

UNITED STATES MARINE CORPS
Marine Aviation Weapons and Tactics Squadron One
Box 99200
Yuma, Arizona 85369-9200

CWTI 00392
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ELECTRO-OPTICAL TACTICAL DECISION AIDS (EOTDAs)

STUDENT HANDOUT

I. INTRODUCTION

A. Forward

The next war will not be a war of attrition. U. S. Marine Corps assets are limited. The number of aircraft and precision guided weapons are equally well defined. Therefore, it is important to maximize the success of the first few engagements.

B. Lesson Purpose

To illustrate the importance of meteorological data in combat mission planning, and introduce an environmental support system, resident within the Marine Wing Support Squadron (MWSS), that can be used operationally to make weapon upload decisions and support execution tactics.

C. References

1. Electro-Optical Tactical Decision Aids (EOTDAs) User's Manual, Volume 1, Version 3.1, June 1994
2. Weather Support for precision Guided Munitions, Vol. I, Cottrell, K. G., Try, P. D., Hodges, D. B., and Wachtman, R. F., (1979)

D. Enabling Learning Objectives

1. Without the aid of references, select the environmental and tactical information that is needed to produce an EOTDA.
2. Without the aid of references, select the two types of tactical decision aids that are produced by the EOTDA program.
3. Without the aid of references, select how EOTDA can be used by combat mission planners.

E. Enclosures

1. EOTDA Worksheet Guide and Worksheets
2. USMC Weather Points of Contact

D. Appendices

1. Appendix A, Targets
2. Appendix B, Backgrounds
3. Appendix C, Output

II. **BODY**

A. Overview

1. The history of conventional warfare illustrates a perpetual problem in aerial bombardment -- how to hit a specific target? In the past, neutralizing a target meant dropping tons upon tons of ordnance in the target area. More often than not, the target was frequently missed and collateral damage was looked upon as an acceptable "cost of doing business". As time passed either the advancement of technology, the humanizing of war or perhaps both dictated a more accurate method of destroying a target.
2. The introduction of Precision Guided Munitions (PGMs) or "Smart Bombs" during the Vietnam era greatly increased weapon accuracy. While the systems have the potential for "high precision" bombing, they are very sensitive to the environment. The Marine Wing Support Squadron (MWSS) is tasked to provide meteorological support to the Aviation Combat Element (ACE) in order to "minimize" the impact adverse weather has on PGM employment.

B. Electro-Optical Tactical Decision Aids

1. EOTDAs are computer models that predict the performance of "air-to-ground" weapon systems and direct view optics, based upon environmental and tactical information, to include.
 - a. Meteorological Forecast
 - b. Target Characteristics
 - c. Type of System
 - d. Tactics Employed

2. Performance is expressed primarily in terms of maximum detection or lock-on range. EOTDAs can be used operationally by combat mission planners to make weapon upload decisions and to support execution tactics.
3. Met /Ops Data. An EOTDA uses two types of input data sets: Met Data and Ops Data.
 - a. Met Data. The EOTDA requires meteorological and site (Met) information including the location, the surface weather forecast, and the thickness of the boundary layer. Met Data consists of three parts.
 - (1) Terminal Aerodrome Forecast (TAF) Code
 - (2) Surface Parameters not in the TAF Code
 - (3) Upper Layer Data
 - b. Ops Data. The EOTDA requires operations and intelligence (Ops) information including the electro-optical sensor ID number, sensor height, viewing direction, targets, and backgrounds. Ops Data consists of three parts:
 - (1) System Data
 - (2) Target Data
 - (3) Background Data

4. Sensors

- a. The EOTDA software supports systems in three wavebands: infrared (8 - 12 um), visible (0.4 - 0.9 um), and laser (1.06 um). The TV (visible) includes low-light devices and direct view optics (e.g., Night Vision Goggles). Sensors are divided into two categories: Standard Sensors and User-Defined Sensors (UDS). See Tables 4-1 and 4-2 below for sensors employed by the U. S. Marine Corps.

Standard Sensors

Sensor (IR)	Sensor (TV)	Sensor (LASER)
AN/AGM-65D/F/G (Maverick)	AN/AGM-65A/B (Maverick)	AN/AGM-65E (Maverick)
AN/AAS-38 (F/A-18, FLIR)	AN/AVS-6 (ANVIS)	Paveway II (LGB/GBU-10/12/16)
AN/AAS-37 (UV, FLIR)	CATEYES	Paveway III (LLLGB/GBU-24B)
AN/AAQ-16 (CH-53E, FLIR)	Walleye I & II	AN/AGM-114B (Hellfire)

AN/AAR-51 (AV-8B, NAVFLIR)		AN/PAQ-3 (MULE)
AN/TAS-6A (NODLR)		
AN/AWS-1(V)1, AH-1W, FLIR)		

TABLE 4 - 1

User-Defined Sensors

Sensor (IR)	Sensor (TV)	Sensor (LASER)
N/AAR-50 (F/A-18, TINS)	AN/ASB-19(V), (AV-8B, ARBS)	AN/ASB-19(V), (AV-8B, ARBS)
	AN/ASQ-173 (F/A-18, LDT/SCAM)	AN/ASQ-173 (F/A-18, LDT/SCAM)
	AN/AWS-1(V), (AH-1W, CCDTV)	AN/AWS-1(V), (AH-1W, LTD/R)
		AN/AAS-38(A), (F/A-18, LTD/R)

TABLE 4 - 2

- b. In most cases, the relationship between IR, TV, and Laser sensor ID numbers and specific system names is classified at the **CONFIDENTIAL** level.
5. Targets. The EOTDA software supports 18 specific targets and 9 classes of generic targets. The specific targets, including 14 mobile targets and 4 "high value" targets, can be used by any of the three EOTDA models. Only the IR TDA model uses the "off-menu" target, and only the TV and Laser TDA models use the "composed" target. (see Appendix A, Targets.)
6. Backgrounds
- a. For each TDA, one, two, or three backgrounds can be entered. The background is the area immediately surrounding the target. The detection and lock-on ranges for IR and TV TDAs are based upon the contrast between the background and target. In the Laser TDA, background is used for ranging. The EOTDA software supports eight (8) generic background types.
- (1) Vegetation
 - (2) Soil
 - (3) Snow
 - (4) Water

