of information users for receipt of information based on their functions in this specific operation and their requirements</li> </ol>	
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### **OPERATIONAL HPF-GROUP WORKSHEET**

	SYSTEM FUNCTION		
HPF's	HPF-GROUP  #  14  SELECT THE MOST APPROPRIATE FRIENDLY UNIT(S) TO ENGAGE IN OPERATION	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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### **OPERATIONAL HPF-GROUP WORKSHEET**

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	SPI		
HPF	HPF-GROUP  # 15 SELECTION AND ORDERING OF APPROPRIATE TARGETS	MARK IF RELEVANT	NEW HPF NUMBER
1.	Locate potential targets		
2.	Identify type and number of potential targets		
3.	Determine threat potentials of targets		
4.	Determine availability of appropriate friendly weapon system		
5.	Determine the probability of eliminating target(s)		
6.	Prioritize targets		
7.	Select targets to attack		
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	SYSTEM FUNCTION		
	SPI		
HPF's	HPF-GROUP #  16 CONTROL OF FRIENDLY FORCES ON THE BATTLEFIELD	MARK IF RELEVANT	NEW HPF NUMBER
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 (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		<del></del>
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		
<sup>1</sup> See	page W5-24 for footnote		
		<u> </u>	

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### FOOTNOTE FOR OPERATIONAL HPF-GROUP WORKSHEET

### 16. CONTROL OF FRIENDLY FORCES ON THE BATTLEFIELD

The 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

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	SYSTEM FUNCTION		
	SPI		
HPF's	HPF-GROUP # 17 LOGISTICS	MARK IF RELEVANT	NEW HPF NUMBER
1.	Maintain information on current status of supplies		
2.	Maintain information on maintenance status of equipment needed for mission		
3.	Recommend location of rear boundary bases		
4.	Recommend main and secondary supply routes		
5.	Determine throughput unit supply requirements		
6.	Recommend movements which are consistent with logistics consider- ations		
7.	Develop policies for area damage control operations		
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### **OPERATIONAL HPF-GROUP WORKSHEET**

SYSTEM FUNCTION	
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HPFS  HPFS  HPFS	MARK IF RELEVANT NEW HPF NUMBER
1. Prepare personnel estimate based on requirements of operation	
2. Estimate casualty rates of friendly forces and projected POW's	
3. Prepare evacuation contingency plans	
4. Coordinate personnel replacement plans with appropriate organizations	
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	SYSTEM FUNCTION		
	SPI		
НРБУ	HPF-GROUP # 19 RECONNAISSANCE/FIRE CONTROL	MARK IF RELEVANT	NEW HPF NUMBER
1.	Determine target type/number/size/direction/speed/elevation		
2.	Determine weather conditions effecting weapons delivery		
3.	Determine target coordinates		
4.	Mark target locations; this may be done by physical, chemical, radiological or electronic means		
5.	Handoff target(s) to attack units		
6.	Determine effects of fire on target		
7.	Relocate target(s)		
8.	Adjust fire of attacking unit(s)		
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	SYSTEM FUNCTION		
	HPF-GROUP # 20 BATTLEFIELD RECONNAISSANCE	MARK IF RELEVANT	NEW HPF NUMBER
HPF's		MARK IF	NEW HPF
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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### **OPERATIONAL HPF-GROUP WORKSHEET**

SYSTEM FUNCTION	
HPF-GROUP #21 ESTABLISHMENT AND MAINTENANCE OF COMMUNICATIONS	MARK IF RELEVANT NEW HPF NUMBER
1. Assemble communications device(s)	
2. Assemble/erect/orient antenna	
3. Establish communications net	
4. Enter communications net	
5. Transmit messages	
6. Receive messages	
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### **OPERATIONAL HPF-GROUP WORKSHEET**

	SYSTEM FUNCTION		
	SPI		
HPF's	HPF-GROUP # 22 PREVENTION OF INTERCEPTION/JAMMING	MARK IF RELEVANT	NEW HPF NUMBER
1.	Encode messages		
2.	Authenticate transmissions		
3.	Decode messages		
4.	Apply anti-jamming procedures		
5.	Apply transmission security procedures		
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	SYSTEM FUNCTION		
	SPI		
HPFs	HPF-GROUP # 23 INFORMATION ROUTING	MARK IF RELEVANT	NEW HPF NUMBER
1.	Identify appropriate recipients of information		
2.	Prioritize recipients for the delivery of information		
3.	Prioritize pieces of information for delivery		
4.	Assign security classification and method for maintaining that classification		
5.	Determine call signals/frequencies		
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SYSTEM FUNCTION		
HPF-GROUP # 24 VEHICLE MANEUVERINGGROUND VEHICLES	MARK IF RELEVANT	
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		

### OPERATIONAL HPF-GROUP WORKSHEET

	SYSTEM FUNCTION		
	SPI		
HPF's	HPF-GROUP # 25 VEHICLE MANEUVERINGHELICOPTERS	MARK IF RELEVANT	NEW HPF NUMBER
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 aceleration/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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### **OPERATIONAL HPF-GROUP WORKSHEET**

	EVETEM FUNCTION		
	SYSTEM FUNCTION		1
	SPI SPI		
	WEHICLE MANEUVERINGHELICOPTERS (CONTINUED)	MARK IF RELEVANT	NEW HPF NUMBER
HPF's		MARK	NEW H
18.	Perform holding procedures	$\bar{\Box}$	
19.	Perform unusual attitude recovery		
20.	Perform before-landing check		<del></del>
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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### **OPERATIONAL HPF-GROUP WORKSHEET**

	SYSTEM FUNCTION		
	SPI SPI		
		·····	
	HPF-GROUP # 26 TACTICAL VEHICLE MANEUVERING HELICOPTERS	MARK IF RELEVANT	NEW HPF NUMBER
HPF's		MARK	NEW
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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SYSTEM FUNCTION		
SPI		
HPF-GROUP # 27 NAVIGATION  HPF's	MARK IF RELEVANT	NEW HPF NUMBER
1. Select appropriate maps and/or navigation aids		
2. Identify present location		
3. Identify destination		
4. Select travel route		
5. Estimate time of arrival and fuel requirements		
6. Travel designated route		
7. Identify position or route at specified times/locations		
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SYSTEM FUNCT	ION	
	SPI	
HPF-GR	28 VEHICLE LOADING/UNLOADING	MARK IF RELEVANT NEW HPF NUMBER
1. Load and position car	go/passengers in/on vehicle	
2. Secure cargo/passenge	ers	
3. Unload vehicle		
4. Fuel vehicle		
5. Load ammunition		
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	SYSTEM FUNCTION		
	SPI		
НРБ	HPF-GROUP # 29 VEHICLE RECOVERY	MARK IF RELEVANT	NEW HPF NUMBER
1.	Position recovery vehicle(s)		
2.	Prepare recovery vehicle(s)		
3.	Prepare system to be recovered		
4.	Attach cables between system to be recovered and recovery vehicles		
5.	Reconnoiter recovery area		
6.	Tow/lift/push system to be recovered		
7.	Disassemble/stow recovery equipment		
SY:	STEM	GE	

#### **OPERATIONAL HPF-GROUP WORKSHEET**

SYSTEM FUNCTION	
SPI	
FIPF-GROUP #30 SELF-RECOVERY	MARK IF RELEVANT NEW HPF NUMBER
1. Prepare system for self-recovery	
2. Reconnoiter for appropriate anchor points and recovery path	
3. Position anchors	
4. Attach cables to anchors/winches	
5. Pull system to safe area	
5. Disassemble/stow self-recovery components	
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# HRTES OPERATIONAL HPF-GROUP WORKSHEET

	SYSTEM FUNCTION		
	SPI		
HPF's	## 31 ESCAPE FROM SYSTEM HARDWARE	MARK IF RELEVANT	NEW HPF NUMBER
1.	Destroy or alter critical components of communication and other sensitive equipment/documents		
2.	Take personal weapon, ammunition, and survival equipment		
3.	Position system hardware for escape, if possible under the conditions imposed		
4.	Open escape path out of system hardware		
5.	Escape from system hardware		
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#### **OPERATIONAL HPF-GROUP WORKSHEET**

	SYSTEM FUNCTION		
HPF's	HPF-GROUP # 32 SYSTEM PROTECTION FROM THREAT	MARK IF RELEVANT	NEW HPF NUMBER
1.	Identify threat to system; e.g., onboard fire, flooding, imminent crash, NBC, enemy attack		·
2.	Activate hardware protective device(s)		
3.	Put on protective gear/clothing		
4.	Secure material/cargo for protection against threat		<del></del> -
5.	Assume protective position for crew/passengers		
6.	Maneuver to protect from threat		
7.	Deactivate hardware protective device(s)		
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# HRTES OPERATIONAL HPF-GROUP WORKSHEET

	SYSTEM FUNCTION .		
	SPI		
HPFS	HPF-GROUP # 33 PREVENTION OF DETECTION/LOCATION OF SYSTEM	MARK IF RELEVANT	NEW HPF NUMBER
1.	Detect threat warning(s) which indicate either search or attack modes		
2.	Identify the nature of the threat(s) from which detected threat warnings emanate		
3:	Take appropriate countermeasures to reduce the probability of identification of location 1		
4.	Camouflage system <sup>2</sup>		
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1,	<sup>2</sup> See page W5-43 for footnotes		
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### FOOTNOTE FOR OPERATIONAL HPF-GROUP WORKSHEET

#### 33. PREVENTION OF DETECTION/LOCATION OF SYSTEM

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<sup>1</sup>These countermeasures include:
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jamming
smoke
flares
chaff
powered decoys
signature alteration
electronic attack of threat-sensing equipment
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 $^2\mathrm{System}$  camouflage includes:

physical infrared radar signature reduction

### **OPERATIONAL HPF-GROUP WORKSHEET**

	SYSTEM FUNCTION		
	SPI		
HPF's	HPF-GROUP #  34 ENGINEERINGOBSTACLE REMOVAL/ BREACHMENT	MARK IF RELEVANT	NEW HPF NUMBER
1.	Acquire obstacle to be dealt with		
2.	Prepare system hardware for obstacle removal/breaching. The nature of this preparation is entirely dependent upon the sort of system under consideration. It may involve preparation for bulldozing, gun firing, demolition, etc.		
3.	Decide on placement of fire, charge, or pressure in relation to obstacle		
4.	Remove/breach obstacle		
5.	Remove/displace remains of obstacle		
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#### **OPERATIONAL HPF-GROUP WORKSHEET**

	SYSTEM FUNCTION		
	SPI		
HPF's	HPF-GROUP # 35 ENGINEERING-BRIDGING	MARK IF RELEVANT	NEW HPF NUMBER
1.	Prepare bridge site		
2.	Excavate foundations		
3.	Construct bridge abutments		
4.	Construct bridge span		
5.	Construct/assemble bridge		
6.	Prepare bridge for launching		
7.	Position bridge transporter for launching		
8.	Launch/drive bridge into water		
9.	Connect bridge		
10.	Recover bridge		
11.	Disassemble bridge		
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### 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	Change/Replace
Lubricate	Troubleshoot/Diagnose
Fill/Drain	Remove
Purge	Disassemble/Assemble
Paint	Install
Clean	Adjust/Align
	Test

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



## GUIDELINES FOR DEVELOPING MAINTENANCE HUMAN PERFORMANCE FUNCTIONS (Continued)

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 <u>high</u> 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.

### MAINTENANCE WORKSHEET

SYSTEM CLASS			_	
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SYSTEM FUNCTION				
SPI				
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	Ž	PERSONNEL SYSTEM OPERATORS	SCHEDULED	UNSCHEDULED
MAINTENANCE HPF's	<u></u>	<u> </u>	<u>×</u>	
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#### **TEST CONDITION WORKSHEET**

SYSTEM FUNCTION	
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SPI	
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HPF's PERFORMED	<del></del>
HPF'S PERFORMED UNDER THE SAME CONDITIONS	
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RELEVANT CONDITION CATEGORIES	
CONDITION CATEGORIES	SELECTED CONDITION(S) FROM EACH CATEGORY
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### FINAL CONDITION SET WORKSHEET

	SYSTEM FUNCTION				
	SPI				- 4
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	HPF's PERFORMED TOGETHER				
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			<del></del>		
			<del></del>		
SET #	CONDITION SET(S) UNDER WE	HICH EACH HP	F IS TO BE TESTED	)	
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### 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.



### GUIDELINES FOR DEVELOPING PERFORMANCE CRITERIA (Continued)

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 a!! the significant errors in the appropriate place on the Worksheet.

FRROR 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.

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/in- formation needed for HPF performance).	<ul><li>2.1 Rock identified as target.</li><li>2.2 Static identified as message.</li></ul>
	3. Signal identified as noise.	3.1 Target identified as rock. 3.2 Message identified as static.
	<ol> <li>Signal recognized as such, but no ident- ification or classification made.</li> </ol>	4.1 Signal recognized as non-noise, but cannot be deciphered.  4.2 Message can be read, but not understood (rather them misunderstood).
	5. Signal misclassified or misunderstood.  Hisclassification 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 T82. 5.6 Platoon Sravo 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.	<ul><li>6.1 Incorrect target prioritization.</li><li>6.2 Enemy in attack thought to be in defense.</li><li>6.3 Error in location of potential enemy breakthrough point.</li></ul>

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TYPE OF HPF (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 amounition 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.
	<ol><li>Incorrect or inappropriate information communicated.</li></ol>	2.1 Incorrect location sent. 2.2 Shopping list sent.
	<ol><li>Garbled (not understandable) meterial communicated.</li></ol>	3.1 Entire message garbled. 3.2 Identified key word garbled.
	4. Message sent to inappropriate recipient.	<ol> <li>4.1 Message sent to wrong friendly unit.</li> <li>4.2 Message sent to enemy unit.</li> </ol>
	S. Hessage sent in inappropriate format.	5.1 Message order wrong. 5.2 Message not coded properly. 5.3 Inappropriate symbols used.

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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) <u>Time Criterion</u>: 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**

SYS	TESTROY ARCK	AFT
	TARAET ACQUISITA	ON IN FULL SUNLIGHT
☑ OPER. ☐ MAINT.	DETECT AND I DEL	TIFY TARGETS
	CONDITION SET	CONDITION SET 3
ERRORS	1) DETECTION WITHOUT TARGET 2) TARGET WITHOUT DETECTION 3) FRIENDLY US. ENEMY ERROR 4) TARGET TUPE ERROR (FUSHTER, BUMBER, RELIN, STC.) 5) TARGET MODEL ERROR	JAME AS CONDITION SET
MAXIMUM ACCEPTABLE TIME	20 3550005	30 SELONOS
PERFORMANCE CRITERION	TRIAL FAILS IF: ANY 3 OR MORE OF ACOVE ENPORS ARE MADE, OR IF TRIAL TAKES MORE THAN 20 SECONDS	TRIAL FAILS IF:  ERRORS 1 OR 2 OCCUR.  OR GERORS 3, 4, AUT.  5 ALL OCCUR., OR  IF TRIAL TAKES MORE  THAN 30 SECONDS
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STATISTIC CRITERION		

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### **SAMPLE**

SYS	DESTROY AIRCRAFT
	TARGET ACQUISITION IN FULL SUNLIGHT
OPER.	SELECT TARGET AND TARGET ONDER
	CONDITION SET CONDITION SET
ERRORS	1.) INCORRECT TARGET ORDER SELECTED. 2.) IMPROPRIATE AIRLRAFT SELECTED AS TARGETS.
MAXIMUM ACCEPTABLE TIME	15 SELOUDS
PERFORMANCE CRITERION	TRIAL FAILS IF:  I.) RANK ORDER OF SCIECTED  TARGETS DOES NOT DIRESLATE  WITH CORRECT RANK ORDER  AT LEAST 80 % OR  2.) 20% INMARCOPRIATE A.C.  SCIECTED AS TAMETS, OR IF  TRIAL TAKES MORE THIN 15 SEC
STATISTIC	
STATISTIC CRITERION	

#### **CRITERION WORKSHEET**

SYS	TEM FUNCTION				
	SPI				
OPER.	HPF				
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	COND	ITION SET		CONDITIO	N SET #
ERRORS					
MAXIMUM ACCEPTABLE TIME		- a			
PERFORMANCE CRITERION					
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### 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 <u>average</u> of all the measure outcomes for the specific HPF; and (b) by calculating the <u>percentage of successful performances</u> 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:

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

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 <u>statistic criterion</u>. 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."

### GUIDELINES FOR DEVELOPING STATISTICS AND STATISTIC CRITERION (Continued)

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 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.



### GUIDELINES FOR DEVELOPING STATISTICS AND STATISTIC CRITERION (Continued)

- (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 Workshoot.

If you have decided on <u>separate</u> 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 <u>across all</u> 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 vise versa.

#### GUIDELINES FOR DEVELOPING STATISTICS AND STATISTIC CRITERION (Continued)

- (b) When the statistic is an average, the defintion 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**

SYS	TESTROY AIRCRA	FT
	SM TARAET ACQUISIT	ON IN FULL SUNLIGHT
OPER.		
MAINT.	DETECT AND IDENT	
<del></del>	CONDITION SET	CONDITION SET
	I) DETECTION WITHOUT TARKET. 2) TARKET WITHOUT DETECTION. 3.) PRIBUDUY US. EVENY GEROR. 4.) TARKET TUPE ERROR. (PRINTER, BANGER, RECON, ETC.) 5) TARKET MODEL ERROR.	SAMEAS COUDITION SET # 1
MAXIMUM ACCEPTABLE TIME	20 SECOUDS	30 3560405
PERFORMANCE CRITERION	TRIAL FAILS IF: AUT 3 OR MORE OF ABOVE BROOKS ARE MADE, OR IF TRIAL TAKES MORE THAN 20 SELANDS.	TRUAL FALLS IF: ERRORS I OR 2 OCCUP, OR ERRORS 3, 4, AND 5 ALL OCCUP. OR IF TRUAL TAKES MORE THAN 30 SECONDS,
STATISTIC	POUDUTAGE OF SULLESSFUL HPF TRUPLS	PERCENTAGE OF SIKLESSFUL HPF TRIALS
STATISTIC CRITERION	STATISTIC FALLS IF: FEWER THAN 80% TRIAL SUCCESSIONS.	ACROSS CONDITION SETS.

### **SAMPLE**

313	TESTRO	Y ARCRAFT		
	SM TARKET	ALBU ISITION I	U PULL SUNLI	SHT
☑ OPER. □ MAINT.	HPF SELECT	TARGET AND	TARAET ORDE	R
	CONDITION SET	2	CONDITION SET	•
ERRORS	1) INCORRECT TARGE SELECTED 2.)/INAPPROPRIATE AIR SELECTED AS TARGE	CLAFT		
MAXIMUM ACCEPTABLE TIME	15 SECONDS			
PERFORMANCE CRITERION	TRIAL FAILS IF:  B) RANK CROER OF SE  TRACTS DOES NOT  WITH CORRECT TRANS  AT LEAST BOB. (C  2) 20 % INAMPROPRIAL  ARCRAFT SCIENTED OR IFTEIAL TAKES A  15.SECANOX	CARRELATE C OXDER VE TE US TIRUSTS		
STATISTIC	AVERAGE ERRORS &	TME		
STATISTIC CRITERION	STATISTIC FAILS IF: PEWER THAN 75% TI SUCCESSIOS.	ZIAL		

# HRTES 6. HUMAN PERFORMANCE MEASUREMENT

#### CONTENTS

- Performance Data Collection Worksheet
- 2. Beginning and End Point Worksheet
- Planning Data Collection Worksheet (8 pages)
- 4. Guidelines for the OT Training Data Collection Worksheet
- OT Training Data Collection Worksheet
- 6. Guidelines for Collecting Data for Diagnosis During OT (2 pages)
- 7. HPF Difficulty Worksheet for OT Observers
- HPF Difficulty Worksheet for OT Participants
- 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

THE CONTRACT AND CONTRACT CONT

#### PERFORMANCE DATA COLLECTION WORKSHEET

SYSTEM FUNCTION					
SPI					
31.		<del></del>			
НРБ		· · · · · · · · · · · · · · · · · · ·			
OPER CONDITION SET(S)					
☐ MAINT	L				
ONE PERFORMANCE UNIT					
NUMBER OF TRIALS PER PERFORMANCE			<u> </u>	TRIAL #	
NUMBER OF PERFORMANCE UNITS RE	COMMENDI	נטיַ		IRIAL  "	
. In cameros our protonous				<b>5</b> 5	
				CIDENT NEAR CIDENT	SPECIFY IF UNSUCCESSFUL
DATA TO BE TAKEN*		OL	ITCOME	04°0 <b>V</b> 04°0	AND EXPLAIN REASON
•					
		i			·
					-
		<u> </u>			
		<u> </u>			
		}			
*If time is to be measured, specify time un	its	L			
SYSTEM	<del></del>	T	ESTD	ATE	PAGE
NAME					

W6-2



#### **BEGINNING AND END POINT WORKSHEET**

SYSTEM FUNC	CTION		
	SPI		
HPF-G	ROUP		
OPER CONDITION	ON SET		
HPF's		BEGINNING POINT	END POINT UN
	· -		
	<del></del>		
	<del></del>		
1			
<b>A</b>			

W6 - 3

## WORKSHEET FOR PLANNING DATA COLLECTION

Consider the	Performance Crite	rion of the HPF's and as	sk:
(1)	Are measures best	taken by an:	
	Observer	Instrumentation	Combination of Both
	If you selected On with 2.	bserver, or Combination	of Both, continue
(2)	·	r an observer without si	ignificantly disturbing
	YES	NO	
		this question is no, you with instrumentation; t	•
(3)		ground (previous training uired of the observer(s)	

(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?

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

	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 (Check'ists, etc.) will be required?
16)	Who will produce these forms?

By what date must these forms be completed?			
-	you selected Instrumentation or Combination of Both continue n Step 18.		
	kind(s) of instrumentation is required to obtain the essary data?		
Is there space for the instrumentation without significantly disturbing the performance you want to measure?			
	,		
	,		
dist	rurbing the performance you want to measure?		
dist	rurbing the performance you want to measure?		
dist	NO  The answer to this question is no, and there is also		

(20)	ls ti	nere adequate power for the device?
	YES	NO
	lf t	he 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,
	(3)	Use an observer to collect data,
	(4)	Collect this information through debriefing.
(21)		the instrumentation available to you? To answer this stion adequately, you will first have to find out:
	(1)	If it already exists
		YES NO
	(2)	Where it can be obtained

## WORKSHEET FOR PLANNING DATA COLLECTION (Continued)

	(3) The lead time for obtaining it						
	(4)	How long it takes to install it in your System					
	lf †	he answer is no, you will have to					
	(1)	Switch to another variety of instrumentation, or					
	(2)	Use an observer to collect data,					
	(3)	Collect this information through debriefing.					
(22)		installation and maintenance of the instrumentation going equire technicians dedicated to this project?					
	YES	NO					
	person	answer to this question may be obvious if there are OT onnel who have already been dedicated to this function. he answer is not obvious, you should consider repeating most applicable of Steps 2-8 substituting the word nician for observer.					

Constituted (1) Processor of the Constitution

### WORKSHEET FOR PLANNING DATA COLLECTION (Continued)

	•	ou selected Combination of Both, all questions from 2-22 y to you. In addition answer:
(23)	ment	there enough space, for both the observer and the instru- ation, without significantly disturbing the performance want to measure?
	YES	NO
	lf t	he 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

Charles Secretary - Francisco

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.

### OT TRAINING DATA COLLECTION WORKSHEET

			TRAI	NING	METH	ODS		, <u>.</u>		
AL/WRITTEN DRILL/ ACTICE	CTURE	DIVIDUAL DISCUSSION	OUP DISCUSSION	ADING TEXTS	PERT DEMONSTRATION/ VISUAL AIDS	OGRAMMED INSTRUCTION	NMES	AULATION	NDS-ON PRACTICE/ REAL HARDWARE	
ŏæ	Ē	Ž	Ğ	RE	Ä	PR	9	SI	主	SUM
<del>                                     </del>										
				·- <u>-</u>						
<u> </u>		!								
						_				
-										
								1		
										·
	ORAL/WRITTEN DRILL/ PRACTICE	ORAL/WRITEN DRILL/ PRACTICE LECTURE	ORAL/WRITTEN DRILL/ PRACTICE  LECTURE INDIVIDUAL DISCUSSION	NO.	NON SION	L/ SiON SION/	ORAL/WRITTEN DRILL/ PRACTICE LECTURE INDIVIDUAL DISCUSSION GROUP DISCUSSION READING TEXTS EXPERT DEMONSTRATION/ VISUAL AIDS PROGRAMIMED INSTRUCTION	SION / RUCTION /	ARITTEN DRILL/ SE JAL DISCUSSION SI TEXTS SEMONSTRATION/ L AIDS INSTRUCTION	ARITTEN DRILL/ SEE JAL DISCUSSION SIEXTS SEMONSTRATION/ L'AIDS AMIMED INSTRUCTION ION ON PRACTICE/ JARDWARE

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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 quidelines:

(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.

- 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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ALMONOMERS TO SERVICE TRANSPORTED TO SERVICE

### TASK (HPF) DIFFICULTY WORKSHEET FOR OT PARTICIPANTS (PLAYERS)

SYSTEM FUNCTION		
SPI		
☐ OPER CONDITION SET		
TASKS (HPF's) PERFORMED TOGET	THER	DIFFICULTY SCORE
rating of 1 means you think rating of 100 means you thin If you rate a task 50 or abo	that a task was extremely easy to per ik that a task was extremely difficult ove, you are concerned about its difficult ould not perform a task. You may choose	rform. A t to perform. iculty. None
	50	100
EXTREMELY EASY TO PERFORM	DIFFICULT ENOUGH TO CAUSE SOME CONCERN	EXTREMELY DIFFICULT TO PERFORM
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AND THE STANDARD SECTION SECTI

### TASK (HPF) DIFFICULTY WORKSHEET FOR OT OBSERVERS .

SYSTEM FUNCTION				
SPI				
OPER CONDITION SET				
TASKS (HPF's) PERFORMED TOGET	THER		DIFFICE SCOR	
	•	<del></del>		
	<del></del>			
				<del></del>
		~		
		P4 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 -		·
Rate each task, listed above	. for performance	difficulty for	om 1 to 100	<u> </u>
rating of 1 means you think rating of 100 means you thin If you rate a task 50 or about these ratings mean a task score from 1-100.	that a task was ex nk that a task was ove, you are concer k could not be perf	tremely easy extremely dined about it:	to perform. A fficult to perform of the first te	orm. None
ļ-	50	<del></del>	100	
EXTREMELY EASY TO PERFORM	DIFFICULT ENOU TO CAUSE SOM CONCERN		EXTREME DIFFICU TO PERFO	ULT
SYSTEM		TESTDATE	PAGE	į
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			SPI:			E:	DATI
						DITION SET:	CON
		ION:	SYSTEM FUNCT				
					serve	have just of	You
ions,	llowing questions,	the fo	It to do. Answe	s diff	nat it	have said th	and
		n.	ng scores to the	gning r	by as	ut this task	abo
				N IBE	IC PRO	UNDERSTANDIN	1
	avers) were	ants (pl	ng what particip				•
С	•	•	ere supposed to				
	·				above	task listed	
	COMPLETELY UNSATISFACTORY O	25	N BETWEEN 50	<i>لــــا</i>		COMPLETELY ATISFACTORY 100	
not adequate	It was so difficult that it was not possible to adequally understand	-	s moderately cult to under-	1+	as		Und no
				PLAYS	RING D	READING/HEAF	2.
s which	r the displays whic	/or hea	players) <u>read an</u>	cipant	ıld pa	How well cou	ı
		?	ance of this tas	e perf	d for	were require	
	COMPLETELY UNSATISFACTORY O	25	N BETWEEN 50			COMPLETELY TISFACTORY 100	
l and/or	impossible to adequately read and/o		ate effort d for displays		le	dable/hearab hout effort	
-c	UNSATISFACTO 0 Impossible to	25	N BETWEEN 50 ate effort	Mo		COMPLETELY TISFACTORY 100 dable/hearab	SA <sup>*</sup> Rea

3. UNDERSTANDING DISPLAYS							
How well could participa	ants understand the informat	ion which was					
presented by the displa	ys during this task performa	nce?					
COMPLETELY SATISFACTORY	IN BETWEEN	COMPLETELY UNSATISFACTORY					
100 75	50 25	0					
Extremely easy to understand	Moderately difficult to understand	Presentation of information so difficult that it could not be adequately understood					
4. USEFULLNESS OF DISPLAY	INFORMATION	adequatery under stood					
How effectively did the	display(s) used during this	task deliver the					
right information and in	n a timely way?						
		0040457517					
COMPLETELY SATISFACTORY 100 75	IN BETWEEN 50 25	COMPLETELY UNSATISFACTORY O					
All information needed for this performance was provided at the right time	The majority of the required information was delivered, usually in time	Information delivered was either completely inadequate, incorrect or so late as to be					
5. MANIPULATION DIFFICULTY		useless					
Check any problems encou	untered when trying to manip	ulate the control(s),					
or any other piece of ed	quipment, during the performa	ance of this task:					
	the Mark and the l						
	oo much effort required.	t.a					
	nreasonable amount of dexter	·					
Too many other thinks required at the same time.							
Too easy to make a r							
	than what is reasonable to ex	xpect.					
Movement requires un							
Uther, specify							

5. MANIPULATI	ON DIFFICULTY (C	ontinued)							
How effect	ively could part	icipants actually	make the required movements						
with eithe	with either the controls <u>or</u> any other piece of equipment involved in								
the perfor	mance of this ta	sk?							
COMPLETELY SATISFACTORY 100 Control/equipm ments required absolutely no of any kind	75 ent move- caused	IN BETWEEN 50	COMPLETELY UNSATISFACTORY  25  Movements required were so difficult that they could not be made adequately						
6. REACH/ACCE	SSIBILITY								
		_	to reach the control(s), or e manipulated, during this						
Angle It was It was Reachi object	fully or partia fully or partia ng it forced expo	hat it could not b lly blocked by and lly blocked by and	other person. s or highly uncomfortable						
	e of equipment whisk?	•	d get at the control(s) or any nipulated for the performance  COMPLETELY  UNSATISFACTORY  25  0						
Controls/other of equipment waccessible with effort	r pieces C vere o rhout a	controls/other pied of equipment were accessible with moderate effort							

7.	CONTROL CONFIGURATION	١								
	Check any problems encountered wth 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 deter	rmine what it was.								
	Too close to othe	er control/equipment.								
	☐ Too far from othe	er control/equipment used	in same performance.							
	Used without look	king at it much, and it fe	It too much like others.							
	☐ Too hard to tell	when it was activated or	moved to correct position.							
	Other, specify		·							
	How useful was the ad	ctual configuration of the	control. or other piece							
		ad to be moved, for perfor								
		, , , , , , , , , , , , , , , , , , , ,								
	COMPLETELY	IN DETWEEN	COMPLETELY							
3	ATISFACTORY 100 75	IN BETWEEN 50 2	UNSATISFACTORY 5 0							
	figuration caused	Configuration had prob-	Configuration so poor							
	olutely no diffi- ty of any kind	<pre>lems, but caused only moderate difficulty</pre>	<pre>it made performance impossibly difficult</pre>							
	Ty Of Gify Kind	model are difficulty	indessity diriredir							
8.	DECISION DIFFICULTY									
	How difficult was it	to make the decisions whi	ch were required for							
	performance of this t	ask?								
	COMPLETELY		COMPLETELY							
	SATISFACTORY 100 75	IN BETWEEN 50 2	UNSATISFACTORY 5 C							
Req	uired decisions	Required decisions	Required decisions were							
wer mak	e very easy to	were moderately difficult to make	so difficulty that the could not be made							
ma K	-	2 2	adequately							

9.	TARGET/TERRAIN VISIBIL	.ITY		
	•		any other elements of the	
		·	or performance of this task	?
	COMPLETELY	The Design (mail)	COMPLETELY	
Si	ATISFACTORY 100 75	IN BETWEEN 50	UNSATI SFACTORY 25 0	
	ibility was excel-	Visibility was ade-	Visibility was una	
see	t. It was easy to all required parts	quate. Enough could be seen to permit	table. Targets and critical parts of	the
of f	the environment, luding targets	the performance	environment could be seen	HOT
	u versione de la companya de la comp			
10.	WORKSTATION DESIGN FOR	· VISIBII IT♥		
			during this task caused by	the
	work station design:	c5 oncountered d(	ruan caused by	
	_/_/ 0051gil.			
	☐ Not enough light o	on outside of workstati	ion.	
	☐ Window/port not bi		•	
	☐ Window/port not in			
	☐ Window/port too di	•		
	☐ Equipment/people i	n the way of window/po	ort.	
		nside work station.		
	Too much glare.			•
		t behind other equipme	·	
	<del></del>	n seat to equipment not		
	Other:			
/				
<b>A</b>	rem	•	ESTPAGE	
	TEM			
NAI	ME	TE	ELEPHONE	

CONTRACTOR OF PROPERTY OF THE

10. WORKSTATIO	N DESIGN	FOR VISIBILITY (C	ontinued)		
The design	of some	parts of the work	station pro	bably had an	impact on
participan	t's abil	ity to see. What	was the effe	ct of those	parts of
the work s	tation o	n the performance	of this task	?	
				00.001 =	<b>T</b> P1 \
COMPLETELY SATISFACTORY		IN BETWEEN		UNSATISFAC	
100	75	50	25	0	
Visual parts of work station pr	0-	Visual parts of w station produced	OCK	•	rts of work to poor that
duced no diftic		moderate difficul	ty	performan	ce impossibly
of any kind		in performance		difficult	
1. NOISE					
Check any	noise pr	oblems encountered	during this	task.	
,	•		<del>-</del> -		
Could	not hear	radio or other de	vice which h	ad to be hea	rd.
=		other crew member			
=		fatigue.			
=		d concentration.			
		discomfort.			
<u> </u>		y location.			
Other:		•			
			····		
What was t	ne effec	t of noise in the	workstation	on the perfo	rmance of
this task?	.5 5,,00	, , , ,, ,, ,, ,, ,, ,, ,, ,, ,, ,, ,,			
11113 10311					
COMPLETELY				COMPLE	
SATISFACTORY 100	75	IN BETWEEN 50	25	UNSATISF O	ACTORY
loise produced	no	Noise produced mo	derate	Noise so e	xtreme that
difficulty of a kind	ny	difficulty in per mance	for-	performanc difficult	e impossibly
CHIU		morros		GILLICUIT	
					4
SYSTEM			TEST	DATE	PAGE
NAME			TELEPHO	NE	
NAME		W6-23			

## PERFORMANCE DIFFICULTY QUESTIONNAIRE (FOR OBSERVERS) (CONTINUED)

SYS						
	TEM			TEST	DATE	PAGE
	ifficulty of kind		moderate difficulty in performance		mance impo	ssibly diffi
SAT otio	MPLETELY ISFACTORY 100 on produced	75	IN BETWEEN 50 Motion produced	25		ACTORY e the perfor
	this task?			[		
	What was the	effect o	of motion at the work	station	on the perf	ormance of
	Motion pro	oduced s				
			vented seeing display	<b>′</b> •		
	_		great for the kind overted reaching contr		support.	
	workstatio	on.				uiside ine
			on produced fatigue. ed detection/identif	ication	of objects o	utsido tho
			ed accurate reading (			i.
	☐ Vibration	affecte	ed accurate use of co	ontrols.	,	
٠.		ion prol	olems encountered du	ing thi	s task:	
2.	MOTION					

W6-24

### PERFORMANCE DIFFICULTY QUESTIONNAIRE (FOR OBSERVERS) (CONTINUED)

NA	ME		W6-25	TELEPHO	NE	
SYS	TEM			TEST	DATE	PAG
					•	
	d no difference nv kind	mode in pe	rate difficulty erformance	ý	quate that impossible	perform
Vent	100 ilation pro-		IN BETWEEN 50 ilation produce		UNSATISF 0 Ventilatio	n so ina
	MPLETELY ISFACTORY		IN DETWEEN		COMPLE	
• ]	What was the e			ine work s	TATION ON TH	е
	What was the e	ff+ -f .	.and:lad: :-	46	4-43	
	Other:					
	☐ Gun/rocket☐ Bad odors		ducts too stron	ng.		
	Exhaust fu		_			
	☐ Not enough		r flow.			
	Much too h					
	Much too he					
					•	
13.	VENTILATION Check any vent	ilation p	roblems encoun	tered durin	ng this task:	
	VEND LEALION					

- CONTROL OF STREET STREET OF STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET

### PERFORMANCE DIFFICULTY QUESTIONNAIRE (FOR OBSERVERS) (CONTINUED)

NAME	W6-26	TELEPHO	ONE
SYSTEM		TEST	DATEPAGE
duced no difficul- ties of any kind	moderate difficularies in performance	ТУ	that performance impossibly difficult
100 Dimensions pro-	75 50 Dimensions produce		0 Dimensions so poor
COMPLETELY SATISFACTORY	IN BETWEEN		COMPLETELY UNSATISFACTORY
What effect did		work stat	ion have on the perform-
Other:			
☐ Hatches too☐ Hatches in	wrong places.		
Poor arrang	ement of equipment.		
=	space to work because of	•	nt, or space allowed. g with other crew members.
	e at wrong height or a	ngle.	
	e too small.		
during this tas	sk:		
<ol> <li>WORKSTATION DIM Check any probl</li> </ol>	ENSIONS ems with the dimension	s of the w	orkstation encountered

LOCATION STANDARD REPORT KANGOS MANNO SPRANKOS

YS1	TEM			_TEST	DATE	PAGE
_						
	•		•			
	kind		in performance		difficult	
	ing produced ifficulty of		Seating produced moderate difficulty		Seating so poo	
	ISFACTORY 100	75	IN BETWEEN 50	25	UNSAT I SFAC	
	MPLETELY		<b>3</b>		COMPLETE	
	What effect di	d the	seating have on the p	erform	mance of this tag	sk?
	Other:		·			<del></del>
			ove or move more.	_ •		
			ole and makes you tire	•	1.	
	Not enough		space. Disorb vibrations well	onou et		
	Not enough	_	·			
	Not enough	shoul	der space.			
	Not enough	head	space.			
	☐ Needs foo					
	Needs arm	_				
			not right.			
	Seat at w	_	_			
	Seat too					
	Check any sea	ing pi	obtains encountered do	n mg	iiiis idsk.	
	Chaok any con-	tina n	roblems encountered du	nina d	thic took.	
•	SEATING					

	SAFETY HAZARDS
	Check any safety hazards encountered at the workstation during this ta
	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 pright that accident could result.
	Dangerously high noise level.
	Dangerous lack of ventilation.
	Anchoring of equipment not adequate.
	Padding of equipment not adequate.
	Crew seat beits/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——(I) they 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.
	being adequate. Complete the Satery Hazard Scale on the next page.
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KAKA PARAKA PERBERAN REPORT REPORT SERVICE SERVICES

100 75 Safety hazards pro- uced no difficulty fany kind culty in performance culty in performance culty in performance cartement that performance impossible  7. TRAINING TIME  To what extent did participants spend adequate time training for this task?  COMPLETELY SATISFACTORY 100 75 50 25 0  IN BETWEEN 25 ON Training time for this performance; a little more would have been helpful  8. PRACTICE CONDITIONS  To what extent did participants practice for this task in condition, or a very similar one. Could have used more training time  TEST DATE PAGE  Safety hazards so extreme that performance extreme that performance in this performance. Safety hazards so extreme that performance in this performance in this task in this condition, or a very similar one. Could have used more training time.	NAME		W6-29	TELEPHO	ONE	
COMPLETELY SATISFACTORY 100 75 50 50 Safety hazards pro- uced no difficulty if any kind  7. TRAINING TIME To what extent did participants spend adequate time training for this task?  COMPLETELY SATISFACTORY 100 75 Sofety hazards so extreme that performance impossible  7. TRAINING TIME To what extent did participants spend adequate time training for this task?  COMPLETELY SATISFACTORY 100 75 Sofety hazards so extreme that performance impossible  7. TRAINING TIME To what extent did participants spend adequate time training for this task?  COMPLETELY SATISFACTORY 100 75 Sofety hazards so extreme that performance impossible  COMPLETELY UNSATISFACTORY 100 To training time for this performance; a little more would have been helpful  8. PRACTICE CCNDITIONS To what extent did participants practice for this task in  (condition)  COMPLETELY SATISFACTORY 100 75 Sofety hazards Safety hazards so extreme that performance impossible  COMPLETELY UNSATISFACTORY 100 75 Sofety hazards Safety hazards	SYSTEM					
COMPLETELY SATISFACTORY 100 75 50 25 Gafety hazards produced no difficulty of any kind  7. TRAINING TIME To what extent did participants spend adequate time training for this task?  COMPLETELY SATISFACTORY 100 75 50 25  COMPLETELY SATISFACTORY 100 75 50 25  COMPLETELY SATISFACTORY 100 75 50 25  COMPLETELY SATISFACTORY 100 75 50 25  Got almost enough training time training time for this performance; a little more would have been helpful  8. PRACTICE CONDITIONS To what extent did participants practice for this task in this condition, or a very similar his condition one. Could have used  COMPLETELY SATISFACTORY 100 75 50 25  Got no training time for this task in this condition, or a very similar one. Could have used						
COMPLETELY SATISFACTORY 100 75 50 25 Safety hazards produced no difficulty duced moderate diffication of any kind  7. TRAINING TIME To what extent did participants spend adequate time training for this task?  COMPLETELY SATISFACTORY 100 75 Sofety hazards produced moderate difficants spend adequate time training for this task?  COMPLETELY SATISFACTORY 100 75 Sofety hazards so extreme that performance impossible  COMPLETELY SATISFACTORY 100 75 Sofety hazards produced moderate difficants spend adequate time training for this task?  COMPLETELY SATISFACTORY 100 Sofety hazards produced moderate difficants spend adequate time training for this task?  COMPLETELY UNSATISFACTORY 100 Sofety hazards produced madequate time training for this task?  COMPLETELY UNSATISFACTORY 100 Sofety hazards produced moderate difficants spend adequate time training for this task in this task in this condition, the second time spending for this task in this condition, the second time spending for this task in this condition, the second time spending for this task in this condition, the second time spending for this task in this condition, the second time spending for this task in this condition, the second time spending for this task in this condition, the second time spending for this task in this condition, the second time spending for this task in this condition, the second time spending for this task in this condition.			one. Could have used			
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COMPLETELY SATISFACTORY 100 75 50 25 0 afety hazards pro- uced no difficulty f any kind  7. TRAINING TIME To what extent did participants spend adequate time training for this task?  COMPLETELY SATISFACTORY 100 75 Safety hazards pro- safety hazards pro- duced moderate difficulty in performance  Mance impossible  COMPLETELY SATISFACTORY 100 75 S0 25 COMPLETELY UNSATISFACTORY 100 75 S0 25 O COMPLETELY UNSATISFACTORY 100 To training time for this performance; a little more would have been helpful  COMPLETELY UNSATISFACTORY 100 To training time for this performance; a little more would have been helpful  COMPLETELY UNSATISFACTORY UNSATISFACTORY UNSATISFACTORY 100 To training time for this performance; a little more would have been helpful  COMPLETELY UNSATISFACTORY 100 To the performance of this task in	SATISFACTORY 100	75	50	25	UNSATISFACTORY	
COMPLETELY SATISFACTORY 100 75 50 25 0 Safety hazards produced no difficulty fany kind  7. TRAINING TIME To what extent did participants spend adequate time training for this task?  COMPLETELY  UNSATISFACTORY 0 Safety hazards so extreme that performance impossible  7. TRAINING TIME To what extent did participants spend adequate time training for this task?  COMPLETELY  SATISFACTORY 100 75 50 25 COMPLETELY UNSATISFACTORY UNSATISFACTORY 100 75 50 25 COMPLETELY UNSATISFACTORY UNSATISFACTORY 100 Got no training time for this performance; a little more would have been helpful	<del></del>		(condition)		<del></del>	-
COMPLETELY SATISFACTORY 100 75 50 25 0 afety hazards pro- uced no difficulty f any kind  TRAINING TIME To what extent did participants spend adequate time training for this task?  COMPLETELY SATISFACTORY 100 75 50 25 0 COMPLETELY UNSATISFACTORY mance impossible  COMPLETELY COMPLETELY SATISFACTORY 100 75 50 25 0 COMPLETELY UNSATISFACTORY UNSATISFACTORY UNSATISFACTORY UNSATISFACTORY UNSATISFACTORY UNSATISFACTORY UNSATISFACTORY Of almost enough ore training time training time for this performance; tall training time for this task little more would				for th	is task in	
COMPLETELY SATISFACTORY 100 75 50 25 0 afety hazards pro- uced no difficulty duced moderate difficulty in performance mance impossible  7. TRAINING TIME To what extent did participants spend adequate time training for this task?  COMPLETELY SATISFACTORY IN BETWEEN  COMPLETELY UNSATISFACTORY  COMPLETELY UNSATISFACTORY	ore training time	,	training time for this performance; a little more would		for the performance	
COMPLETELY SATISFACTORY 100 75 50 25 0 afety hazards pro- uced no difficulty f any kind  To what extent did participants spend adequate time training for this	SATISFACTORY	75		25	UNSATISFACTORY	
COMPLETELY SATISFACTORY  100 75 50 25 0 Safety hazards pro- uced no difficulty f any kind  COMPLETELY UNSATISFACTORY Safety hazards pro- duced moderate diffi- culty in performance  COMPLETELY UNSATISFACTORY Extreme that performance extreme that performance mance impossible  7. TRAINING TIME			· · · · · · · · · · · · · · · · · · ·	<u> </u>		
COMPLETELY SATISFACTORY 100 75 Safety hazards pro- uced no difficulty f any kind  COMPLETELY UNSATISFACTORY 25 O Safety hazards pro- duced moderate diffi- culty in performance  COMPLETELY UNSATISFACTORY Extreme that performance mance impossible		did	participants spend adec	guate	time training for th	is
COMPLETELY SATISFACTORY 100 75 100 100 75 100 100 100 100 100 100 100 100 100 10	7. TRAINING TIME					
COMPLETELY SATISFACTORY  IN BETWEEN  COMPLETELY UNSATISFACTORY	afety hazards pro- uced no difficulty	•	Safety hazards pro- duced moderate diffi-	23	Safety hazards so extreme that pers	
What was the effect of safety hazards on the performance of this task?	COMPLETELY SATISFACTORY		IN BETWEEN		COMPLETELY UNSATISFACTORY	
	What was the e	ffect	t of safety haza <b>rd</b> s on :	the pe	rformance of this tas	sk?
. SAFETY HAZARDS (Continued)	. SAFETY HAZARDS	(Cor	ntinued)			

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-	it could have been im- proved a little		<u>ly do</u> this	task
he best method for raining this task	Could learn the task with this method, but		in learning	ided <u>no</u> help how to <u>actua</u>
100 75		25	0	
COMPLETELY ATISFACTORY	IN BETWEEN		COMPLET UNSATISE	1 1
371001146 do	you mill mill kille of t			L
How effective do	you think this kind of t	rainin	n is for this	task?
Other (speci	fy):			
Doing it you	rself with the actual har	dware		
☐ Watching some	eone doing it			
Practice in a	a simulator			
Paper and per	ncil workbook			
Reading print	ted material			
Film or other	- audio-visual method			
Lecture				
<u>How</u> was this task	v iraineu:			
	•			
. TRAINING METHOD(				
ng this task as as necessary	training this task			
ood a job train-	ponsible job of		to teach th	nis task
100 7 Tainer did as		25	O Trainer was	unable
COMPLETELY ATISFACTORY	IN BETWEEN		COMPLE UNSATISE	
How effective was	the <u>trainer</u> in training	this	task?	
. TRAINER				

### PERFORMANCE DIFFICULTY QUESTIONNAIRE (FOR OBSERVERS) (CONTINUED)

### 21. WORKLOAD

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

COMPLETELY SATISFACTORY		IN BETWEEN		COMPLETELY UNSATISFACTORY
100	75	50	25	0

Workload perfectly adequate during performance

Moderate performance difficulty caused by workload. Player fully loaded. Totally inadequate workload made task performance impossible

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	,
TO THE TEST OBSERVER, OR OTHER APPLICABLE OT PERSONNEL	
If there are other places of information which you bel and important to this field test, write them here.	ieve are applicable
	•
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# PERFORMANCE DIFFICULTY QUESTIONNAIRE FOR PARTICIPANTS (PLAYERS)

Understanding was lit was moderately no problem, at all difficult to understand possible to adequate ly understant  2. READING/HEARING DISPLAYS  How well could you read and/or hear the displays which were required for the performance of this task?  COMPLETELY COMPLETELY SATISFACTORY 100 75 50 25 0  Readable/hearable Moderate effort Impossible to adequately	NAME:	TASK (HPF):			
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 50 25 0 COMPLETELY UNSATISFACTORY 100 75 11 was moderately 11 was so difficult that it was not possible to adequate ly understand 12 understand 13 understand 14 understand 15 understand 16 understand 17 understand 17 understand 18 understand 19 understand 19 understand 19 understand 100 75 100 25 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	DATE:		_		
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 10 25 0 COMPLETELY UNSATISFACTORY 100 75 10 25 0 11 was so difficult that it was not possible to adequate ly understant  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 50 25 0 COMPLETELY UNSATISFACTORY 100 75 50 25 COMPLETELY UNSATISFACTORY 100 75 50 25 COMPLETELY UNSATISFACTORY 100 75 50 25 Impossible to adequately read and/or hear displays  SYSTEM	CONDITION SET:	SPI:			
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 50 25 0 UNSATISFACTORY 100 75 50 25 0 UNSATISFACTORY 100 75 50 25 0  It was so difficult that it was not possible to adequate ly understant  2. READING/HEARING DISPLAYS How well could you read and/or hear the displays which were required for the performance of this task?  COMPLETELY 100 75 50 25  COMPLETELY UNSATISFACTORY 100 75 50 25  Readable/hearable Moderate effort UNSATISFACTORY 100 75 50 25  Readable/hearable Moderate effort read and/or hear displays without effort needed for displays read and/or hear displays					
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 IN BETWEEN 100 75 50 25 Understanding was It was moderately It was so difficult to understand possible to adequate ly understant  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 IN BETWEEN 100 75 50 25 COMPLETELY SATISFACTORY IN BETWEEN 100 75 SO Readable/hearable Moderate effort without effort needed for displays  TEST DATE PAGE					
you were supposed to do it for the specific task listed above?  COMPLETELY SATISFACTORY  100 75 50 25 0 UNSATISFACTORY  In BETWEEN 100 ro 50 25 10 ro 25 11 was so difficult that it was not possible to adequate ly understant  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 50 25 0 COMPLETELY UNSATISFACTORY 100 75 50 25 0 COMPLETELY IN BETWEEN 100 75 50 25 0 COMPLETELY IN BETWEEN 100 100 100 100 100 100 100 100 100 10	about this task, by assi  1. UNDERSTANDING	gning ratiny scores	to the	em.	
SATISFACTORY  100  75  50  25  Understanding was It was moderately It was so difficult that it was not possible to adequate ly understant  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  50  25  COMPLETELY SATISFACTORY  100  75  50  25  COMPLETELY SATISFACTORY  100  75  50  25  Readable/hearable Moderate effort without effort needed for displays  TEST  DATE  PAGE		,		, .	
How well could you read and/or hear the displays which were required for the performance of this task?  COMPLETELY SATISFACTORY 100 75 50 25 0 Readable/hearable Moderate effort without effort needed for displays  IEST	SATISFACTORY 100 75 Understanding was It no problem, at all di	50 was moderately fficult to under-	25	UNS  It was that i	SATISFACTORY  0 s so difficult it was not ole to adequate
for the performance of this task?  COMPLETELY SATISFACTORY 100 75 50 Readable/hearable without effort needed for displays  TESTDATEPAGE	2. READING/HEARING DISP	LAYS			
SATISFACTORY 100 75 50 25 0  Readable/hearable Moderate effort Impossible to adequately without effort needed for displays read and/or hear displays  SYSTEM	· —		displ	ays which were	e required
	SATISFACTORY 100 75 Readable/hearable	50 Moderate effort		Impossible to	NSATISFACTORY 0 o adequately
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## HRTES PERFORMANCE DIFFICULTY QUESTIONNAIRE FOR PARTICIPANTS (PLAYERS) (CONTINUED)

3.	UNDERSTANDING	DISPLAYS	<b>S</b>			
	How well coul	ld you und	derstand the infor	mation wh	nich was pres	sented by
		•	nis task performar			,
	, , , , , , , , , , , , , , , , , , ,				<b> </b>	
	MPLETELY		IN DETWEEN			PLETELY
SATE	ISFACTORY 100	75	IN BETWEEN 50	25	UNSAT	ISFACTORY 0
	emely easy		derately difficul		Presenta	
דה עי	nderstand	TO	understand		cult tha	tion so diffi- et it could
					not be a understo	adequately
					dilder 510	,0 <b>u</b>
4.	USEFULLNESS C	OF DISPLAY	'INFORMATION			
	How effective	ely did th	ne display(s) used	in this	task deliver	· the
	right informa	ation and	in a timely way?			
CO1	ADLETELV					4D. 5751.V
	MPLETELY SFACTORY		IN BETWEEN			MPLETELY ISFACTORY
	00	75 <del>-</del> .	50	25		0
	nformation ed for this		majority of the ired information		Information was either	
perfo	ormance was	was	delivered, usual	ly	inadequate,	incorrect,
•	ded at the time	in t	ime		or so late useless	as to be
. 5					430.033	
5.	MANIPULATION	DIFFICULT	~			
			countered when try	vina to ma	ninulate the	control(s)
			equipment, during	_	•	Ť
	or any other	prece or	equipment, during	, me per i	Office Of 1	mis idsk.
	Too hard	to move.	too much effort r	required.		
			unreasonable amou	•	terity.	
	=	•	ngs required at t		•	
			mistake.			
	Movement	different	than what is rea	sonable t	o expect.	
			unavailable tool(		• •	
	Other, sp	ecify:				
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# HRTES PERFORMANCE DIFFICULTY QUESTIONNAIRE FOR PARTICIPANTS (PLAYERS) (CONTINUED)

5.	MANIPULATION DIFFI		the meanin	and mayomants with siths
	·	•		red movements with either ved in the performance
SATIS Contr movem cause	MPLETELY SFACTORY 100 75 rol/equipment ments required ed absolutely ifficulty of kind	IN BETWEEN 50 It was possible to make the required movements or contro equipment with moder ate difficulty		COMPLETELY UNSATISFACTORY 0 Movements required were so difficult that they could not be made adequately
6.			-	ch the control(s), or oulated, during this
	Angle to it wa  It was fully o  It was fully o  Reaching it fo	o reach reasonably. s such that it could r partially blocked b r partially blocked b rced exposure to haza sively hot, excessive	oy another o oy another p ardous or hi	bject. erson. ghly uncomfortable
	•	uld you reach and get which had to be mani		·
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andress processions is according by the second of the seco

HRTES PERFORMANCE DIFFICULTY QUESTIONNAIRE FOR PARTICIPANTS (PLAYERS) (CONTINUED)