- (5) Concrete
 - (6) Asphalt
 - (7) Swamp/Marsh
 - (8) Rocky Field
- b. Each background type or category has two or three parameters to further define the background. (See Appendix B, Backgrounds)
7. Execution or Planning TDAs. EOTDA prediction models (IR, TV, and Laser) can be exercised in two modes: Execution and Planning.
- a. Execution TDA. An execution TDA provides detailed performance data for a "single" time over target.
 - b. Planning TDA. A planning TDA gives broad performance data for a period of time (2 - 24 hours).
8. EOTDA Output. Output data is displayed in alphanumeric and graphic formats. (See Appendix C, Output)
- a. Alphanumeric Output. The alphanumeric output is designed to allow mission planners to tailor the output products to meet specific mission requirements.
 - b. Graphic Output. A gallery of output graphs is supplied with the software. Mission planners can tailor displays to suit their needs by adding, deleting, or trimming.
9. Solar and Lunar Data. Solar and lunar information could be critical to your mission. Twenty-four hour plots of the sun and moon are available for all planning TDAs. Solar and lunar information is included in the alphanumeric results for a planning TDA.
10. EOTDA Worksheets. EOTDA Ops Data Worksheets are provided for your use during the WTI Course. A worksheet guide is included to assist you in filling out the worksheets correctly. (See Enclosure [1])
11. EOTDA Generic Target Worksheets. EOTDA Generic Target Worksheets should be utilized when specifying an off-menu, composed, or generic target. (See Enclosure [2])

III. SUMMARY

Low intensity conflicts tend to exacerbate the need for meteorological data. Over the last forty years, many of the limited conflicts have been in places where U. S. forces have had to operate in areas where there are complex sea/land conditions. An obvious example of this is the recent Persian Gulf experience. Sensors operating within the electromagnetic spectrum are susceptible to weather conditions, due primarily to the extremes in conditions that can be encountered. Weather effects are complex, interactive, correlated and spectrally dependent. Adverse weather conditions are therefore unique to the system. However, the effective use of EOTDAs can "minimize" the impact that adverse weather has on PGM employment.

Review and Approved

(Instructor)

(Coordinator)

APPENDIX A (TARGETS)

TARGET ID

The EOTDA software supports 18 specific menu targets and 9 classes of generic targets. Each target has a unique number associated with it. The specific targets have ID numbers between 1 and 18. Each generic target type is allowed a range of 50 ID numbers. The first of each series corresponds to the default provided with the EOTDA software. The other numbers are available for targets that you generate; they are created sequentially. Table A-1 gives a short description of each of the targets, along with the target dimensions and the number of surface facets. Table A-2 provides additional information about the specific targets. Figure A-1 shows the diagram of all the targets.

**TABLE A-1
Targets, Dimensions and Number of Facets**

ID Designation	Height	Length	Width	No. of Facets
1 T-62 Tank (Steel)	2.16 m 7.09 ft	9.33 m 30.61 ft	3.35 m 10.99 ft	64
2 T-72 Tank (Weathered Steel)	2.29 m 7.51 ft	9.60 m 31.50 ft	3.59 m 11.78 ft	58
3 ZIL (Olive Drab)	2.60 m 8.53 ft	7.10 m 23.30 ft	2.80 m 9.19 ft	60
4 APC (Armor)	2.88 m 9.42 ft	6.84 m 22.44 ft	3.65 m 11.98 ft	32
5 BRDM-2 (Weathered Steel)	2.09 m 6.86 ft	5.71 m 18.73 ft	2.35 m 7.71 ft	66
6 Generator (Weathered Steel)	1.93 m 6.33 ft	1.84 m 6.08 ft	1.83 m 6.00 ft	51
7 Frigate (Navy Gray)	12.75 m 41.83 ft	123.5 m 405.20 ft	14.00 m 45.93 ft	63
8 AH-64 Helicopter (Titanium)	5.38 m 17.65 ft	17.94 m 58.86 ft	14.45 m 47.41 ft	68
9 F-4 (Gray)	4.00 m 13.12 ft	18.40 m 60.37 ft	11.70 m 38.39 ft	50
10 Scud Launcher (Green & Black)	2.83 m 9.29 ft	13.02 m 42.72 ft	3.01 m 9.88 ft	63
11 T-80 Tank (Armored Steel)	3.73 m 12.24 ft	9.10 m 29.86 ft	4.64 m 15.22 ft	60

**APPENDIX A
(TARGETS)**

**TABLE A-1
Targets, Dimensions and Number of Facets (Cont.)**

ID Designations	Height	Length	Width	No. of Facets
12 MICV (Green)	2.97 m 9.65 ft	6.41 m 21.03 ft	3.22 m 10.56 ft	60
13 Gunboat (Navy Gray)	8.80 m 28.97 ft	41.50 m 136.16 ft	9.75 m 31.99 ft	60
14 HIND Helicopter (Aluminum)	5.24 m 17.19 ft	17.10 m 56.11 ft	14.80 m 48.56 ft	61
15 Eglin Bunker (Concrete)	6.40 m 21.00 ft	22.00 m 72.18 ft	82.00 m 269.04 ft	49
16 Lock and Dam	27.00 m 88.59 ft	185.00 m 606.92 ft	20.00 m 65.62 ft	39
17 Hydroelectric Power plant	32.30 m 105.98 ft	97.50 m 319.90 ft	51.20 m 167.99 ft	55
18 Causeway Bridge	8.50 m 27.89 ft	51.21 m 168.02 ft	34.31 m 112.57 ft	49
101 - 149 Generic Bunker	User Defined	User Defined	User Defined	31
150 - 199 Generic Dam	User Defined	User Defined	User Defined	43
200 - 249 Generic POL	User Defined	User Defined	User Defined	17
250 - 299 Generic Power Plant	User Defined	User Defined	User Defined	46
300 - 349 Generic Bridge	User Defined	User Defined	User Defined	46
350 - 399 Generic Building	User Defined	User Defined	User Defined	User Defined
400 - 449 IR Off-Menu	User Defined	User Defined	User Defined	N/A
450 - 499 Generic Runway	User Defined	User Defined	User Defined	1
500 - 549 TV/Laser Composed	User Defined	User Defined	User Defined	6

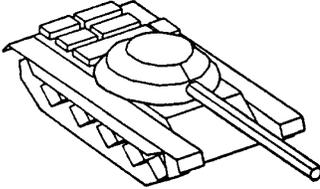
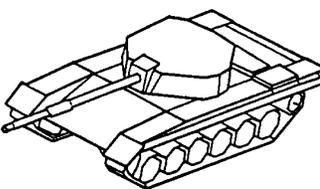
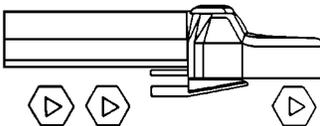
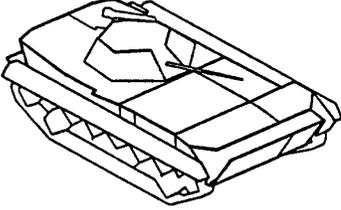
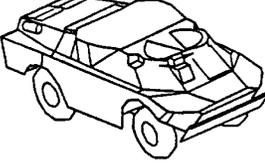
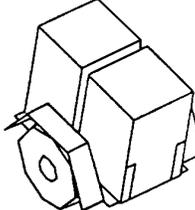
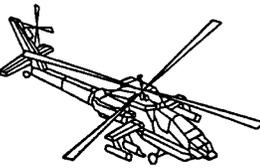
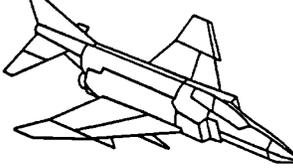
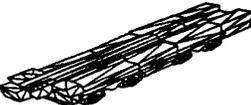
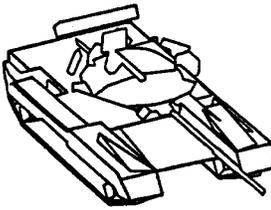
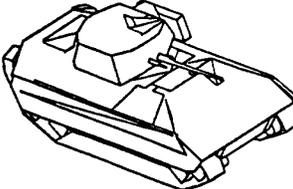
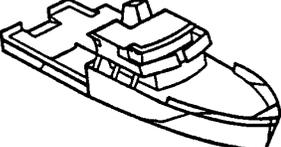
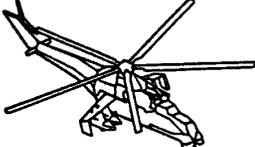
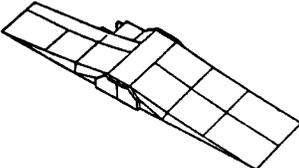
**APPENDIX A
(TARGETS)**

TABLE A-2

Target Comments

Target ID	Notes
1, 2, 11	Soviet Armored Tanks
3	Soviet ZIL-157 Truck--Canvas Covered w/wood sides
4	Soviet Armored Personnel Carrier
5	Anti-Tank Vehicle (BRDM-2)
6	U.S. Army Field Generator
7	Soviet Missile Frigate
8	U.S. Apache Helicopter
9	"Parked" Aircraft (F4)
10	Soviet Mobile Missile Launcher (SCUD)
12	U.S. Light Infantry Vehicle (M2)
13	Naval Ship
14	Soviet Helicopter
15	Aircraft Shelter (Eglin AFB, FL)
16	Flood Control Dam (Coffeeville, AL)
17	Hydroelectric Plant (Millers Ferry, AL)
18	Highway Bridge Section (Destin, FL)

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<p>1 T62 Tank</p> 	<p>2 T72 Tank</p> 	<p>3 ZIL</p> 
<p>4 APC</p> 	<p>5 BRDM</p> 	<p>6 Generator</p> 
<p>7 Krivak</p> 	<p>8 Apache Helicopter</p> 	<p>9 F-4 Aircraft</p> 
<p>10 Scud Launcher</p> 	<p>11 T80 Tank</p> 	<p>12 MICV</p> 
<p>13 Gunboat</p> 	<p>14 HIND Helicopter</p> 	<p>15 Eglin Bunker</p> 

(Continued on Next Page)

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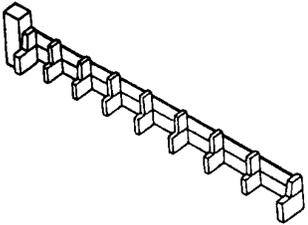
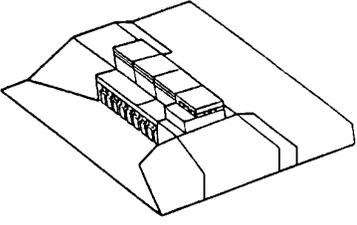
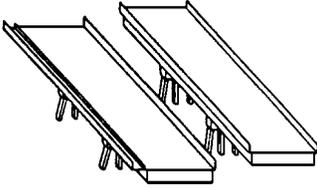
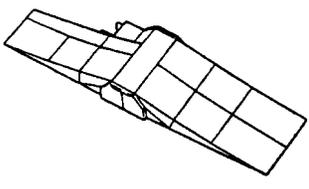
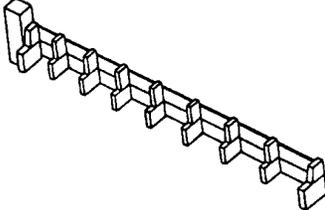
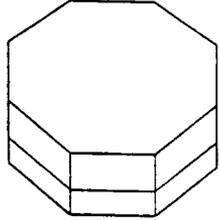
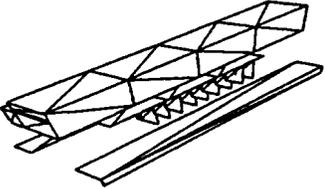
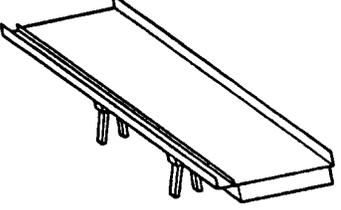
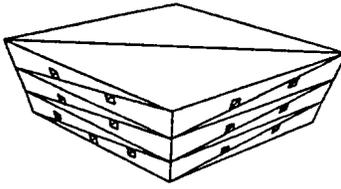
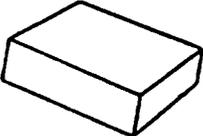
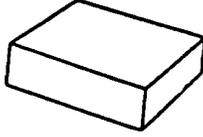
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<p>100 - 149 Generic Bunker</p> 	<p>150 - 199 Generic Dam</p> 	<p>200 - 249 Generic POL</p> 
<p>250 - 299 Generic Power Plant</p> 	<p>300 - 349 Generic Bridge</p> 	<p>350 - 399 Generic Building</p> 
<p>400 - 449 IR Off - Menu</p> 	<p>450 - 499 Runway</p> 	<p>500 - 549 TV/Laser Composed</p> 