6. REACH/ACCESSIBILIT	Y (Continued)	
COMPLETELY SATISFACTORY 100 75 Controls/other pieces or equipment were accessible without effort	IN BETWEEN 50 25 Controls/other pieces of equipment were accessible with moder- ate effort	COMPLETELY UNSATISFACTORY 0 Not accessible fromeither my assigned position or any other position which did not interfere with my performance
7. CONTROL CONFIGURAT	ION	
	encountered with the config of equipment which had to b	
☐ Too close to o ☐ Too far from o ☐ Used without id	termine what it was. ther control/equipment. ther control/equipment used poking at it much, and it fe Il when it was activated or	It too much like others.
	actual configuration of the had to be moved, for the pe	·
COMPLETELY SATISFACTORY 100 75 Configuration caused absolutely no difficulty of any kind	IN BETWEEN 50 25 Configuration had problems, but caused only moderate difficulty	COMPLETELY UNSATISFACTORY O Configuration so poor it made performance impossibly difficult
SYSTEM	TEST_	PAGE
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HRTES PERFORMANCE DIFFICULTY QUESTIONNAIRE FOR PARTICIPANTS (PLAYERS) (CONTINUED)

eve	TEM			TEST	DATEPAGE
SATI Visi exce easy requ the	MPLETELY SFACTORY 100 bility was llent. It was to see all ired parts of environment, uding targets	75	IN BETWEEN 50 Visibility was adequate. Enough could be seen to permit the performance		COMPLETELY UNSATISFACTORY 0 Visibility was unacceptable. Targets and/or critical parts of the environment could not be seen
9.		d you s	see targets or any o		
SAT I Requ	the performan MPLETELY SFACTORY 100 ired decisions very easy to	ce of <sup>.</sup> 75		25	COMPLETELY UNSATISFACTORY 0 Required decisions were so difficult that they could not be made adequately
8.	DECISION DIFF		t to make the decisi	ons which	were required for

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## PERFORMANCE DIFFICULTY QUESTIONNAIRE FOR PARTICIPANTS (PLAYERS) (CONTINUED)

NAME	TELEPHO	NE	
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			•
COMPLETELY ATISFACTORY 100 75 isual parts of orkstation pro- uced no difficulty f any kind	IN BETWEEN 50 25 Visual parts of work- station produced moder- ate difficulty in per- formance	UNSAT Visual pa station	PLETELY ISFACTORY 0 arts of work so poor thance impos- fficult
your ability to see.	warts of your workstation pro What was the effect of tho prmance of this task?	•	·
Other, specify:			
	ment behind other equipment or from seat too equipment not go		
Too much glare.	#OI NOI TOIT.		
	in the way of window/port.		
☐ Window/port not☐ Window/port too	in right place. dirty or distorted.		
☐ Window/port not	-		
the workstation:	problems encountered during	rusk cat	
O. WORKSTATION DESIGN F	OR VISION problems encountered during	this task on	read by

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### PERFORMANCE DIFFICULTY QUESTIONNAIRE FOR PARTICIPANTS (PLAYERS) (CONTINUE (CONTINUED)

11.	NOISE			
	Check any noise p	problems encountered d	luring this ta	ask.
	Could not hea	r radio.		
	Could not hea	ar other crew members.		
	Noise produce	ed fatigue.		
		ped concentration.		
		ed discomfort.	•	
	Noise gave aw	•		
	Other, specif	Y:		
	What	at at mater to the	nkotot:-	the nentenness of
	What was the effe this task?	ect of noise in the wo	UO NOLIBICA IV	the performance of
	iiis idSKI			
	MPLETELY			COMPLETELY
	SFACTORY 100 75	IN BETWEEN 50	25	UNSATISFACTORY O
Noise	e produced no	Noise produced mod		Noise so extreme that
diffi kind	iculty of any	ate difficulty in performance		performance impossibly difficult
-				
	MOTION			
	Check any motion	problems encountered	during this	task.
	☐ Vibration aff	fected accurate use of	controls.	
	☐ Vibration aff	fected accurate readin	ng of displays	S.
		ration produced fatigu		
	☐ Vibration aff workstation.	fected detection/ident	ification of	objects outside the
		too great for the kin	id of seat sup	pport.
	<pre>Acceleration</pre>	prevented reaching co	ontrol.	
	Acceleration	prevented seeing disp	lay.	
	Kind of motio			
	Other, specif	fy:		
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# PERFORMANCE DIFFICULTY QUESTIONNAIRE FOR PARTICIPANTS (PLAYERS) (CONTINUED)

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		TEST _	DATE	PAGE
tilation pro- ed no difficulty any kind	Ventilation produced moderate difficulty in performance			tion so inad hatperforman ble
OMPLETELY ISFACTORY 100 7:		25	UNSA	MPLETELY TISFACTORY 0
of this task?				
		worksta	tion on the	nerformance
=				
Gun/rocket f	ire products too strong.			
	·			
☐ Not enough f	resh air flow.			
Much too hum	nid.			
☐ Much too col	d.			
Much too hot				
Check any ventil	ation problems encountere	d during	this task:	
VENTILATION				
anv kind	performance		difficul	
on produced	Motion produced moder	`-		nade the per
SFACTORY	IN BETWEEN 50	25	UNSAT	O O
MPLETELY				IPLETELY
of this task?				
What was the effe	ect of motion at your wor	kstation	on the perfe	ormance
	of this task?  MPLETELY SFACTORY 130 75 on produced ifficulty nv kind  VENTILATION Check any ventil  Much too hot  Much too hum  Not enough f  Exhaust fume  Gun/rocket f  Bad odors pr  Other, speci  What was the eff of this task?  MPLETELY ISFACTORY 100 75 rilation pro- ed no difficulty	MPLETELY SFACTORY 130 75 50 on produced Motion produced moder ate difficulty in performance  VENTILATION Check any ventilation problems encountere  Much too hot.  Much too hot.  Much too humid.  Not enough fresh air flow.  Exhaust fumes too strong.  Gun/rocket fire products too strong.  Gun/rocket fire products too strong.  Other, specify:  What was the effect of ventilation in the of this task?  MPLETELY ISFACTORY IN BETWEEN 100 75 Filation pro- 25 Wentilation produced moderate difficulty	MPLETELY SFACTORY  IN BETWEEN 130 75 50 25 on produced Motion produced moderate difficulty at difficulty in performance  VENTILATION  Check any ventilation problems encountered during  Much too hot.  Much too hot.  Much too old.  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 workstate of this task?  MPLETELY IN BETWEEN 100 75 50 25 tentilation produced moderate difficulty in performance	MPLETELY SFACTORY 100 75 50 25 on produced Motion produced moderate difficulty are difficulty in performance difficulty in performance difficulty.  VENTILATION Check any ventilation problems encountered during this task:  Much too hot.  Much too hot.  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 of this task?  MPLETELY IN BETWEEN 100 75 50 25  Ventilation produced moderate difficulty in performance impossi

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PERFORMANCE DIFFICULTY QUESTIONNAIRE FOR PARTICIPANTS (PLAYERS) (CONTINUED)

NAME		W6-41	TELEPHON	IE
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ulties of any ki	nd ir	n performance		impossibly difficult
100 Dimensions pro- Juced no diffi-	mo	50 imensions produced oderate difficulty	25	0 Dimensions so poor that performance
COMPLETELY ATISFACTORY	75	IN BETWEEN	25	COMPLETELY UNSATISFACTORY
of this task		imensions of your v	O KSTATTO	The per formand
What effect	did the d	imensions of your w	vorkstatio	on have on the performanc
	pecify:			
	too small. in wrong p			
	_	of equipment.		
	•	to work because of	, ,	•
		rong height or ang! to work because of		, or space allowed.
<u></u>		rong place.		
☐ Work sur	face too s	small.		
during this				
4. WORKSTATION Check any pr			of the wor	kstation encountered
		_		

PERFORMANCE DIFFICULTY QUESTIONNAIRE FOR PARTICIPANTS (PLAYERS) (CONTINUED)

SYSTEM	TEST	DATE	PAGE
•			
eating produced difficulty of y kind	Seating produced moder- ate difficulty in per- formance		so poor that ance impossib It
COMPLETELY ATISFACTORY 100 75			MPLETELY TISFACTORY 0
What effect did	the seating have on the performa	ance of this	task?
Other, speci	fy:		
Seat needs t	o move or move more.		
	t absorb vibrations well enough. rtable and makes you tired.	•	
Not enough f			
☐ Not enough I	eg space.		
<u> </u>	houlder space.		
Needs foot s  Not enough h			
Needs arm su			
Seat back an	gle not right.		
Not enough b	ack support.		
Seat too nar			
Check any seatin	g problems encountered during th	nis task:	
. SEATING			

### PERFORMANCE DIFFICULTY QUESTIONNAIRE FOR PARTICIPANTS (PLAYERS) (CONTINUED)

SYSTER	м	TEST	DATEPAGE
	s was necessary	this task	
Traine	r did as good training this	Trainer did a respon- sible job of training	Trainer was unable to teach this task
SATISE:	ACTORY 0 75	IN BETWEEN 50 25	UNSATISFACTORY 0
	LETELY		COMPLETELY
	FRAINER How effective was :	the trainer in training this t	rask?
10 7	TDA I NED		
	ondition	have used more training time	
	of practice s task in	in this condition, or a very similar one. Could	this task in this condition
10 Had an	0 75 adequate	50 25 Practiced this task	0 Got no practice of
SATISF	ACTORY	IN BETWEEN	COMPLETELY UNSATISFACTORY
00110		(00.00111011)	000000
_		(condition)	
7	To what extent did	you practice for this task in	
18. F	PRACTICE		
<i></i>		would have been helpful	<b></b>
	raining time	ing time for this per- formance; a little more	for the performance of this task
10 Did no	00 75 of require any	50 25 Got almost enough train-	O Got no training time
	PLETELY FACTORY	IN BETWEEN	COMPLETELY UNSATISFACTORY
		you spone <u>adaquate 11me 11 att</u>	
7		you spend adequate time train	ing for this task?
17.	TRAINING TIME		

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PERFORMANCE DIFFICULTY QUESTIONNAIRE FOR PARTICIPANTS (PLAYERS) (CONTINU (CONTINUED)

EM		v ,		
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y kind pe	rtormance	m	ance impossible	
no difficulty mo	derate difficulty in	+	reme that perfo	r-
00 75			0	0.04
FACTORY	IN BETWEEN	<del></del>	UNSATISFACTOR	Y
of this task?			COMPLETELY	
being adequate. What	was the effect of saf	ety haza <u>rds</u>	on the perform	ance
<del></del>	<del></del>			
produce actual injury	which keeps performan	ce from bei	ng adequate, an	đ
Safety hazards can have	e two possible effect	s on perfor	mance(1) they	can
Uther, specify:			<del></del>	
	when outside situati	on becomes	dangerous.	
			_	
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	•	dequate.		
Slippery walking o	r climbing surface.			
Crew seat beits/re	straints not adequate	•		
☐ Padding of equipme	nt not adequate.			
☐ Anchoring of equip	ment not adequate.			
☐ Dangerous lack of	ventilation.			
☐ Dangerously high n	oise level.			
☐ Glare so bright th	at accident could res	ult.		
So little light th	at accident could res	ult.		
Moving machinery e	xposed.			
Poisonous material	exposed.			
	•			
	-			
Sharp, iagged. poi	nted object(s).			
Check any safety hazar	ds encountered at the	workstatio	on during this t	ask
	Dangerous lack of Dangerously hot ma Source of electric Poisonous material Moving machinery e So little light th Dangerously high n Dangerously high n Dangerous lack of Anchoring of equipme Crew seat belts/re Slippery walking o Handholds for lift Footholds for clim No adequate signal No adequate signal No adequate signal Other, specify: Safety hazards can have produce actual injury to being adequate. What to of this task? PLETELY FACTORY OO 75 y hazards pro- no difficulty	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 rese Glare so bright that accident could rese 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 a feotholds for climbing not adequate.  No adequate signal when equipment opera No adequate signal when outside situation of the produce actual injury which keeps performance to the produ	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.  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  No adequate signal when outside situation becomes  Other, specify:  Safety hazards can have two possible effects on perfor produce actual injury which keeps performance from beid (2) they can produce worry about injury which keeps pebeing adequate. What was the effect of safety hazards of this task?  PLETELY  FACTORY  IN BETWEEN  OD  75  50  25  y hazards pro-  Safety hazards produced	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 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 perform of this task?  PLETELY FACTORY  N BETWEEN  COMPLETELY FACTORY  To So 25  O y hazards pro-  Safety hazards produced  Safety hazards streme that perform moderate difficulty in treme that performance from difficulty moderate difficulty in treme that performance from moderate difficulty in treme that performance from moderate difficulty in treme that performance from moderate difficulty in treme that performance from moderate difficulty in treme that performance from moderate difficulty in treme that performance from moderate difficulty in treme that performance from moderate difficulty in treme that performance from moderate difficulty in treme that performance from moderate difficulty in treme that performance from the performance from moderate difficulty in treme that performance from the performance from the performance from the performance from the performance from the performance from the performance from the performance from the performance from the performance from the performance from the performance from the performance from the performance from

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HRTES PERFORMANCE DIFFICULTY QUESTIONNAIRE FOR PARTICIPANTS (PLAYERS) (CONTINUED)

20.	TRAINING MET	THOD			
	How was this		ained?		
	Lecture.				
	Film or	other au	dio-visual method.		
	Reading	printed	material.		
	Paper an	d pencil	workbook.		
	_	in a si			
	= -		doing it.		
			f with the actual ha	ardware.	
	Other, s	pecity:_			
	How effectiv	e do you	think this kind of	training i	is for this task?
		•		<del>-</del>	
	PLETELY FACTORY		IN BETWEEN		COMPLETELY
10	00 est method	75	50 Could learn the task	25	0
for tr	-aining	W	rith this method, bu		Method provided no help in learning h
this 1	task		t could have been mproved a little		to <u>actually</u> <u>do</u> thi task
		•			
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PERFORMANCE DIFFICULTY QUESTIONNAIRE FOR PARTICIPANTS (PLAYERS) (CONTINUED)

### 21. WORKLOAD

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

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

SYSTEM	TEST DATE	PAGE
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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.	

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	W6-47

### CRITICAL INCIDENT REPORT

		الكبيب كبيد المستبد		
HPF				
CONDITIONS				
CONDITIONS				
WHAT HAPPENED?				
WHAT PRODUCED THIS PROBLEM?				_
				_
		· · · · · · · · · · · · · · · · · · ·		
HOW DID YOU DISCOVER THIS PROBLE	EM?			
···	•			
HOW DID YOU, OR WOULD YOU, SOLV	/E THIS PROBLEM?			
				•
WHAT DID IT, OR COULD IT, HAVE CAU	ISED?		<del></del>	
☐ PARTICIPANT☐ OBSERVER				
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W6-48

### OPINION SUMMARY DATA WORKSHEET

HPF																
L																
SPI																
SYSTEM FUNCTION							. <u>.                                   </u>				<del></del>					
CONDITION SET	#				<del></del>				DI	FFIC	CUL	TY	SCOF	RE		
OPINION SCALES 0		10	2	0_	30	l	40_	50		60	7	0_	80	9(	) 1	10
1. Understanding Procedures																
2. Display Readability/ Hearability Measurement															$\downarrow$	
3. Display Information Understanding		_	$\downarrow$	<u> </u>		_	_	-	$\downarrow$	-			-		$\dashv$	
<ul><li>4. Usefulness of Display Information</li><li>5. Manipulation Difficulty</li></ul>	_	1	-	-		4	-	-		-	-		$\vdash$	+	$\dashv$	_
6. Reach/Accessibility	_	-	+	-		$\dashv$	-}-	$\frac{1}{1}$	-	+-	-	_	H	-	$\dashv$	
7. Control Configuration		+	+	$\vdash$	H	$\dashv$	+	+	-	+	-		H	+	$\dashv$	_
8. Decision Difficulty		+	$\dagger$	+		-	+	11	+	1	$\vdash$				1	_
9. Target/Terrain Visibility			1	T												
O. Workstation Design for Visibility																
1. Sound			$\perp$	┦				44	$\perp$		↓	igspace	$\downarrow \downarrow$			_
2. Motion		$\sqcup$	_					11		_	igspace	ļ	$\sqcup$		·	_
3. Ventilation		$\sqcup$	$\downarrow$	_	$\sqcup$			$\downarrow\downarrow$		4_	<u> </u>	_	$\downarrow \downarrow$			_
4. Workstation Dimensions		$\sqcup$	_	$\perp$				$\downarrow\downarrow$	_		_	_	$\sqcup$			_
15. Seating		$\sqcup$	$\perp$	$\perp$				$\coprod$	_		_	_	11			L
16. Safety		Ц		<u> </u>				$\bot \downarrow$	4	<u>ا</u> ــــــــــــــــــــــــــــــــــــ	_	<u> </u>	$\downarrow \downarrow$			L
17. Training Time	L	$\coprod$					Ш	$\bot \downarrow$	$\bot$	$\perp$		$oxed{oxed}$	11			L
i8. Practice Condition								$\perp \downarrow$	$\perp$		_		$\coprod$		┞-	1
19. Trainer(s)				$\int$				$\perp \downarrow$	$\bot$	$\perp$		_			<u> </u>	_
20. Training Method				$\int$					$\perp$						_	$\downarrow$
21. Workload	1	III	T	T	Ţ	1	1 T		T		1	1	1	ł	1	1

W6-49

# HRTES STATISTIC WORKSHEET

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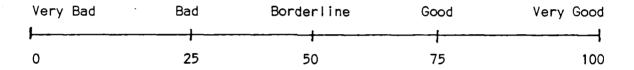
- Guidelines for Defining Value Functions (Including Example)
- 2. Value Function Worksheet

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3. Sample Function Worksheet

### 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 <u>Value Function</u>. 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 <u>one</u> successful trial, the type of the statistic, and the statistic criterion.