Figure A-1: Diagrams of EOTDA Targets (Cont.).

**APPENDIX A
(TARGETS)**

GENERIC BUILDING MODEL

The generic building model allows you to define a box structure with a flat roof. All EOTDA buildings must have four sides. However, buildings may have between one and five levels. You can specify such variables as the surface finish, building dimensions, windows, and doors. The allowed values for these parameters are shown in Table A-3 and Table A-4.

TABLE A-3

Generic Building Model Parameters

Roof & Structure Types	Surface Types
1 Ins. Frame Wall	1 White Paint
2 Ins. Ltwt. Wdframe	2 Green Paint
3 Mason w/Int. Ins.	3 Black Paint
4 Mason w/Sandwich	4 Plywood
5 Wdframe w/Brick	5 Concrete, Rough
6 Asph Shingle on wd	6 Brick, Red
	7 Masonry
	8 Granite
	9 Slate
	10 Marble, White
	11 Glass
	12 Asphalt
	13 Gravel
	14 Galvanized-Clean
	15 Galvanized-Weathered

**APPENDIX A
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TABLE A-4

Generic Building Model Parameters

Insulation Types	Window Types	Door Types
1 Good	1 Plate	1 Single Door
2 Average	2 Pane	2 Double Door
3 Poor		

GENERIC BRIDGE, BUNKER, POWER PLANT, AND DAM MODELS

These four generic target models are similar. The user is required to enter overall target dimensions such as length, width, and height. Each target consists of several target sections. Each section has a changeable surface and material description. These inputs define the target's thermal and reflectivity characteristics. The allowed values for these parameters are shown in Table A-5 through Table A-8.

TABLE A-5

Generic Bridge Model Parameters

Surface List	Material List
1 Bare Concrete - Uncolored	1 Concrete - Normal
2 Bare Concrete - Darkened	2 Concrete - Very Dry
3 Bare Concrete - Blackened	3 Concrete - Wet
4 White Paint - Acrylic	4 Hardwood
5 White Paint - ZnOxide	5 Softwood
6 Green Paint	
7 Black Paint - Parsons	
8 Unpainted Wood	
9 Tar / Asphalt / Creosote	

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TABLE A-6

Generic Bunker Model Parameters

Door Surface List	Door Material List
1 Bare Concrete - Uncolored	4 Steel
2 Bare Concrete - Darkened	
3 Bare Concrete - Blackened	
4 White Paint - Acrylic	
5 White Paint - ZnOxide	
6 Green Paint	
7 Black Paint - Parsons	
9 Tar / Asphalt / Creosote	
10 Galvanized - Clean	
11 Galvanized - Weathered	
12 Rusted Steel	
Side Surface List	Sides Material List
1 Bare Concrete - Uncolored	1 Concrete - Normal
2 Bare Concrete - Darkened	2 Concrete - Very Dry
3 Bare Concrete - Blackened	3 Concrete - Wet
4 White Paint - Acrylic	
5 White Paint - ZnOxide	
6 Green Paint	
7 Black Paint - Parsons	
9 Tar / Asphalt / Creosote	

**APPENDIX A
(TARGETS)**

TABLE A-6 (Cont.)

Generic Bunker Model Parameters

Earth Surface Layer List	Earth Surface Material List
13 Very DRY Mid East Sand	5 NORMAL average soil
14 Very DRY Soil surface	6 NORMAL loam
15 Normal Soil Surface	7 NORMAL sand
16 WET Soil Surface	8 NORMAL clay
	9 NORMAL peat
	15 DRY average soil
	16 WET average soil
	17 DRY loam
	18 WET loam
	19 DRY sand / sandy soil
	20 WET sand / sandy soil
	21 DRY clay
	22 WET clay
	23 DRY peat
	24 WET peat

**APPENDIX A
(TARGETS)**

TABLE A-6 (Cont.)

Generic Bunker Model Parameters

Earth Subsurface Layer List	Earth Subsurface Material List
17 Not applicable	10 NORMAL average soil
	11 NORMAL loam
	12 NORMAL sand / sandy soil
	13 NORMAL clay
	14 NORMAL peat
	15 DRY average soil
	16 WET average soil
	17 DRY loam
	18 WET loam
	19 DRY sand / sandy soil
	20 WET sand / sandy soil
	21 DRY clay
	22 WET clay
	23 DRY peat
	24 WET peat

**APPENDIX A
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TABLE A-7

Generic Power Plant Parameters

Upper Level Walls Surface List		Upper Level Walls Material List	
1	Bare Concrete - Uncolored	2	Asphalt
2	Bare Concrete - Darkened	4	Concrete - Normal
3	Bare Concrete - Blackened		
4	White Paint - Acrylic		
5	White Paint - ZnOxide		
6	Green Paint		
7	Black Paint - Parsons		
8	Tar / Asphalt / Creosote		
13	Gravel (Polished)		
Decks Surface List		Decks Material List	
1	Bare Concrete - Uncolored	4	Concrete - Normal
2	Bare Concrete - Darkened	5	Concrete - Wet
3	Bare Concrete - Blackened	6	Concrete - Very Dry
4	White Paint - Acrylic		
5	White Paint - ZnOxide		
6	Green Paint		
7	Black Paint - Parsons		

**APPENDIX A
(TARGETS)**

TABLE A-7 (Cont.)

Generic Power Plant Model Parameters

Windows Surface List	Windows Material List
4 White Paint - Acrylic	1 Common Glass
5 White Paint - ZnOxide	
6 Green Paint	
7 Black Paint - Parsons	
12 Common Glass	

TABLE A-7 (Cont.)

Generic Power Plant Model Parameters

Roof - Surface Layer Only And Downstream - Flow Exit Area Surface List	Roof - Surface Layer Only and Downstream - Flow Exit Area Material List
1 Bare Concrete - Uncolored	4 Concrete - Normal
2 Bare Concrete - Darkened	5 Concrete - Wet
3 Bare Concrete - Blackened	6 Concrete - Very Dry
4 White Paint - Acrylic	
5 White Paint - ZnOxide	
6 Green Paint	
7 Black Paint - Parsons	

**APPENDIX A
(TARGETS)**

TABLE A-8

Generic Dam Model Parameters

Lower Flow Wall and Concrete Supports Surface List	Lower Flow Wall and Concrete Supports Material List
1 Bare Concrete - Uncolored	1 Concrete - NORMAL
2 Bare Concrete - Darkened	2 Concrete - Very Dry
3 Bare Concrete - Blackened	3 Concrete - Wet
4 White Paint - Acrylic	
5 White Paint - ZnOxide	
6 Green Paint	
7 Black Paint - Parsons	

TABLE A-8 (Cont.)

Generic Dam Model Parameters

Control Building Surface List	Control Building Material List
4 White Paint - Acrylic	5 Steel
5 White Paint - ZnOxide	
6 Green Paint	
7 Black Paint - Parsons	
8 Tar / Asphalt / Creosote	
9 Galvanized - Clean	
10 Galvanized - Weathered	
11 Rusted Steel	

**APPENDIX A
(TARGETS)**

TABLE A-8 (Cont.)

Generic Dam Model Parameters

Flow Control Gates Surface List	Flow Control Gates Material List
1 Bare Concrete - Uncolored	1 Concrete - NORMAL
2 Bare Concrete - Darkened	2 Concrete - Very Dry
3 Bare Concrete - Blackened	3 Concrete - Wet
4 White Paint - Acrylic	
5 White Paint - ZnOxide	
6 Green Paint	
7 Black Paint - Parsons	
Control Building Windows Surface List	Control Building Windows Material List
12 Common Glass	4 Common Glass

GENERIC PETROLEUM / OIL / LUBRICANT (POL) STORAGE TANK MODEL

The inputs for the generic POL target include the height, diameter, fullness, POL top paint, and POL side paint. The cylindrical tank is modeled as eight-sided. Fullness is an important parameter for the IR model only. The allowed values for these parameters are shown in Table A-9.

TABLE A-9

Generic POL Model Parameters

POL Material Parameters
1 White
2 Black
3 Aluminum
4 Light Green
5 Light Gray
6 Bare Metal
7 Rusted Steel

APPENDIX A (TARGETS)

OFF-MENU TARGET

The inputs for the off-menu target includes overall target length, width, and height and between one and three surrogate materials. The surrogate materials are taken from the generic background list. (See Appendix B, Backgrounds.)

GENERIC RUNWAY MODEL

The generic runway target is modeled as a single, flat facet. In the IR model, this target is modeled as a background. In the TV model, it merits special consideration because it has no along-track dimension and can never have a shadow. The Laser model treats the runway target as it does any other target. The allowed values for these parameters are shown in Table A-10.

TABLE A-10

Generic Runway Model Parameters

Runway Surface	Runway Material	Runway Wetness
1 UNCOLORED	1 CONCRETE	1 DRY
2 BLACK	2 ASPHALT	2 INTERMEDIATE
		3 WET

COMPOSED TARGET

The TV and Laser composed target is a box-shaped target that can consist of a variety of surface materials. The box-shaped target should be used to approximate targets that cannot be modeled well with the other generic types. The simplified geometry of this target has been found to work well in many cases, especially for tank-sized targets.

The inputs for the composed target include the overall target length, width, and height, the basic target surface material, and up to two component materials for the target top and sides. The basic material should be the predominant surface material or the underlying material for the target that is camouflaged. The component material could be a surface material of lesser importance or a camouflage material. The composed target model computes average reflectivities for the basic and component materials. The allowed values for these parameters are shown in Table A-11.

**APPENDIX A
(TARGETS)**

TABLE A-11

Composed Target Parameters

Basic Materials List	Component Materials List
1 Wx Galvanized Iron	1 Green Paint
2 Wx Steel Armor	2 Black Paint
3 Aluminum	3 White Paint
4 Titanium Surface	4 Naval Gray Paint
5 Wx Aircraft Skin	5 Green Burlap
6 Concrete, Aged	6 Glass
7 Plywood, Dirty	7 Rubber
8 Camo Cloth - Green	8 Asphalt
	9 Vegetation
	10 Sand
	11 Soil
	12 Snow

APPENDIX B (BACKGROUNDS)

ALBEDO

The general target area reflectivity is the albedo. The EOTDA supports the five categories of terrain types shown in Table B-1. Albedo has a weak influence in the computation of ranges for the IR and TV models.

TABLE B-1

Terrain Types for Albedo Entry

ID	Terrain Type
1	Continental
2	Urban
3	Desert
4	Ocean
5	Snow

BACKGROUND LIST

The background list consists of eight generic categories. These categories are listed in Table B-2. Each category has two or three parameters to further define the background. The following sections describe the generic categories and their associated parameters.