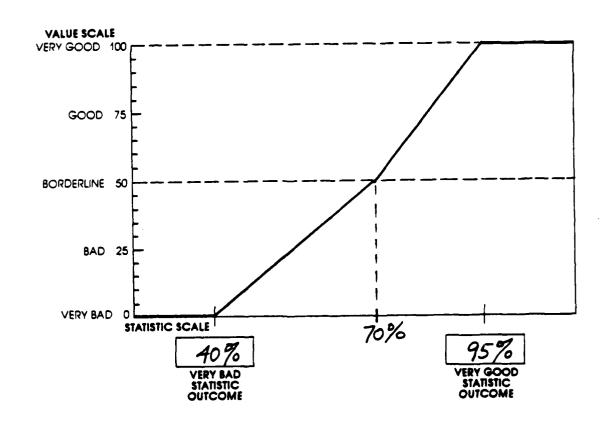
One point on each Value Function is determined in advance: the statistic criterion point. This is done by assigning to the statistic criterion of each HPF the value 50 (borderline). This preassignment may aid you in assessing other points on the Value Function. You will be asked to determine an outcome 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 <u>criterion point</u>, 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)

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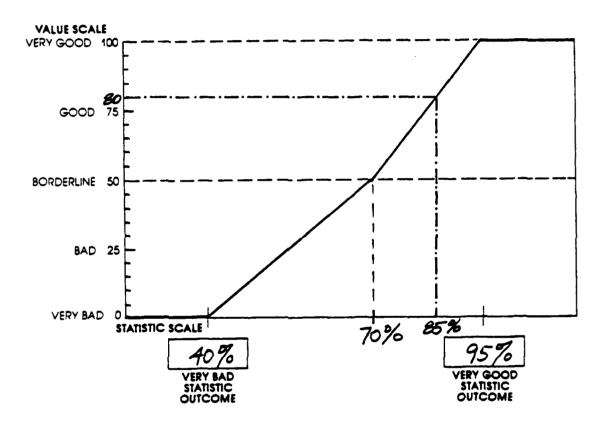
The HPF is "Target Detection and Identification." The statistic developed for this HPF is "Percentage of Successful Trials." The definition of the performance criterion of one trials and the condition sets are specified, and the statistic criterion is 70%. After considering the performance criterion 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:



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### 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 pa.agraphs, 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.

# HRTES GUIDELINES FOR DEFINING VALUE FUNCTIONS (Continued)

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?



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

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- (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.

### **VALUE FUNCTION WORKSHEET**

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	HPF	
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VALUE SCALE		
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-		
GOOD 75		
<u> </u>		
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BORDERLINE 50		
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F		
BAD 25		
E		
-		
VERY BAD 0		
STATISTIC	SCALE 1	<u> </u>
•	VERY BAD	VERY GOOD STATISTIC
	STATISTIC OUTCOME	OUTCOME
		STATISTIC CRITERION
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### **SAMPLE**

S	YSTEM FUNCTION	DESTROY AIRCRAFT
	SPI	ACQUIRE TARAETS) IN FULL SUNLIGHT
	HPF	DETELT AND IDENTIFY TARGETS
	CONDITION SET	3
ZOPER. ] MAINT.	STATISTIC	PERCENTAGE
VALUE SCALE		
FRY GOOD 100		
	- -	
GOCD 75	- -	
	<b>-</b>	
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8AD 25	<del>-</del>	
VERY BAD 0		
57	ATISTIC SCALE	70%
	VERY BA	AD VERY GOOD STATISTIC
	OUTCOM	ME OUTCOME
		STATISTIC CRITERION 70 %

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# HRTES HPF DIAGNOSTIC WORKSHEET

	DATE OF TEST:		EVALUATOR:	
TEL OF EVALUATOR:				
TYPE OF DIAGNOSIS	: TRAINING	; HFE	; PERSONNEL SELECTION	
HPF'S TO	BE DIAGNOSED		CONDITIONS IN WHICH EAR HPF PERFORMED INADEQUAT	
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## ERTES GENERAL INSTRUCTIONS FOR TRAINING MEASURES

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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	Adequacy of method used to	25-39
Methods and Required Skills	train HPF.	
4. Adequacy of personnel who	Adequacy of Operational Test	40-43
trained HPF	Trainers.	

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

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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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# HRTES GENERAL INSTRUCTIONS FOR TRAINING MEASURES

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- 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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## HRTES 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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■ SECTION OF STREET STREET, S

### 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:

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- (1) Determine if you can meet <u>all</u> 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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## WORKSHEET FOR TRAINING TIME ALLOCATION MEASURE (ALTERNATIVE 1)

SIMILAR I	ASELINE SYSTEM:		
BASEL INE	HPF/TASK:		
TRAINING	TIME FOR DIAGNOSED HP	F:	
TRAINING	TIME FOR BASELINE HPF	:	
O I AGNOSEI	HPF/BASELINE HPF (1.0	) MAXIMUM) =	
	ADEQUACY FOR TRAINING QUOTIENT ABOVE BY 100	TIME =	

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## 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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## HRTES GENERAL INSTRUCTIONS FOR TRAINING MEASURES

- System Level (at the top of the tree); (a)
- System Function Level (the second level);
- System Performance Issue or SPI Level (the third level);
- Human Performance Function Group or HPF-Group Level (the (d) 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 notes 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 <u>successfully performed HPF's</u>. Enter it in the standard deviation box.

Standard Deviation Formula:

$$SD = \sum_{N-1}^{\infty} (X-\overline{X})^2$$

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### Where:

- X = the values in column 4 of the worksheet for the successfully performed HPF's.
- $\overline{X}$  = column 4 mean of the successfully performed HPF.
- N = number of successfully performed HPF's listed on the worksheet.

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### GUIDELINES FOR THE HPF DIFFICULTY RATING WORKSHEFT 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:

easy to perform

	1100.	You can	assign <u>a</u>	iny number	from	1-100.		
	1	25		50		75		100
HPF	extremely	/	HPF	moderately	diff		HPF	extreme

cult to perform

difficulty to

perform

(1) Rate each of the HPF's (or tasks) on the following scale from

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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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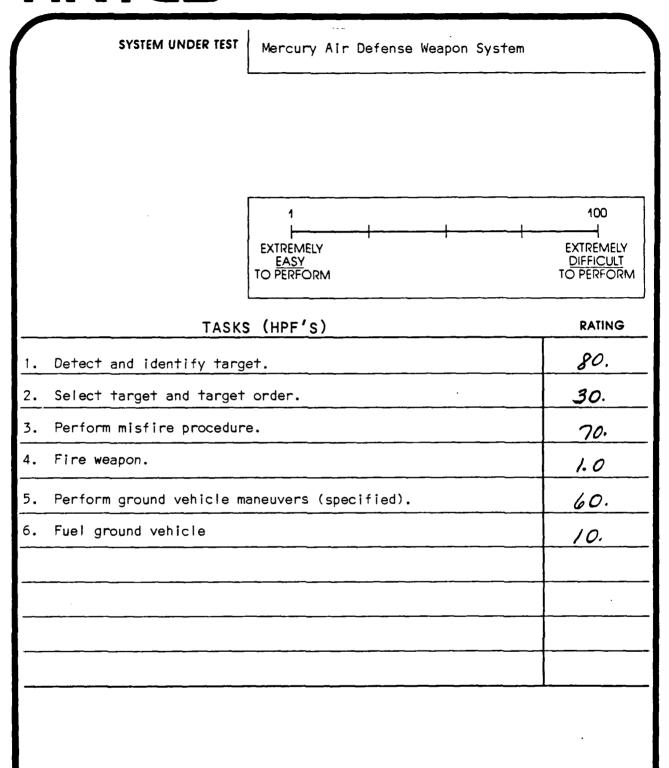
### HPF DIFFICULTY RATING WORKSHEET

SYSTEM	UNDER TEST	
	<b></b>	
	EXTREMELY EASY TO PERFORM	100  EXTREMELY DIFFICULT TO PERFORM
	TASKS (HPF'S)	RATING
/STEM	TEST	DATEPAGE

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# HRTES HPF DIFFICULTY RATING WORKSHEET EXAMPLE FOR MEASURE ALTERNATIVE 2



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### TRAINING TIME ALLOCATION MEASURE ALTERNATIVE 2 WORKSHEET

EXAMPLE FOR MEASURE ALTERNATIVE 2

SUCCESSFULLY PERFORMED HPF's	CRITICALITY × DIFFICULTY (2)	TRAINING TIME (3)	(3) ÷ (2)
1. Select target and target order.	.lc × 3C = 18	8 his	.44
2. Perform misfire procedure.	.3×70=21	8 hrs	.38
3. Fire weapon.	.5 x 1. C=.5	5his	16.0
4. Perform ground vehicle maneuvers.	.3×60 =14	8 hrs.	.44
5. Fuel ground vehicle.	.1x1C=1.C	2 /15	2.0
<del></del>			
		<u> </u>	
UNSUCCESSFUL HPF	<del>,</del>		r
1. Detect and identify target.	.6 x80=48	1 hr.	.02
		MEAN	. 85
	STAND	ARD DEVIATION	.69
		OF ADEQUACY	2.35

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## 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:

であるからのです。 これのからのでは、これのからのから、これのからない。 これのからのからは、これのからないのでは、これのからないのでは、これのからないできます。 これのからのからないのできます。

- (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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# HRTES PRACTICE CONDITION WORKSHEET

HPF						
CONDITION						
Was the above HPF practiced under the above condition?	□ YES	□ <b>NO</b>				
If the answer to number 1 was "NO," was there a condition that was a good substitute?	□ YES	□ <b>NO</b>				
If the answer to this question is "YES," list the substitute condition here.						
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 <u>both</u> questions 1 and 2 was "NO," ignore the rating form below, and return it to sender						
PRACTICE CONDITION RATING FORM	Λ					
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.	0			50	······································	100
Your rating is to be made on the scale, as indicated here. Any number petween 0 and 100 can be given.	PRACT TOTAL INADEQI	LY		<del></del>		PRACTICE FULLY ADEQUATE
ENTER YOUR RATING HERE—						
		_ <b></b>				
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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:

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- (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 <u>utility</u> 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 <u>each</u> 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:

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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 alloted 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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## HRTES TABLE 8-1 EXPERTS' UTILITY ESTIMATES

			SKI	LLS		
TRAINING METHODS	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 PRACTICEREAL HARDWARE	.5	.6	1.0	1.0	1.0	.6

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## HRTES TRAINING METHOD FIRST EXAMPLE

### TRAINING METHODS WORKSHEET #1

HPF			SK	ILLS	· · · · · · · · · · · · · · · · · · ·	<b></b>	
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	1.7				./	./	40
INDIVIDUAL DISCUSSION							
GROUP DISCUSSION							
READING TEXTS	.8				./	./	20
EXPERT DEMONSTRATION/VISUAL AIDS	.5				.7	.3	20
PROGRAMMED INSTRUCTION							
GAMES							
SIMULATION							
HANDS ON PRACTICE — REAL HARDWARE							

SYSTEM_	Mercury	Air	Defense	Weapon	System	TES	T OTII	_DATE_	6/23/81	_PAGE
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### TRAINING METHODS WORKSHEET #2

FIRST EXAMPLE

	v	

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 <u>must</u> sum to 100.

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

% REQUIRED

NAME						 TELEPHONE		
SYSTEM_	Mercury	Air	Defense	Weapon	System	 TEST_OT     DATE 6/25/81	PAGE	

# HRTES TRAINING METHO

### TRAINING METHODS WORKSHEET #3

HPF			SKI	LLS	<del> </del>		
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				jet	6	
PROGRAMMED INSTRUCTION							
GAMES							
SIMULATION							
HANDS ON PRACTICE — REAL HARDWARE							
CORRELATION SUM OF COLUMN	54				Zi	12	
% OF HPF INVOLVING SKILL	40				+0	20	í
INDEX OF ADEQUACY 65							

SYSTEM Mercury	Air Defense	Weapon	System	TEST_ <u>OT    </u>	DATE 6/27/81	PAGE
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### TRAINING METHODS WORKSHEET #1

### SECOND EXAMPLE

HPF	<del></del>		SKI	LLS			
Detect and identify target							0
TRAINING METHODS	KNOWLEDGE	UNDERSTANDING	VERBAL/WRITTEN	PSYCHOMOTOR	PERCEPTUAL	DECISION MAKING	% OF HPF TRAINING TIME USING THIS METHOD
ORAL/WRITTEN DRILL/PRACTICE	1.0				./	./	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
	1						
			<u> </u>	٠			

SYSTEM Mercury Air Defense Weapon System	TEST_OTII DATE 6/23/81PAGE
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### TRAINING METHODS WORKSHEET #2

SECOND EXAMPLE

ı	1	1	۵	E
r	1	ı	7	ı

Detect and idetnify target

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

The performance of all skills <u>must</u> sum to 100.

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

% REQUIRED

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## HRTES TRAINING METHOD SECOND EXAMPLE

#### TRAINING METHODS WORKSHEET #3

HPF			SK	ILLS		<del>, , ,</del>
Detect and identify target						
TRAINING METHODS	KNOWLEDGE	UNDERSTANDING	VERBAL/WRITTEN	PSYCHOMOTOR	PERCEPTUAL	DECISION MAKING
ORAL/WRITTEN DRILL/PRACTICE	40				4	4
LECTURE						
INDIVIDUAL DISCUSSION						
GROUP DISCUSSION						
READING TEXTS						
EXPERT DEMONSTRATION/VISUAL AIDS						
PROGRAMMED INSTRUCTION						
GAMES						
SIMULATION	4				16	16
HANDS ON PRACTICE — REAL HARDWARE	20				40	24
CORRELATION 98 SUM OF COLUMN	64				60	44
INDEX OF ADEQUACY 98	40				40	20

SYSTEM	Mercury	Air Defense	Weapon	System	TEST_OTII	DATE 3/27/81	PAGE
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### TRAINING METHODS WORKSHEET #1

HPF			SK	ILLS			
TRAINING METHODS	KNOWLEDGE	UNDERSTANDING	VERBAL/WRITTEN	PSYCHOMOTOR	PERCEPTUAL	DECISION MAKING	% OF HPF TRAINING TIME USING THIS METHOD
ORAL/WRITTEN DRILL/PRACTICE							
LECTURE							
INDIVIDUAL DISCUSSION							
GROUP DISCUSSION							
READING TEXTS							
EXPERT DEMONSTRATION/VISUAL AIDS							
PROGRAMMED INSTRUCTION							
GAMES							
SIMULATION							
HANDS ON PRACTICE — REAL HARDWARE							
		1	<u> </u>	1	<u> </u>	<u> </u>	

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#### **TRAINING METHODS WORKSHEET #2**

ter the percentage of each of a following skills required for the stormance of HPF above a performance of all skills must sum 100  SKILLS  SKILLS  FOR PERFORMANCE  UNDERSTANDING  VERBAL/WRITTEN  PSYCHOMOTOR  PERCEPTION  DECISION MAKING  SUM	
SKILLS FOR PERFORMANCE OF All skills must sum  SKILLS FOR PERFORMANCE  KNOWLEDGE  UNDERSTANDING  VERBAL/WRITTEN  PSYCHOMOTOR  PERCEPTION  DECISION MAKING	
UNDERSTANDING  VERBAL/WRITTEN  PSYCHOMOTOR  PERCEPTION  DECISION MAKING	EQUIRED FORMAN
VERBAL/WRITTEN  PSYCHOMOTOR  PERCEPTION  DECISION MAKING	
PSYCHOMOTOR  PERCEPTION  DECISION MAKING	
PERCEPTION  DECISION MAKING	
DECISION MAKING	
SUM	
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#### TRAINING METHODS WORKSHEET #3

HPF			SKI	LLS			
TRAINING METHODS	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				_			
CORRELATION SUM OF COLUMN COEFFICIENT							
* OF HPF INVOLVING SKILL							
ADEQUACY		····	·	•	·		
SYSTEM	_TEST.		_ DAT	E		PA	GE
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W8-38

では、これでは、これでは、これでは、これではないので、これではなるで、これでは、これには、これではないでは、これではないでは、これではないできょう。

#### **UTILITY ESTIMATE WORKSHEET**

						7	
Estimate the utility of each listed Training Method in the matrix below for the training of each skill, accord- ing to the current technology. Your  Little ratings should fall between 0		SKILLS					
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.	KNOWLEDGE	UNDERSTANDING	VERBAL/WRITTEN	PSYCHOMOTOR	PERCEPTUAL	DECISION MAKING	
TRAINING METHODS	<u> </u>	5	>	P.	꿃	۵	
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 bakeground 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:

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(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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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.
- (37) For each background experience listed estimate the <u>minimal</u> 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.