TABLE B-2

Background List

Background ID	Generic Name
1	Vegetation
2	Soil
3	Snow
4	Water
5	Concrete
6	Asphalt
7	Swamp/Marsh
8	Rocky Field

GENERIC VEGETATION BACKGROUND

The vegetation model is used for grass, trees, shrubs, crops, etc. It consists of vegetation and underlying soil. Three parameters are available to specify the characteristics of this background: Growing State, Coverage, and Soil Moisture. The allowed values for these parameters are shown in Table B-3.

TABLE B-3

Vegetation Background Parameters

Growing State	Coverage	Soil Moisture
1 Dormant	1 Dense	1 Dry
2 Intermediate	2 Intermediate	2 Intermediate
3 Growing	3 Sparse	3 Wet

GENERIC SOIL BACKGROUND

The generic soil background should be used for areas that have little or no vegetation. Three parameters are available to specify the characteristics of this background: Type, Surface Moisture, and Depth Moisture. The allowed values for these parameters are shown in Table B-4.

TABLE B-4

Soil Background Parameters

Type	Surface Moisture	Depth Moisture
1 Average	1 Dry	1 Dry
2 Loam	2 Intermediate	2 Intermediate
3 Sand	3 Wet	3 Wet
4 Clay		
5 Peat		
6 Gravel		
7 Desert Sand		

APPENDIX B (BACKGROUNDS)

GENERIC SNOW BACKGROUND

The generic snow background model assumes widespread coverage. Bare ground and vegetation are not taken into consideration. Three parameters are available to specify the characteristics of this background: Type, Depth, and Condition. The allowed values for these parameters are shown in Table B-5.

TABLE B-5

Snow Background Parameters

Type	Depth	Condition
1 Fresh	1 - 99 Inches	1 Compacted
2 Old		2 Windy Region
3 Rained Upon		3 Late in Season
4 Surface Melted		4 Tundra
		5 Undisturbed

GENERIC WATER BACKGROUND

The generic water background is appropriate for bodies of fresh or salt water. Two parameters are available to specify the characteristics of this background: Depth and Clarity. The allowed values for these parameters are shown in Table B-6.

TABLE B-6

Water Background Parameters

Depth	Clarity
1 - 99 Feet	1 Clear
	2 Turbid

GENERIC CONCRETE BACKGROUND

The generic concrete background is used for various concrete structures. Three parameters are available to specify the characteristics of this background: Type, Surface, and Wetness. The allowed values for these parameters are shown in Table B-7.

TABLE B-7

Concrete Background Parameters

Type	Surface	Wetness
1 Road	1 Uncolored	1 Dry
2 Sidewalk	2 Black	2 Intermediate
3 Runway		3 Wet
4 Parking Lot		
5 Bridge		
6 Heavy Pad		

GENERIC ASPHALT BACKGROUND

The generic asphalt background is used for various asphalt structures. Three parameters are available to specify the characteristics of this background: Type, Surface, and Wetness. The allowed values for these parameters are shown in Table B-8.

TABLE B-8

Asphalt Background Parameters

Type	Surface	Wetness
1 Road	1 Aged	1 Dry
2 Sidewalk	2 New	2 Intermediate
3 Runway		3 Wet
4 Parking Lot		
5 Bridge		

APPENDIX B (BACKGROUNDS)

GENERIC SWAMP/MARSH BACKGROUND

The generic swamp/marsh background should be used for target areas that have vegetation and water, with at least 40% being vegetation. This relatively high percentage allows the model to assume that there is enough foliage to negate the directional effects of the exposed water surface. If the target area is primarily open water then the water background should be used. Three parameters are available to specify the characteristics of this background: Growing State, Coverage, and Water Depth. The allowed values for these parameters are shown in Table B-9.

TABLE B-9

Swamp/Marsh Background Parameters

Growing State	Coverage	Water Depth
1 Dormant	1 Dense	1 - 99 Feet
2 Intermediate	2 Intermediate	
3 Growing	3 Sparse	

GENERIC ROCKY FIELD BACKGROUND

The generic rocky field background is a special case of the generic soil background. This background should be used when the field or area is made up of rocks that are larger than gravel, but not as big as boulders. Three parameters are available to specify the characteristics of this background: Concentration of Quartz, Surface Moisture, and Depth Moisture. The allowed values for these parameters are shown in Table B-10.

TABLE B-10

Generic Rocky Field Background

Quartz Concentration	Surface Moisture	Depth Moisture
1 None	1 Dry	1 Dry
2 Low	2 Intermediate	2 Intermediate
3 High	3 Wet	3 Wet

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APPENDIX C (OUTPUT)

IR ALPHANUMERIC OUTPUT PRODUCTS

The Product selection Menu (PSM) for IR alphanumeric output is shown in figure C-1.

• MET INPUT	Method
	<ul style="list-style-type: none"> • MDT DETECTION • LOCK-ON
• OPS INPUT	
• DATE/LOCATION	Target
	<ul style="list-style-type: none"> • T80 TANK BRDM
• RANGES	
• TEMPERATURES	Background
	<ul style="list-style-type: none"> • SOIL VEGETATION CONCRETE
• DELTA Ts	
HOT-TO-COLD	FOV
• 4 KM TRANS	<ul style="list-style-type: none"> • NARROW • WIDE
• SOLAR/LUNAR	

Figure C-1: A Sample IR Product Selection Menu for a Planning Run with various output products selected.

The marks (•) indicate which items are selected. The EOTDA automatically produces output for the number of fields-of-view (FOV) and the number of methods supported by your sensor. Ranges, temperatures, and delta Ts are available for each FOV, each method, each background, and each target. The hot-to-cold list is generated for selected backgrounds and targets. The 4 km Trans output product includes transmissivity at a range of 4 km, IR visibility, absolute humidity, and sky temperature. These are automatically selected for an Execution run; 4 km Trans is not included on the PSM. The solar/lunar information includes solar and lunar elevation and azimuth angles and lunar phase. This information is available for a Planning Run only. Sample IR Planning & Execution Runs follow:

07/1100	5.0	5.1	4.4
07/1200	5.0	5.0	4.3
07/1300	5.0	5.1	4.3
07/1400	5.1	5.0	3.7
07/1500	0.0	0.0	0.0

MDT TGT Temp (K)				
TIME (Z)	BKGND Temp (K)	NFOV	WFOV	Lock-on TGT Temp (K)
06/2100	321.5	326.6	326.8	319.7
06/2200	319.7	324.9	324.4	0.0
06/2300	316.6	321.8	321.6	318.5
07/0000	312.3	317.2	317.4	315.9
07/0100	307.6	312.6	312.6	311.7
07/0200	304.3	309.2	309.3	307.9
07/0300	303.2	308.1	308.3	306.3
07/0400	302.4	307.5	307.5	305.3
07/0500	301.6	306.8	306.3	304.5
07/0600	299.6	304.6	304.8	303.2
07/0700	298.1	303.1	303.1	302.4
07/0800	297.3	302.3	302.3	301.7
07/0900	296.5	301.5	301.5	300.9
07/1000	295.8	300.8	300.8	300.2
07/1100	295.2	300.2	300.2	299.5
07/1200	294.5	299.5	299.5	298.9
07/1300	294.4	299.4	299.5	298.7
07/1400	297.1	302.2	302.1	300.8
07/1500	301.7	0.0	0.0	0.0

- 0.0 -> No value computed.
- 1.0 -> No solution possible.
- 2.0 -> Sensor is above overcast.
- # -> Reduce sensor height (xxx hft).

TIME (Z)	IR VIS (kft)	4 km TRANS	ABS HUM (g/m**3)	SKY TEMP (K)
06/2100	154.8	0.80	9.2	256.0
06/2200	154.8	0.80	9.2	255.9
06/2300	154.7	0.80	9.2	255.6
07/0000	154.7	0.80	9.3	255.2
07/0100	154.6	0.80	9.3	254.7
07/0200	154.6	0.80	9.3	254.4
07/0300	154.5	0.80	9.4	254.2

**APPENDIX C
(OUTPUT)**

TIME (Z)	IR VIS (kft)	4 km TRANS	ABS HUM (g/m**3)	SKY TEMP (K)
07/0400	154.5	0.80	9.4	254.0
07/0500	154.5	0.80	9.4	253.8
07/0600	154.4	0.80	9.4	244.2
07/0700	154.3	0.80	9.5	244.0
07/0800	154.3	0.80	9.5	243.8
07/0900	154.3	0.80	9.5	243.6
07/1000	154.2	0.80	9.5	243.4
07/1100	154.2	0.80	9.5	243.2
07/1200	154.2	0.80	9.6	243.0
07/1300	154.2	0.80	9.6	243.1
07/1400	154.3	0.80	9.5	243.6
07/1500	154.3	0.80	9.4	244.1

SOLAR/LUNAR

SOLAR POSITION			LUNAR POSITION		
TIME (Z)	ELEV	AZ	ELEV	AZ	PHASE
06/2100	57.4	220.7	-40.0	78.1	93%
06/2200	47.7	239.4	-27.9	86.8	94%
06/2300	36.2	252.2	-15.8	94.5	94%
07/0000	23.8	261.9	-3.7	101.9	94%
07/0100	11.2	270.3	8.1	109.8	94%
07/0200	-1.4	278.4	19.3	118.8	95%
07/0300	-13.7	286.8	29.6	129.8	95%
07/0400	-25.4	296.6	38.2	143.6	95%
07/0500	-36.1	308.8	44.1	161.1	95%
07/0600	-44.8	324.8	46.1	181.3	95%
07/0700	-50.1	345.5	43.8	201.5	95%
07/0800	-50.8	9.0	37.8	218.8	95%
07/0900	-46.5	30.7	29.1	232.6	96%
07/1000	-38.4	47.8	18.8	243.5	96%
07/1100	-28.2	60.8	7.6	252.6	96%
07/1200	-16.0	71.1	-4.2	260.7	96%
07/1300	-4.4	79.8	-16.2	268.5	96%
07/1400	8.1	87.9	-28.2	276.7	96%
07/1500	20.7	96.2	-39.9	286.4	97%

SECURITY CLASSIFICATION:

IR EXECUTION SUMMARY

7 Sep 1995 0100 Z **Sen ID:** 100 **Abs Hum:**9.3 (g/m**3)
32°39' N 114°37' W **Sen Ht:** 100.0 hft **4 km Trans:** 0.8
Sky Temp: 254.8 (K)
IR Vis: 154.6 (kft)

MET INPUT

Comment: OAS I **Bndy Lyr:** 1 hft
Date: 6/ 9/95 **UL Def?** Yes
Lat/Long: 32°39' N/114°37' W
Temperature: 79/103/ 80 F
Dewpoint: 52 F
Aer: 5 Desert

KNYL TAF 1515 VRB05KT 48000 SCT250 QNH2986INS
TEMPO 1602 BKN250 CIG250
BECMG 1820 16010KT 48000 SCT060 SCT250 QNH2979INS
BECMG 0406 VRB05KT 32000 SKC QNH2980INS;

OPS/INTEL INPUT

COMMENT: OAS I

TYPE IR **ELEV** 800.0 ft MSL **ALBEDO** 3 DESERT
SENSOR ID 100 **1.TARGET** 11 T80 TANK **1.BKGD** 2 SOIL
VIEW DIR 90 deg **HEADING** 180 deg **SLOPE** 0 deg
SENSOR HT 100.0 hft **POSITION** N/A **DIR** N/A deg
COMPLEXITY LOW **OP STATE** EXER
SPEED 10 kts **2.BKGD** 0 UNDEF
2.TARGET 0 UNDEF **SLOPE** 0 deg
HEADING 0 deg **DIR** N/A deg
POSITION N/A **3.BKGD** 0 UNDEF
OP STATE N/A **SLOPE** 0 deg
SPEED N/A kts **DIR** N/A deg