ABSOLUTELY NONE **MODERATE** REQUIRED 25 1 50 75 100 No utility for Moderately useful for Absolutely required training this HPF training this HPF 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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- 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 INDEX OF TRAINER ADEQUACY WORKS

INDEX OF	TRAINFR	ADFQUAC	Y WORKSHEET

BACKGROUND EXPERIENCE	TIME	WEIGHT	PRODUCT	TRAINER TIME	PRODUCT
	···				
		,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,			
· · · · · · · · · · · · · · · · · · ·					
		<u> </u>			
				<del></del>	
			,		
					·
		SUM (A)		SUM (B)	
SUM (A)					- H
÷ =		× 100=			
SUM (B)			INDEX		

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### SUMMARY WORKSHEET FOR TRAINING DIAGNOSIS

CONDITIONS (if applicable):_ SPI:		 ****
SYSTEM FUNCTION:		
SPECIFIC TRAINING PROBLEMS CONTRIBUTING TO INDICES	TRAINING MEASURE	INDEX OF
	1 TRAINING TIME ALLOCATION	
	2 PRACTICE CONDITIONS ADEQUACY	—TRAIN
	3 TRAINING METHODS ADEQUACY	
	4 OT TRAINER ADEQUACY	
	TEST DA	

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### GENERAL INSTRUCTIONS FOR HUMAN FACTORS ENGINEERING (HFE) MEASURES 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 <b>-</b> 57
2.	Difficulty of Decisions	Difficulty of making decisions required by HPF.	58-66
3.	Display Information Adequacy and Timeliness	Presentation of required infor- mation on time by displays used in HPF.	67-71
4.	Display Readability/ Hearability	Adequacy of presentation charac- teristics of information required ir HPF.	72-77

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	MEASURE NAME	MEASURE FUNCTION	PAGE W8:
5.	Display Information Under-	Understandability of information	78 <b>-8</b> 2
	standability	required for HPF as presented by	
		displays.	
6.	Control Accessibility	Accessibility of controls or	83-86
		other equipment manipulated in	
		HPF performance.	
7.	Control Static Charac-	Adequacy of control characteristics	87-91
	teristics	other than those for actual manipu-	
		lation or accessibility (includes	
		any equipment to be manipulated in	
		HPF performance.	
8.	Control Dynamic	Adequacy of control manipulation	92-96
	Characteristics	characteristics (includes any	
		equipment to be manipulated in HPF	
		performance	
9.	Workstation Dimensional	Adequacy of physical dimensions of	97
	Characteristics	the workstation for HPF performance	
	i	(does not include seat dimensions	•
		or dimensions involved in control	
		accessibility.	1
10.	Workstation Seating	Adequacy of seating dimensions and	98
	Characteristics	other related characteristics for	
		HPF performance.	
11.	Workstation/Environment	Adequacy of workstation charac-	99
	Visual Characteristics	teristics which affect vision both	
		within and outside the workstation	
		for HPF performance.	T.
12.	Workstation/Environment	Adequacy of workstation and environ-	100
	Sound Characteristics	mental sound characteristics which	
		affect HPF performance.	
\			

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 MEASURE NAME	MEASURE FUNCTION	PAGE W8:
Workstation Motion Characteristics	Adequacy of workstation motion characteristics which affect HPF performance.	101
Workstation/Environment Ventilation Characteristics	Adequacy of workstation/environ-	102
Workstation/Environment Safety Characteristics Workload	Evaluation of safety hazards which might affect HPF performance.  Adequacy of workload during the	103 From Question
	performance of the HPF being diagnosed.	i nati es

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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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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- (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 <u>not</u> 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 <u>all</u> 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 ceil of the Relevance Column. If a characteristic is not relevant, record a "O" in the cell.
- (4) Rate each characteristic <u>that you have selected</u> 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 O/1 column. If it does not meet its standard (or your judgment), record a "O" 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 O 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 <u>fully</u> 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 <u>elements</u>. 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

LEMENTS REQUIRED FOR HPF PERFORMANCE		PERFORMANCE SEQUENCE		
		7-1	$\neg$	
		+		-
		+	-	-
	<del></del>		_	
	<del></del>			
		+-+-		
		+	-	
			-+	
		+		
			11	
		44		
		111	1	
		+++	+	
	<del></del>	+	+-	
		+	+	_
		+	-	
		1		
TOTAL NUMBER OF REQUIRED ELEMENTS:			المراجعين	
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# HRTES PROCEDURE UNDERSTANDABILITY WORKSHEET #2

of the HPF election of the	effect of lements (serstanding 25 lex, perforble.	Number of elements produces moderate difficulty in understanding procedure.  the complexity of the shown on the preceding g the performance?  50  Sequence complexity produces moderate difficulty in understanding procedure	sequenc workshe 75	This number of elements would reincrease the und standing difficulatall.
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understandi	ing	produces moderate difficulty in under-	-	This number of elements would rincrease the und
				This number of
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0	25	50	75	100
roceding wor	rksheet) (	on the difficulty of und	derstan	naing the procedure
		p. 000 <b>00</b> 100		
y previous		a previously performed		previous proced
0 ly unrelated		<del></del>		100% identical
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	=			
hat is the d	degree of	similarity between the	proced	ure for performing
		MFAN RA	TING	
ing of proce	edures fo	r the HPF listed above.		
n a rating c	of 0-100 t	to each of the following	, attri	butes of under-
	hat is the chis HPF and ave actually  O  Iy unrelated y previous dure.	hat is the degree of his HPF and the procedure actually perform   O 25  Iy unrelated y previous dure.  hat is the effect of roceding worksheet)	MEAN RATE (INC.)  That is the degree of similarity between the his HPF and the procedure for a similar HPF ave actually performed, previously?  O 25 50  If unrelated Moderately related to a previously performed procedure.  That is the effect of this HPF's number of e roceding worksheet) on the difficulty of uncomposition.	MEAN RATING (INDEX) =  that is the degree of similarity between the procedure his HPF and the procedure for a similar HPF which ave actually performed, previously?  O 25 50 75  If unrelated Moderately related to a previously performed procedure.  That is the effect of this HPF's number of elements roceding worksheet) on the difficulty of understant

### 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 <u>fully</u> understnad the HPF in the system that was tested, or have access to an individual who does.

#### PROCEDURE:

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- (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 resuliting 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) multipled 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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# HRTES DECISION DIFFICULTY RATING WORKSHEET #1

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	SUM =
1	
	SUM =
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	SUM =
DECISIONS REQUIRED FOR HPF	ALTERNATIVE RESPONSES TO EACH DECISION
TOTAL NUMBER OF DECISIONS REQU	IRED FOR HPF:
риотосору тт.	
have just developed. If there	is insufficient space on this worksheet,
	eet, which apply to the information you
	ach decision. Fourth, complete the rating
	among which each decision selects. Third isions required for this HPF and the number
	ond, for each type of decision listed,

### DECISION DIFFICULTY RATING WORKSHEET #1 (CONTINUED)

SUM =
SUM =
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SUM =
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SUM =

#### DECISION DIFFICULTY RATING WORKSHEET #1 (CONTINUED)

DECISIONS REQUIRED FOR HPF	ALTERNATIVE RESPONSES TO EACH DECISION
	SUM =
•	
	SUM =
•	
	SUM =
	SUM =
	SUM =
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# HRTES RATING SCALES FOR DECISION DIFFICULTY WORKSHEET #2

taken <u>together</u>	. All other r	ating scales apply to	o <u>each</u> re	equired decision,
independently.	Recrod your	rating from the ratio	ng scale	number one in
the box at the	top of Worksh	eet #2, and all other	r ratings	in the appro-
priate cells o	f the workshee	et.		
I. How diffic	ult would it b	e to make the number	of decis	ions required
		his HPF in this system		Tons required
, , , , , , , , , , , , , , , , , , ,	. , , , , , , , , , , , , , , , , , , ,		•	
0	25	50	75	100
No difficulty	У	Moderately difficult.		So difficult that it could
a		difficult.		not be done.
in this sys	25	50	75	100
in this sy:	25	50 Moderately significant.	75	Extremely sign ficant. Affec mission succes system surviva
in this sys	25	Moderately	75	Extremely sign ficant. Affec mission succes
in this sys	25 nce	Moderately		Extremely sign ficant. Affec mission succes system surviva bility.
in this system of the system of the significant at all.	25 nce istic conditio	Moderately significant.	ll be lik	Extremely sign ficant. Affec mission succes system surviva bility.
O  No significate at all.  3. Under real available	25 nce istic conditio	Moderately significant.	ll be lik	Extremely sign ficant. Affec mission succes system surviva bility.
O  No significate at all.  3. Under real available	25 nce istic conditio to make this d	Moderately significant.	ll be lik	Extremely sign ficant. Affec mission succes system surviva bility.

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# HRTES RATING SCALES WORKSHEET #2 (CONTINUED)

ACCOUNT SECRETARY SECRETAR

0	25	50	75_	100
Not an issue. Decision may be reversed as many times as desired.		Small number of reversals possibl	le.	Irreversibility total. Decision must stand as made
5. How difficult w	ould it be	e to make this decis	sion consi	dering the
number of alter	native res	sponses possible?		
		F.0	75	100
0	25	50	13	100
O No difficulty at all.	25	Moderately difficult.		So difficult the
No difficulty at all.	the alter	Moderately		So difficult the this decision could not be made successfully.
No difficulty at all.  6. How similar are	the alter	Moderately difficult.		So difficult the this decision could not be made successfully.
No difficulty at all.  6. How similar are	the alter decision?	Moderately difficult. rnative responses wh	nich must	So difficult the this decision could not be made successfully.  be considered
No difficulty at all.  6. How similar are in making this  O  No similarity at all. Responses are completely different from	the alter decision?	Moderately difficult.  Enative responses where the moderately moderately	nich must	So difficult the this decision could not be made successfully.  be considered  100  Responses are extremely simi

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# HRTES DECISION DIFFICULTY WORKSHEET #2

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ATING FOR SCALE ONE:		SIGNIFICANCE	1	IRREVERSIBILITY	NUMBER OF ALTERNATIVES	ALTERNATIVE SIMILARITY	SUM + SCALE ONE RATING
		SIGN	TIME	IRRE	NUME	ALTE	SUM
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	<del></del>			_			
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	100			GKA	ND S	oum:	
GRAND SUM  TOTAL # OF DECISIONS X 6	- =	=	] 11	NDEX	OF A	NDEQUA	CY
TOTAL # OF BEGISTORS X C	, ———						
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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 judgment 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:

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- (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 <u>absolutely required</u> for the successful performance of the HPF being diagnosed. This includes information which would be produced visually <u>or</u> 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 <u>both</u> 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 "O", or a "1". An 1/0 TIME Cell can contain a "O", 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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#### DISPLAY INFORMATION ADEQUACY AND TIMELINESS WORKSHEET

X	1/0	TIME	TIME P	PRDC
-	<del> </del>		<u>.                                    </u>	
1		•		
<del></del>				
				-
				_
	<del>                                     </del>		<b></b>	
		SUM	=	
X 100 =	=		INDEX	
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	TEST		X 100 =	

### 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 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 dipslays. 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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### DISPLAY READABILITY/HEARABILITY WORKSHEET #1

ME							
TEM		TES	7	DAT	E		_PAGE
					1		
						-	
REQUIRED INFORMATION FOR HPF	VISU						
	VISUAL AND AUDITORY DISPLAYS						
NDEX FOR HPF:	ID AU						
MEAN READABILITY/HEARABILITY	0110						
1 AND/OR #2):	RY D						
OF ALL DISPLAYS IN BOX WHICH OLLOWS (COMPUTED FROM WORKSHEETS	ISPL						
OR THIS HPF, RECORD MEAN INDEX	AYS						
F MORE THAN ONE DISPLAY IS USED							
CONDITIONS (II applicable):			. — —	<del></del>	<del></del>		
CONDITIONS (if applicable):							



NAME.

CONDITIONS (If applicable):	<del></del>				
CHARACTERISTICS	RELEVANCE	RATING	0/1	PRDCT	SOURCE
SIZE OF SYMBOL(S)					
SHAPE/STYLE OF SYMBOL(S)					
DEFINITION					
BRIGHTNESS					
FIGURE-GROUND CONTRAST					
COLOR					
PLACEMENT OF SYMBOL(S)					
MOTION (in relation to realworld motion)					
RESOLUTION					
JITTER					
GREY SCALE GRADATION					
FLICKER FREQUENCY					
SIGNAL TO NOISE RATIO					····
REFLECTIVITY					
SIZE OF DISPLAY					
VIEWING ANGLE					<del></del>
VIEWING DISTANCE					
PLACEMENT					
FUNCTIONAL CLUSTERING					
OTHER:					
RAT	ING SUM:				INDEX:
			1	PRDCT Sum	

## DISPLAY READABILITY/HEARABILITY WORKSHEET #3 (AUDITORY)

DISPLAY:	<del> </del>					
HPF:						
CONDITIONS:	•	<u>.                                    </u>				
	S C E					
CHARACTERISTICS	RELEVANCE	RATING	0/1	PRDCT	SOURCE	
VOLUME					JOOKOL	
FREQUENCY RANGE						
DYNAMIC RANGE						
SIGNAL TO NOISE RATIO						
HARMONIC DISTORTION						
CLIPPING						
DISCRIMINABILITY						
ALERTING CAPABILITY						
MASKING						
SPURIOUS SIGNALS						
OTHER:						
<del></del>						
	RATING SUM:				INDEX:	
				PRDCT Sum		
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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:

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- (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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# HRTES RATING SCALES FOR DISPLAY IT UNDERSTANDABILITY WORKSHEET

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#### RATING SCALES FOR DISPLAY INFORMATION

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

TOTALLY INADEQUATE O	25	MODERATELY COMPLEX 50	75	COMPLETELY ADEQUATE 100
So complex they will be impossible to understand.		May cause some problems.		Should cause no difficulty.

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

TOTALLY UNFAMILIAR		MODERATELY UNFAMILIAR		ADEQUATELY FAMILIAR
0	25	50	75	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 O	25	MODERATELY CONFUS ING 50	75	COMPLETELY ADEQUATE 100
Identical to other symbols/vocabulary, but with a radically different meaning.		Moderate confusion between this symbolo vocabulary and meani 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?

INADEQUATE 0	25	INADEQUATE 50 75		ADEQUATE 100	
uch infor-		Moderately under	ctanable	Understandable	

So much infor mation presented at once that it cannot be understood, or so little that The key relationships are lost.

いっぱん かんじじょうしょう おいしょうしょう かんしゅ なじしょうしょう 大きな

amount of information presented at one time.

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		MODERATELY INADEQUATE		COMPLETELY ADEQUATE
0	25	50`	75	100
Presentation time		Presentation time a		Adequate amount
totally much too short.		little too short.		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 O	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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### DISPLAY INFORMATION UNDERSTANDABILITY WORKSHEET

DISPLAYS	LEVEL OF SIMPLICITY	UNFAMILIARITY	RITY + DIFFERENT MEANING	DUNT OF INFORMATION	AMOUNT OF TIME PRESENTED	PRESENTATION		(CES)
DISPLAYS	OF.	AMILIARITY	+	OF.	ME PRE	ATL	. 1	. –
DISPLAYS	OF.	AMILIARIT		Z IND	•	ENT		AY IND
DISPLAYS		AMI		AM	. OF TI	OF PRES		SUM/6 (DISPLAY INDICES)
		NS	SIMILARITY	TOTAL AMOUNT	AMOUNT	RATE 0	SUM	SUM/6
		+						
		+-						-
		+						ļ
		+			-	-		-
								<del>                                     </del>
		+						-
		+-		-				-
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						PLAY:		
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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 it user. Therefore, to take this measure you must have access to the actual hardware, detailed specifications of that hardware, or similar HFE tests 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 <u>must</u> 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) Absense 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 absense of such objective standards, you may substitute your expert judgment, though this is substantially less desirable.
- (7) If a given control/equipment meets <u>all</u> accessibility standards (or your judgment) record a "1" in the appropriate cell of the 0/1 column or 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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- If a given control/equipment is given a "O", 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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# HRTES ACCESSIBILITY ADEQUACY WORKSHEET

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

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- (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 <u>each</u> 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 "O" 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  1 2	25_	MODERATE CRITICALITY 50	75	HIGH CRITICALITY
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 O/I 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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CONTROLS AND OTHER EQUIPMENT TO BE MANIPULATED FOR HARDWARE	CHARACTERISTICS	SIZE	SHAPE	COLOR/LABELING	FUNCTIONAL PLACEMENT	ORDER	SEPARATION	VISABILITY	OTHER:	SUMS: PRDCT SUMS: RATING	STATIC CONTROL INDICES
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### HFE MEASURE #8 CONTROL DYNAMIC CHARACTERISTICS

DESCRIPTION: In HRTES static characteristics, dynamic chracteristics, 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 <u>each</u> control/equipment listed decide if each characteristic on the Worksheet is relavant 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 "O" in the cell.
- (6) Rate each characteristic <u>that you have selected</u> 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 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.
  - (a) 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 O/1 Row. If it does not meet its standard (or your judgement), record a "0" in its 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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CONDITIONS (if applicable):													
CONTROLS AND OTHER EQUIPMENT T BE MANIPULATED FOR HARDWARE	CHARACTERISTICS	RESISTANCE	DIRECTION OF MOTION	FEEDBACK	CONTROL-DISPLAY RATIO	CONTROL-SYSTEM MOTION RATIO	SYSTEM LAG	CONTROL GRADATION	CONTROL GRADATION SIZE	CONTROL JITTER/ VIBRATION	OTHER:	SUM: PRDCT SUM: RATING	DYNAMIC CONTROL INDICES
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HFE MEASURE #9--WORKSTATION DIMENSIONAL CHARACTERISTICS ADEQUACY WORKSHEET

CONDITIONS (If applicable):				<del></del>	······································	-
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WORK SURFACE HEIGHT SITTING					1	1
WORK SURFACE HEIGHT STANDING						┨
WORK SURFACE HEIGHT KNEELING						{
WORK SURFACE WIDTH						}
WORK SURFACE AREA						
WORK SURFACE SLOFE (ANGLE)				<u> </u>		
WORKSPACE DEPTH						
WORKSPACE HEIGHT SITTING						
WORKSPACE HEIGHT STANDING			-			
WORKSPACE HEIGHT KNEELING						
WORKSPACE UNUSUAL POSITION CLEARANCE						
WORKSPACE LATERAL AREA						
WORKSPACE VOLUME						
FREE FLOOR SPACE						
DOOR/HATCH HEIGHT						
DOOR/HATCH WIDTH						
TREAD DEPTH						
RISER HEIGHT						
RISER WIDTH						
OTHER:						
RATING	SUM:				INDEX:	
				PRDCT SUM		

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### HRTES HEE MEASURE #10--WORKSTATION SEATING CHARACTERISTICS ADEQUACY WORKSHEET

	RELEVANCE	9		<del>L</del>		
CHARACTERISTICS	RELE	RATING	0/1	PROCT	SOURCE	
HEAD CLEARANCE SITTING-VERTICAL						
HEAD CLEARANCE SITTING-LATERAL						
SHOULDER CLEARANCE-VERTICAL						
SHOULDER CLEARANCE-LATERAL						
KNEE CLEARANCE-VERTICAL						
KNEE CLEARANCE-LATERAL	1					
THIGH CLEARANCE-VERTICAL						
THIGH CLEARANCE-LATERAL						
HIP CLEARANCE-LATERAL	1					
KICK SPACE	1					
FOOT SUPPORT LENGTH	7					
FOOT SUPPORT WIDTH						
FOOT SUPPORT SLOPE (ANGLE)						
FOOT SUPPORT TO SEAT SURFACE	T					
SEAT SURFACE TO ARM SUPPORT						
ARM SUPPORT LENGTH	I					
UM SUPPORT WIDTH						
VAM SUPPORT SLOPE (ANGLE)						
SEAT LENGTH	$\mathbf{I}^{-}$					
SEAT WIOTH-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	S SUM:				INDEX:	
				PRDCT SUM		
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HFE MEASURE #11--WORKSTATION/ENVIRON-MENT VISUAL CHARACTERISTICS ADEQUACY WORKSHEET

VISUAL	RELEVANCE	RATING		PRDCT	
CHARACTERISTICS	REL	₹ .	<u> </u>	<del></del>	SOURCE
EXTERNAL ILLUMINATION		ļ			
EXTERNAL WARNING ILLUMINATION					
WORKSTATION AMBIENT ILLUMINATION					
WORKSTATION DIRECT ILLUMINATION					
EXTERNAL FIELD OF VIEW					
VIEWING ANGLE TO TARGET(S)					
VIEWING ANGLE TO SIGNIFICANT PARTS OF WORKSTATION (OTHER THAN DISPLAYS)					
VISUAL DISTORTION FROM WORKSTATION					
VISUAL OBSCURATION FROM WORKSTATION					· <del></del>
VISUAL OBSCURATION WITHIN WORKSTATION					
REFLECTIVITY WITHIN WORKSTATION					
VISIBILITY OF WORKSTATION EXTERIOR					
OTHER:					
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		RATING SUM		PRDCT SUM	INDEX

HFE MEASURE #12--WORKSTATION/ENVIRON-MENT SOUND CHARACTERISTICS ADEQUACY WORKSHEET

RELEVANCE	RATING	0/1	PRDCT	SOURCE	
				INDEX:	
	RATING SUM		PRDCT		
	RELEV	RATING	RATING	RATING PRDCT	RATING PROCT

## HETES HEASURE #13--WORKSTATION MOTION CHARACTERISTICS ADEQUACY WORKSHEET

MOTION CHARACTERISTICS  VIBRATION AMPLITUDE IN WORKSTATION  VIBRATION FREQUENCY IN WORKSTATION  AMOUNT OF ACCELERATION IN WORKSTATION  DIRECTION OF ACCELERATION IN WORKSTATION  CHARACTER OF MOTION IN WORKSTATION  OTHER:	
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HFE MEASURE #14--WORKSTATION/ENVIRONMENT VENTILATION CHARACTERISTICS ADEQUACY WORKSHEET

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			INDEX:	
			INDEX:	
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HE MEASURE #15--WORKSTATION/ENVIRONMENT SAFETY CHARACTERISTICS ADEQUACY WORKSHEET

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INTED OBJECT						<u> </u>
MOGING OBJECT			<del>                                     </del>			<del>                                     </del>
WLL DIAMETER PROJECTION			1			1
INGEROUSLY INADEQUATE AD CLEARANCE						<del>                                     </del>
POSED EXCESSIVELY HOT MATERIAL						
POSED EXCESSIVELY COLD NATERIAL						1
POSED SOURCE OF ELECTRIC SHOCK		<del>                                     </del>				1
POSED MACHINERY IN MUTION IT ADEQUATELY HIGHLIGHTED			_			<del> </del>
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IXIOUS MATERIAL CONTACTABLE		<del>                                     </del>	_			<del>                                     </del>
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EQUENCY MEROULSY INADEQUATE ILLUMINATION		-	_	-		<del> </del>
POTENTIAL ACCIDENT SITE		-	<del> </del>	-		<del> </del>
MEROUSLY EXCESSIVE ILLUMINATION		-	<del> </del>			<del> </del>
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MOEDUATE EQUIPMENT PADDING		<u> </u>	<u> </u>			<del> </del>
IPPERY WALKING SURFACE			<u> </u>			ļ
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INSING SURFACE WITHOUT MEDUATE FOOTHOLDS						
FTING/CLIMBING SURFACE WITHOUT EQUATE HANDHOLDS						
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### SUMMARY WORKSHEET FOR HUMAN FACTORS ENGINEERING DIAGNOSIS

SP1: SYSTEM FUNCTION: SPECIFIC HFE PROBLEMS CONTRIBUTING TO INDECES	SPECIFIC HFE INDECES OF ADEQUACY	EXP		
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SPECIFIC HEE PROBLEMS	OF ADEQUACY			
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	DISPLAY INFORMATION ADEQUACY & TIMELINESS		 ]	
	4 DISPLAY READABILITY/		DISPLAYS -	
	5 DISPLAY INFORMATION UNDERSTANDABILITY			
	6 CONTROL ACCESSIBILITY		]	
	7 CONTROL STATIC CHARACTERISTICS		CONTROLS/OTHER EQUIPMENT TO BE MANIPULATED	_
	8 CONTROL DYNAMIC CHARACTERISTICS		[ ]	HUMAN FACT
	9 MORKSTATION DIMENSIONAL CHARACTERISTICS		]	ENGINEERIN
	10 MORKSTATION SEATING CHARACTERISTICS			
	11 MORKSTATION VISUAL CHARACTERISTICS			
	MORKSTATION SOUND CHARACTERISTICS		MORKSTATION/ ENVIRONMENT	$\dashv$
	MORKSTATION MOTION CHARACTERISTICS		[]	
	14 MORKSTATION VENTILATION CHARACTERISTICS			
	MORKSTATION SAFETY CHARACTERISTICS	QUEST	J	
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			DATE	PAGE

## 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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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	117
2.	Aptitude/Ability that Bears on Cognitive Functioning	mental work.  Adequacy of those aptitude/ ability characteristics which	118
3.	Vision for Display Use	bear on cognitive functioning.  Adequacy of vision character- istics.	119
4.	Anthropometry for Visual Display	Adequacy of anthropometric characteristics required for	120
5.	Audition for Auditory Display Use	visual display use.  Adequacy of audition character- istics required for auditory	121
6.	Anthropometry for Auditory Display Use	display use.  Adequacy of anthropometric  characteristics required for	122
7.	Length/Reach Anthropometry for Accessibility	auditory display use.  Adequacy of length-reach characteristics required for	123
8.	Joint Motion for Accessibility	control/equipment assessibility  Adequacy of joint motion char-	124-125
		acteristics required for con- trol/equipment accessibility.	

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	MEASURE NAME	MEASURE FUNCTION	PAGE W8:
9.	Size Anthropometry for	Adequacy of size characteristics	126
	Accessibility	required for control/equipment	1
	!	accessibility (in limited space).	
10.	Vision for Manipulation	Adequacy of vision characteris-	127
	!	tics required for detection and	1
	!	use of controls/equipment to be	
	!	manipulated.	
11.	Anthropometry for Static	Adequacy of anthropometric char-	128
	Characteristics of Con-	acteristics required to interact	
	trols/Equipment to Be	with static characteristics of	1
	Manipulated	controls/equipment to be manip-	•
	!	lated.	
12.	Strength for Manipulation	Adequacy of strength character-	129
	!	istics required for manipulation.	
13.	Range of Movement for	Adequacy of range of movement	130
	Manipulation	characteristics required for	
	ļ	manipulation.	
14.	Coordination for	Adequacy of coordination charac-	131
	Manipulation	teristics required for Manipula-	
	1	tion.	1
15.	Anthropometry for Work-	Adequacy of anthropometric	132-133
	station/Environment	characteristics required for	
	Dimensions	compatibility with workstation/	1
	!	environment dimensions.	1
16.	Anthropometry for Seats	Adequacy of anthropometric char-	134-135
		acteristics required for compati-	1
	1	bility with seating arrangements.	
17.	Vision for Workstation/	Adequacy of vision characteristics	136
	Environment	required for compatibility with	1
	!	the workstation/environment.	l

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	MEASURE NAME	MEASURE FUNCTION	PAGE W8:
18.	Audition for Workstation/	Adequacy of audition characteristics	<b>1</b> 37
	Environment	required for compatibility with the	
	}	workstation/environment.	
19.	Central Nervous System	Adequacy of central nervous system	138
	Functioning for Compati-	characteristics (other than vision	
	bility with Workstation	and audition) required for compati-	
	Motion	bility with workstation motion.	
20.	Characteristics Required	Adequacy of personnel character-	139
	by Workstation Ventila-	istics required to interact with	
	tion and Air Filtration	workstation/environment ventilation	
		and air filtration.	
21.	Physiological Indices of	Adequacy of personnel character-	140
	of Workload Tolerance	istics that relate to workload	
		tolerance.	

This section includes a set of "Common Procedures" which apply to <u>all</u> 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 than 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.	Sea†ing	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  $\underline{both}$  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 diffe entiate between Personnel Selection and HFE causes of inadequate performance.
- (3) One could use a given scale score to replace <u>one</u> of a parallel measure pair if the other parallel measure indicated <u>no</u> 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 "O" 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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LOW CRITICALITY	1	MODERATE CRITIC	CALITY	HIGH CRITICALITY
1	25	50	75	100
Just important er to be measured. cality low for the	Criti-	Criticality mode for this HPF.	derate	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 <u>only</u> to those individuals who performed the given HPF below criterion. If a given characteristic, for <u>one</u> individual, falls inside the fifth to ninety-fifth percentile envelope, or exceeds the appropriate standard, or your judgement, <u>assign (do not record) a 1</u>. If it does not, <u>assign a 0</u>. If only one individual performed this HPF inadequately, then the 1 or 0 assigned that individual's

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characteristic is <u>recorded directly</u> 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, <u>record the mean of the zeros and ones</u> 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 <u>by</u> 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 <u>all</u> 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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PERSONNEL SELECTION MEASURE #1--BACKGROUND THAT BEARS ON COGNITIVE FUNCTIONING ADEQUACY WORKSHEET

	بب				
	RELEVANCE	RATING		5	
CHARACTERISTICS	REL	₹ .	- <del> </del>	PRDCT	SOURCE
CIVILIAN EDUCATION LEVEL					
AMOUNT OF APPROPRIATE CIVILIAN EXPERIENCE					
LENGTH OF MILITARY SERVICE					
MILITARY RANK					
MOS					
MOS SKILL LEVEL				ļ	
AMOUNT OF APPROPRIATE MILITARY EXPERIENCE					
SPECIFIC MILITARY TRAINING IN SYSTEM TYPE					
QUALIFICATION LEVEL WITH SYSTEM					
TIME SINCE QUALIFICATION WITH SYSTEM					
OTHER:			_		
					<u> </u>
				ļ	
	<u> </u>				
RATING	SUM:			L	INDEX:
				PRDCT Sum	

PERSONNEL SELECTION MEASURE #2-APTITUDE/ABILITY THAT BEARS ON
COGNITIVE FUNCTIONING ADEQUACY WORKSHEET

CONDITIONS (If applicable):					
CHARACTERISTICS	RELEVANCE	RATING	0/1	PROCT	SOURCE
READING APTITUDE/ABILITY	T				
VOCABULARY ABILITY					
MATHEMATICS/NUMERICAL APTITUDE ABILITY					
SPATIAL ORIENTATION APTITUDE/ABILITY					
MEMORIZATION APTITUDE/ABILITY					
REASONING APTITUDE/ABILITY					
OTHER:					
	$\bot$				
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	4				
<del></del>					
RATING	SUM: (		1		INDEX:
			F	PRDCT Sum	

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

HPF:						
ONDITIONS (if applicable):						
	REVERANCE	EYE: RT, LT, OR B.	RATING	_	PRDCT	
CHARACTERISTICS	- RE	<u>==</u>	<b>*</b>	6	<u> </u>	SOURCE
/ISUAL ACUITY-NEAR (AT DISPLAY DISTANCE)						
VISUAL DISCRIMINATION (RETINAL PERIPHERY)						
COLOR DISCRIMINATION						
DEPTH DISCRIMINATION						
NOVEMENT DISCRIMINATION						
VISUAL SEARCH						
DARK ADAPTATION						
LIGHT ADAPTATION						
EYE DOMINANCE		х				
ATIQUE TOLERANCE FOLLOWING-LONG TERM ISE OF DISPLAY(S)		x				
OTHER:						
					-	
						· ·
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PERSONNEL SELECTION MEASURE #4-ANTHROPOMETRY FOR VISUAL DISPLAY USE
ADEQUACY WORKSHEET

ONDITIONS (If applicable):						•
	RELEVANCE	5 <u>K</u>		5		
CHARACTERISTICS	MET.	RATING	<u>    0</u>	PRDCT	SOURCE	
NECK FLEXION-RIGHT						
NECK FLEXION-LEFT					·	
NECK FLEXION-DORSAL						
NECK FLEXION-VENTRAL						
NECK ROTATION-RIGHT						
NECK ROTATION-LEFT						
FOOT TO EYE HEIGHT-STANDING						
BUTTOCKS TO EYE HEIGHT-SITTING (PER- PNDCULR LINE TO WKSPACE FLOOR/DECK)						
INTERPUPILLARY DISTANCE						
ANGLE OF SIGHT AT EXPECTED HEAD POSITION						]
OTHER:						
RATING	SIM				INDEX:	

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PERSONNEL SELECTION MEASURE #5-AUDITION FOR AUDITORY DISPLAYS
ADEQUACY WORKSHEET

CONDITIONS (if applicable):					<del>-</del>		
CHARACTERISTICS	RELEVANCE	EAR: RT. LT, OR B.	RATING	0/1	PRDCT	SOURCE	
AUDITORY ACUITY AT ELECTRONICALLY MODULATED SPEECH FREQUENCY RANGE							
AUDITORY ACUITY AT FREQUENCIES OF APP- PROPRIATE ELECTRONIC/MECHANICAL SIGNALS							
ABILITY TO DISCRIMINATE ELECTRONIC/MECH- NICAL SIGNALS FROM APPROPRIATE MASKING							
ABILITY TO DETECT FREQUENCY CHANGE OF APPROPRIATE ELECTRONIC/MECH. SIGNALS							
ABILITY TO DETECT SOUND PRESSURE CHANGE OF APPROPRIATE ELECT/MECH. SIGNALS					L		
MEARING RECOVERY FOLLOWING-ELECTRONICALLY MODULATED SPEECH FREQUENCY RANGE							
HEARING RECOVERY FOLLOWING-ELECTRONIC/ MECHANICAL SIGNAL(S)			<u></u>				
FATIGUE TOLERANCE FOLLOWING-LONG TERM, LECT. MOD. SPEECH FREQUENCY RANGE		x					
FATIGUE TOLERANCE FOLLOWING-LONG TERM LECTRONIC/MECHANICAL SIGNALS		x					
THER:		İ					
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PERSONNEL SELECTION MEASURE #6-ANTHROPOMETRY FOR AUDITORY DISPLAY
USE ADEQUACY WORKSHEET

	RELEVANCE	EAR: RT, LT, OR B.	RATING		5	
CHARACTERISTICS	<u>_</u>	₩ <u>.</u>	<u>*</u>	- 10	PRDCT	SOURCE
BIAURICULAR BREADTH		X				
HEAD BREADTH		x				
HEAD HEIGHT-TRAGION TO TOP						
EAR BREADTH						
EAR LENGTH						
EAR PROTRUSION						
OTHER:	+					
	+					
	+	-				
	+					
	-					
	-					
	4					
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PERSONNEL SELECTION MEASURE #7--LENGTH/REACH ANTHROPOMETRY CHARACTERISTICS FOR ACCESSIBILITY ADEQUACY WORKSHEET

COMDITIONS (if applicable):	<u> </u>	RT, 8.							
	RELEVANCE	LIMB: 1 LT, OR 1	RATING		PROCI	Source			
CHARACTERISTICS		75	<b>~</b>	5	<u> </u>	SURCE	$\neg$		
FURWARD ARM REACH-STANDING		<del> </del>	1	-			_		
FORWARD ARM REACH-SITTING									
FORWARD ARM REACH-SQUATTING									
FORWARD ARM REACH-SUPINE									
FORWARD ARM REACH-PRONE									
LATERAL ARM REACH-STANDING									
OVERHEAD ARM REACH-STANDING									
OVERHEAD ARM REACH-SITTING									
OVERHEAD ARM REACH-SQUATTING							$\Box$		
OVERHEAD ARM REACH-SUPINE							$\exists$		
FOREARM-HAND LENGTH									
BUTTOCK-HEEL LENGTH							7		
POPLITEAL HEIGHT									
FOOT LENGTH									
OTHER:									
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PERSONNEL SELECTION MEASURE #8--JOINT MOTION FOR ACCESSIBILITY ADEQUACY WORKSHEET

	<b>W</b> CE	₹ 9.	"			
CHARACTERISTICS	RELEVANCE	LIMB: LT. 0R	RATING	1/0	PRDCT	SOURCE
WRIST FLEXION					-	
WRIST EXTENSION						
WRIST ADDUCTION						
WRIST ABDUCTION						
FOREARM SUBINATION						
FOREARM PRONATION						
ELBOW FLEXTION						
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						
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CONDITIONS (if applicable):						
	NCE	£				
CHARACTERISTICS	RELEVANCE	LIMB: RT, LT. OR B.	RATING	1/0	PRDCT	SOURCE
KNEE LATERAL ROTATION						
HIP FLEXION						
HIP ADDUCTION						
HIP ABDUCTION						
HIP MEDIAL ROTATION						
HIP LATERAL ROTATION						
OTHER:						
_						
					!	
	RATING SUM			PRDCT SUM=		INDEX

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PERSONNEL SELECTION MEASURE #9--SIZE ANTHROPOMETRY FOR ACCESSIBILITY ADEQUACY WORKSHEET

CHARACTERISTICS	RELEVANCE	LIMB: RT, LT, OR B.	RATING	0/1	PRDCT	SOURCE
SHOULDER (BIDELTOID) BREADTH	<del>~</del> _			0		SUURCE
CHEST DEPTH		X				
WAIST DEPTH	<del> </del>	X			-	<del>,</del>
BUTTOCK-ABDOMEN DEPTH		. X				
		}				···
HIP BREADTH (STANDING)	<del></del>	X		-		
HIP BREADTH (SQUATTING)		X				·
HAND BREADTH						
HAND THICKNESS						
HAND LENGTH						
FOREARM DIAMETER/CIRCUMFERENCE						
BICEP DIAMETER/CIRCUMFERENCE						
THIGH CLEARANCE						•
THIGH CIRCUMFERENCE						
OTHER:						
<del></del>					_	
					_	·
					-	
	_				-	<del></del>
					_	
	RATING SUM			PRDCT SUM=	$\dashv$	

PERSONNEL SELECTION MEASURE #10-VISION FOR MANIPULATION ADEQUACY
WORKSHEET

CONDITIONS (if applicable):						
	RELEVANCE	OR B.	RATING		5	
CHARACTERISTICS	_ <del>_</del> _	EYE LT.		1/0	<u>&amp;</u>	SOURCE
VISUAL ACUITY-NEAR (AT CONTROL DISTANCE)						
VISUAL DISCRIMINATION (RETINAL PERIPH.)						
COLOR DISCRIMINATION						
DARK ADAPTATION						
LIGHT ADAPTATION						
EYE DOMINANCE		х				
OTHER:						
					-	
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			_			
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PERSONNEL SELECTION MEASURE #11--ANTHROPOMETRY FOR STATIC CHARAC-TERISTICS OF CONTROLS/EQUIPMENT TO BE MANIPULATED ADEQUACY WORKSHEET

CONDITIONS (if applicable):	<del></del>						•
CHARACTERISTICS	RELEVANCE	LIMB: RT, LT. OR B.	RATING	0/1	PRDCT	SOURCE	
FOOT TO EYE HEIGHT (STANDING)		х					
BUTTOCK TO EYE HEIGHT (SITTING)		х					
HANDEDNESS		x					
HAND BREADTH							
INDEX FINGER TIP DIAMETER/CIRCUMFERENCE							
MIDDLE FINGER TIP DIAMETER/ CIRCUMFERENCE							
RING FINGER TIP DIAMETER/CIRCUMFERENCE							
THUMB LENGTH TIP-FIRST JOINT							
THUMB DEPTH							
FOOT BREADTH							
NECK FLEXION-LEFT		x					
NECK FLEXTION-RIGHT		х					
NECK FLEXTION-DORSAL		х					
NECK FLEXION-VENTRAL		х					
NECK ROTATION-RIGHT		х					
NECK ROTATION-LEFT		х					
ANGLE OF SIGHT AT EXPECTED HEAD POSITION							
OTHER:							
RATI	NG SUM			PRDCT SUM=		INDEX	
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# PERSONNEL SELECTION MEASURE #12-STRENGTH FOR MANIPULATION ADEQUACY WORKSHEET

CONDITIONS (if applicable):								
CHARACTERISTICS	RELEVANCE	LIMB: RT. LT, OR B.	STRENGTH: S OR EX	CONTROL: V OR H	RATING	0/1	PROCT	SOURCE
HUMB-INDEX FINGER GRASPING TRENGTH			0,0,					
XTENDED INDEX FINGER STRENGTH IN LEXION								
XTENDED MIDDLE FINGER STRENGTH IN								
SRIP STRENGTH								
RM STRENGTH PULLING STRAIGHT BACK SPECIFY ELBOW FLEXION)								
RM STRENGTH PUSHING STRAIGHT FOR- IARD (SPECIFY ELBOW FLEXION)								
RM STRENGTH MOVING TO THE RIGHT (SPECIFY ELBOW FLEXION)	_							•
RM STRENGTH MOVING TO THE LEFT SPECIFY ELBOW FLEXION)								
RM STRENGTH MOVING UP, VERTICALLY SPECIFY ELBOW FLEXION)								
RM STRENGTH MOVING DOWN, VERTICALLY SPECIFY ELBOW FLEXION)								
RM STRENGTH MOVING CLOCKHISE SPECIFY ELBOW FLEXION)								
RM STRENGTH MOVING COUNTERCLOCK- ISE (SPECIFY ELBOW FLEXION)								
EG STRENGTH PUSHING FROM SEATED OSITION (SPECIFIY KNEE ANGLE)								
EG STRENGTH IN A VERTICAL UPWARD ULL								
ACK STRENGTH IN A VERTICAL UPWARD ULL								
HOLE BODY STRENGTH IN A VERTICAL PWARD PULL								
HOLE BODY STRENGTH IN A HORIZON- AL PUSH (FROM A SQUAT)								
HOLE BODY STRENGTH IN A HORIZON- AL PUSH (STANDING)								
ATIQUE TOLERANCE FOLLOWING-LONG ERM USE OF REQUIRED STRENGTH								
THER:								

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

CONDITIONS (if applicable):						
	RELEVANCE	3: RT,	94		<b>5</b>	
CHARACTERISTICS		CIMB:	RATING	6/1	PROCT	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:						
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PERSONNEL SELECTION MEASURE #14-COORDINATION FOR MANIPULATION
ADEQUACY WORKSHEET

CONDITIONS (IF APPLICABLE)						
	RELEVANCE	: RT,	ş			
CHARACTERISTICS	RELE	LIMB: LT, OR	RATING	1/0	PRDCT	SOURCE
GROSS BODY COORDINATION		x	<u>.                                    </u>			
MULTI-LIMB COORDINATION	-	х				
HAND-EYE COORDINATION						
MANUAL DEXTERITY						
FINGER DEXTERITY						
PEDAL DEXTERITY						
CONTROL PRECISION						
RATE CONTROL						
FATIGUE TOLERANCE FOLLOWING-LONG TERM PER- FORMANCE OF APPROPRIATE MOVEMENTS						
OTHER:						
					-	
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PERSONNEL SELECTION MEASURE #15-ANTHROPOMETRY FOR WORKSTATION/ENVIRONMENT DIMENSIONS ADEQUACY WORKSHEET

CHARACTERISTICS	RELEVANCE	RATING	0/1	PRDCT	SOURCE
STATURE		3	8	]	3001.02
SHOULDER HEIGHT (STANDING)	1				
SHOULDER BREADTH					
CHEST DEPTH					
CHEST BREADTH					
WAIST DEPTH					
ELBOW HEIGHT (STANDING)					
HIP BREADTH (STANDING)					
BUTTOCK-ABDOMEN BREADTH (STANDING)  SPECIFY LEFT	ļ				
KNEE BREADTH RIGHT OR BOTH	-				
HEAD CIRCUMFERENCE	-				· · · · · · · · · · · · · · · · · · ·
FOOT LENGTH SPECIFY LEFT OR RIGHT FOOT BREADTH RIGHT OR BOTH					
PRONE LENGTH					
PRONE HEIGHT					
CRAWLING LENGTH					
CRAWLING HEIGHT					
KNEELING LENGTH					
KNEELING HEIGHT (CROUCHING)					
KNEELING HEIGHT (UPRIGHT)					
CONTINUED ON FOLLOWING PAGE					
DATING	SIM.				******
RATING	ourt:		1	PRDCT Sum	INDEX:

## HRTES PERSONNEL SELECTION MEASURE #15--CONT.

RELECTION OF THE CONTROL OF THE CONT

SYSTEM.

CONDITIONS (If applicable):					
	ANCE	c5			
HARACTERISTICS	RELEVANCE	RATING	0/1	PRDCT	SOURCE
INIMUM SQUATTING HEIGHT					
QUATTING HEIGHT (UPRIGHT)					
ERTICAL TRUNK CIRCUMFERENCE (STANDING					<del></del>
UTTOCK-EYE HEIGHT (SITTING)					
SUTTOCK-EYE HEIGHT (STANDING)					
ECK FLEXION-LEFT					
ECK FLEXION-RIGHT					
ECK FLEXION-DORSAL					
ECK FLEXION-VENTRAL					
ECK ROTATION-RIGHT					
ECK ROTATION-LEFT					
NGLE OF SIGHT AT EXPECTED EAD POSITION					
THER:					
					······································
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CHARACTERISTICS	RELEVANCE	8. 8. 8. 3.					
	9		ల్త				
0.55140 1815.5 45555	쀭	LIMB: LT, OR	RATING	16	PROCT	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						<del></del>	•
BUTTOCK-HEEL LENGTH							
FOOT LENGTH							
BUTTOCK-HEEL LENGTH (DIAGONAL)							
HEAD BREADTH		x					
SHOULDER (BIDELTOID) BREADTH		x					
FOREARM-FOREARM BREADTH		X					
WAIST BREADTH (SITTING)		х					
HIP-HIP BREADTH (SITTING)		x					
THIGH CLEARANCE HEIGHT (SITTING)		x					
THIGH BREADTH (SITTING)							
KNEE-KNEE BREADTH (SITTING)		x					
Continued on Following Page							
<del></del>							
	ELBOW REST MEIGHT (SITTING)  ELBOW-FINGERTIP LENGTH  MEAD LENGTH  BUTTOCK-KNEE LENGTH  BUTTOCK-POPLITEAL LENGTH  BUTTOCK-HEEL LENGTH  BUTTOCK-HEEL LENGTH  BUTTOCK-HEEL LENGTH (DIAGONAL)  HEAD BREADTH  SHOULDER (BIDELTOID) BREADTH  FOREARM-FOREARM BREADTH  MAIST BREADTH (SITTING)  THIGH CLEARANCE HEIGHT (SITTING)  THIGH BREADTH (SITTING)  KNEE-KNEE BREADTH (SITTING)	ELBOW REST HEIGHT (SITTING)  ELBOW-FINGERTIP LENGTH  BUTTOCK-KNEE LENGTH  BUTTOCK-POPLITEAL LENGTH  BUTTOCK-HEEL LENGTH  BUTTOCK-HEEL LENGTH  BUTTOCK-HEEL LENGTH  BUTTOCK-HEEL LENGTH (DIAGONAL)  HEAD BREADTH  SHOULDER (BIDELTOID) BREADTH  FOREARM-FOREARM BREADTH  MAIST BREADTH (SITTING)  THIGH CLEARANCE HEIGHT (SITTING)  THIGH BREADTH (SITTING)  KNEE-KNEE BREADTH (SITTING)	ELBOW REST HEIGHT (SITTING)  ELBOW-FINGERTIP LENGTH  MEAD LENGTH  SUTTOCK-KNEE LENGTH  POPLITEAL HEIGHT  BUTTOCK-POPLITEAL LENGTH  BUTTOCK-HEEL LENGTH  BUTTOCK-HEEL LENGTH  BUTTOCK-HEEL LENGTH  SHOULDER (BIDELTOID) BREADTH  X  MAIST BREADTH (SITTING)  X  THIGH CLEARANCE HEIGHT (SITTING)  X  X  X  X  X  X  X  X  X  X  X  X  X	ELBOW REST HEIGHT (SITTING)  ELBOW-FINGERTIP LENGTH  HEAD LENGTH  SUTTOCK-KNEE LENGTH  BUTTOCK-POPLITEAL LENGTH  BUTTOCK-HEEL LENGTH  BUTTOCK-HEEL LENGTH  BUTTOCK-HEEL LENGTH  X  SHOULDER (BIDELTOID) BREADTH  X  FOREARM-FOREARM BREADTH  X  MAIST BREADTH (SITTING)  X  THIGH CLEARANCE HEIGHT (SITTING)  X  X  THIGH BREADTH (SITTING)  X  X  X  X  X  X  X  X  X  X  X  X  X	ELBOW REST HEIGHT (SITTING)  ELBOW-FINGERTIP LENGTH  HEAD LENGTH  BUTTOCK-KNEE LENGTH  BUTTOCK-POPLITEAL LENGTH  BUTTOCK-HEEL LENGTH  FOOT LENGTH  BUTTOCK-HEEL LENGTH (DIAGONAL)  HEAD BREADTH  SHOULDER (BIDELTOID) BREADTH  X  FOREARM-FOREARM BREADTH  X  HIP-HIP BREADTH (SITTING)  X  THIGH CLEARANCE HEIGHT (SITTING)  KNEE-KNEE BREADTH (SITTING)  X	ELBOW REST HEIGHT (SITTING)  ELBOW-FINGERTIP LENGTH  MEAD LENGTH  BUTTOCK-KNEE LENGTH  BUTTOCK-POPLITEAL LENGTH  BUTTOCK-HEEL LENGTH  BUTTOCK-HEEL LENGTH  BUTTOCK-HEEL LENGTH  X  SHOULDER (BIDELTOID) BREADTH  X  MAIST BREADTH (SITTING)  X  THIGH CLEARANCE HEIGHT (SITTING)  KNEE-KNEE BREADTH (SITTING)  X  X	ELBOW REST HEIGHT (SITTING)  ELBOW-FINGERTIP LENGTH  MEAD LENGTH  BUTTOCK-KNEE LENGTH  BUTTOCK-POPLITEAL LENGTH  BUTTOCK-PEEL LENGTH  BUTTOCK-HEEL LENGTH  BUTTOCK-HEEL LENGTH  X  SHOULDER (BIDELTOID) BREADTH  FOREARM-FOREARM BREADTH  MAIST BREADTH (SITTING)  THIGH CLEARANCE HEIGHT (SITTING)  KNEE-KNEE BREADTH (SITTING)  KNEE-KNEE BREADTH (SITTING)

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## HRTES PERSONNEL SELECTION MEASURE #16--CONT.

CONDITIONS (if applicable):		•			
	RELEVANCE	7: RT, OR B.	9	F.	
CHARACTERISTICS	RELE	LIMB:	RATING 0/1	PROCT	SOURCE
FOOT-FOOT BREADTH					
WEIGHT					
OTHER:					
- · · · · - · · · · · · · · · · · · · ·					
				<u> </u>	
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PERSONNEL SELECTION MEASURE #17--VISION FOR WORKSTATION/ENVIRONMENT ADEQUACY WORKSHEET

	EYE: RT, LT, OR B.	RELEVANCE	9 9		<b>þ-</b>	
CHARACTERISTICS	EYE: LT, (	RELE	RATING	0/1	PROCT	SOURCE
VISUAL ACUITY-NEAR (AT DISTANCE FROM SIGNIFICANT PART OF WORKSTATION)						
VISUAL ACUITY-INTERMEDIATE (AT DISTANCE FROM ENVIRONMENT FEATURE)						
VISUAL ACUITY-FAR (AT DISTANCE FROM FARGET)						
VISUAL DISCRIMINATION (RETINAL PERIPH)						
COLOR DISCRIMINATION						
DARK ADAPTATION						
IGHT ADAPTATION		-				
DEPTH DISCRIMINATION						
DVEMENT DISCRIMINATION						
ISUAL SEARCH						
YE DOMINANCE						
THER:				-		
				-		
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PERSONNEL SELECTION MEASURE #18--AUDITION FOR WORKSTATION/ENVIRONMENT ADEQUACY WORKSHEET

CHARACTERISTICS	RELEVANCE	EAR: RT, LT, OR B.	RATING	0/1	PRDCT	comer
AUDITORY ACUITY AT NATURAL SPEECH FREQUENCY RANGE	~	<u> </u>				SOURCE
ABILITY TO DISCRIMINATE NATURAL SPEECH FREQ. RANGE FROM APPROPRIATE MASKING						
HEARING RECOVERY FOLLOWING-IMPULSE NOISE APPROPRIATE TO SYSTEM FUNCTIONS						<u> </u>
HEARING RECOVERY FOLLOWING-BLAST APPROPRIATE TO SYSTEM FUNCTIONS						
HEARING RECOVERY FOLLOWING-LONG TERM, HIGH LEVEL STEADY-STATE NOISE						
FATIGUE TOLERANCE FOLLOWING-IMPULSE NOISE APPROPRIATE TO SYSTEM FUNCTIONS		χ				
FATIGUE TOLERANCE FOLLOWING-BLAST APPROPRIATE TO SYSTEM FUNCTIONS		х				
FATIGUE TOLERANCE FOLLOWING-LONG TERM, HIGH LEVEL, STEADY-STATE NOISE		x				
FATIGUE TOLERANCE FOLLOWING-LONG TERM, LOW LEVEL, STEADY-STATE NOISE		х				
OTHER:						
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PERSONNEL SELECTION MEASURE #19--CENTRAL NERVOUS SYSTEM FUNCTIONING FOR COMPATIBILITY WITH WORKSTATION MOTION ADEQUACY WORKSHEET

CONDITIONS (if applicable):						
	æ	RELEVANCE	9 9		<b>-</b>	
CHARACTERISTICS	VECTOR	RELE	RATING	2	PROCT	SOURCE
MOTION SICKNESS/VERTIGO TOLERANCE TO VIBRATION OF APPROP. Hz AND AMPLITUDE						
VOLUNTARY MUSCULAR CONTROL TOLERANCE TO VIBRATION OF APPROP. Hz AND AMPLITUDE					i	
REACTION TIME TOLERANCE TO VIBRATION OF APPROP. Hz AND AMPLITUDE						
PERCEPTUAL TOLERANCE TO VIBRATION OF APPROP. Hz AND AMPLITUDE						
COGNITIVE TOLERANCE TO VIBRATION OF APPROP. Hz AND AMPLITUDE						
FATIGUE TOLERANCE FOLLOWING LONG TERM VIBRATION OF APPROP. Hz AND AMPLITUDE						
MOTION SICKNESS/VERTIGO TOLERANCE TO ACCELERATION OF APPROP. ONSET/DURATION						
VOLUNTARY MUSCULAR CONTROL TOLERANCE TO ACCELERATION OF APPROP. ONSET/DURATION						
REACTION TIME TOLERANCE TO ACCELERATION OF APPROP. ONSET/DURATION						
PERCEPTUAL TOLERANCE TO ACCELERATION DF APPROP. ONSET/DURATION						
COGNITIVE TOLERANCE TO ACCELERATION OF APPROP. ONSET/DURATION						
POSTURAL TOLERANCE TO ACCELERATION OF APPROP. ONSET/DURATION						
COMMUNICATION TOLERANCE TO ACCELERATION OF APPROP. ONSET/DURATION						
FATIGUE TOLERANCE FOLLOWING SUSTAINED ACCELERATION OF APPROP. ONSET						
OTHER:						
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PERSONNEL SELECTION MEASURE #20--CHARACTERISTICS REQUIRED FOR WORKSTATION VENTILATION AND AIR FILTRATION ADEQUACY WORKSHEET

	RELEVANCE	RATING		5	
CHARACTERISTICS	REL	RAT	0/1	PROCT	SOURCE
IGH TEMPERATURE+HIGH HUMIDITY TOLERANCE IN PPROP. CLOTHING/GEAR OVER APPROP. TIME					
HIGH TEMPERATURE+LOW HUMIDITY TOLERANCE IN APPROP. CLOTHING GEAR OVER APPROP. TIME					
OW TEMPERATURE TOLERANCE IN APPROP.					
NGINE COMBUSTION PRODUCTS TOLERANCE					
SUNFIRE PRODUCTS TOLERANCE OVER APPROP. TIME					
ROCKET FIRE PRODUCTS TOLERANCE OVER APPROPRIATE TIME					
OLERANCE TO REDUCED OXYGEN SUPPLY OVER APPROPRIATE TIME					
OLERANCE TO CHEMICAL WARFARE PRODUCTS OVER APPROP. TIME					
OLERANCE TO BIOLOGICAL WARFARE PRODUCTS OVER APPROP. TIME					
TOLERANCE TO NUCLEAR WARFARE PRODUCTS OVER APPROP. TIME					
OTHER:					
		1			
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PERSONNEL SELECTION MEASURE #21-PHYSIOLOGICAL INDICES OF WORKLOAD
TOLERANCE ADEQUACY WORKSHEET

CONDITIONS (If applicable):					<del></del>	_
CHARACTERISTICS	RELEVANCE	RATING	0/1	PRDCT	SOURCE	
LEVEL OF SECONDARY TASK PERFORMANCE						7
SIZE OF PUPIL DILATION						1
RATE OF RHYTHMIC CONTRACTION AND DILATION OF PUPIL						1
EYE MOVEMENT RATE						7
RATE OF SINUS ARRHYTHMIA						1
LEVEL OF PERIPHERAL VASOCONSTRICTION						1
LEVEL/RATE OF ALTERATION IN SKIN CONDUCTANCE						1
LEVEL OF EEG DESYNCHRONIZATION						]
OTHER:						]
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### SUMMARY WORKSHEET FOR PERSONNEL SELECTION DIAGNOSIS

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=	20 CHARACTERISTICS ASSOCIATED WITH VENTILATION/FILTRATION  21 WORKLOAD TOLERANCE	•			
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