Soil Parameters: Type Surface Moisture Depth Moisture
Sand Dry Dry

TARGET 1: T80 TANK **TGT HEADING:** 180 deg

BACKGROUND 1: SOIL **View Dir:** 90 deg

Soil Parameters: Type Surface Moisture Depth Moisture
Sand Dry Dry

**APPENDIX C
(OUTPUT)**

VIEW DIR	MDT Det Rng (kft)		Lock-on Rng
(deg)	NFOV	WFOV	(kft)
0	41.1	23.8	38.0
45	40.5	23.8	40.5
90	31.8	19.5	39.2
135	55.8	28.1	54.6
180	52.1	26.3	52.1
225	50.9	26.9	50.9
270	25.7	17.1	39.2
315	32.5	20.2	39.2

VIEW DIR	MDT Delta-T (K)		Lock-on Delta-T
(deg)	NFOV	WFOV	(K)
0	3.4	3.2	3.4
45	5.0	4.9	3.9
90	5.0	5.1	4.1
135	5.0	5.2	5.2
180	4.9	4.9	4.9
225	4.8	5.8	4.8
270	5.2	5.2	2.5
315	5.0	4.9	2.7

VIEW DIR	BKGND	MDT TGT Temp (K)		Lock-on TGT
(deg)	Temp (K)	NFOV	WFOV	Temp (K)
0	308.8	312.2	312.0	312.2
45	308.8	313.8	313.7	312.6
90	308.8	313.8	313.9	312.8
135	308.8	313.7	314.0	314.0
180	308.8	313.7	313.7	313.7
225	308.8	313.6	314.6	313.6
270	308.8	313.9	314.0	311.3
315	308.8	313.8	313.7	311.5

- 0.0 -> No value computed.
- 1.0 -> No solution possible.
- 2.0 -> Sensor is above overcast.
- # -> Reduce sensor height (xxx hft).

IR EOTDA OUTPUT DESCRIPTION

- 1. MDT Range** - Distance from IR sensor to target where probability of target detection is 50%. Detection range of target is based on Minimum Detectable Temperature (MDT), also called "hot spot / cold spot", describes the situation in which the target is detected as an unresolved spot or blob that stands out from the background by virtue of its contrast.
- 2. MRT Range** - Distance from IR sensor to target where probability of target detection is 50%. Detection range of target is based on Minimum Resolvable Temperature (MRT), where the target is perceived as a definite shape, possibly mottled in gray shade, that is distinguishable from its surroundings.
- 3. Lock-On Range** - Distance from IR sensor to target where probability of target acquisition is 50%.
- 4. MDT Temp** - Temperature of target at MDT detection range.
- 5. MRT Temp** - Temperature of target at MRT detection range.
- 6. Lock-On Temp** - Temperature of target at Lock-On range.
- 7. MDT Delta T** - Temperature difference between target and background at MRT detection range.
- 8. MRT Delta T** - Temperature difference between target and background at MRT detection range.
- 9. Lock-On Delta T** - Temperature difference between target and background at Lock-On range.
- 10. IR Visibility** - MRT detection range for an "average" FLIR viewing a target of "standard" size and inherent contrast in a moderately cluttered scene.
- 11. Absolute Humidity** - Amount of moisture in the air.
- 12. 4 km Transmissivity** - Probability of transmission through a 4 kilometer slant path at a sensor height of 125 meters.
- 13. Solar Position** - Azimuth angle and elevation angle of the sun.
- 14. Lunar Position** - Azimuth angle, elevation angle, and phase of the moon.

**APPENDIX C
(OUTPUT)**

TV ALPHANUMERIC OUTPUT PRODUCTS

This Product Selection Menu (PSM) for the TV alphanumeric output is shown in Figure C-2.

• MET INPUT	Method
	<ul style="list-style-type: none"> • DETECTION • LOCK-ON
• OPS INPUT	
• DATE/LOCATION	Target
	<ul style="list-style-type: none"> • T80 TANK BRDM
• RANGES	
• NORM BRIGHTNESS	Background
	<ul style="list-style-type: none"> • SOIL VEGETATION CONCRETE
• 4 KM TRANS	
• SOLAR/LUNAR	FOV
	<ul style="list-style-type: none"> • NARROW • WIDE

Figure C-2: A Sample TV Product Selection Menu for a Passive Sensor with various output products selected.

The marks (•) indicate which items are selected. The EOTDA automatically produces output for the number of FOV and the number of methods supported by your sensor. For passive TV sensors, ranges are reported for the target in direct and diffuse light for each FOV, each method, each background, and each target. Normalized brightness for the target, shadow, and background are also produced for direct and diffuse lighting situations for each background. The 4 km Trans output product includes transmissivity at a range of 4 km, the probability that the target scene is illuminated by direct light, and the ground illuminance. The solar / lunar information includes solar and lunar elevation and azimuth angles and lunar phase. Sample TV Planning & Execution Runs follow:

SECURITY CLASSIFICATION:

TV PLANNING SUMMARY

6 - 7 Sep 1995 **Sen ID:** 304
32° 39' N 114° 37' W **Sen Ht:** 100.0 hft **View Dir:** 90 deg

MET INPUT

Comment: OAS I **Bndy Lyr** 1 hft
Date: 6/ 9/95 **UL Def?** Yes
Lat/Long: 32°39' N/114°37' W
Temperature: 79/103/ 80 F
Dewpoint: 52 F
Aer: 5 Desert

KNYL TAF 1515 VRB05KT 48000 SCT250 QNH2986INS
TEMPO 1602 BKN250 CIG250
BECMG 1820 16010KT 48000 SCT060 SCT250 QNH2979INS
BECMG 0406 VRB05KT 32000 SKC QNH2980INS;

=====

OPS/INTEL INPUT

COMMENT: OAS I

TYPE TV	ELEV 800.0 ft MSL	ALBEDO 3 DESERT
SENSOR ID 304	1.TARGET 11 T80 TANK	1.BKGD 2 SOIL
VIEW DIR 90 deg	HEADING 180 deg	SLOPE 0 deg
SENSOR HT 100.0 hft	POSITION N/A	DIR N/A deg
COMPLEXITY LOW	OP STATE EXER	
	SPEED 10 kts	2.BKGD 0 UNDEF
		SLOPE 0 deg
	2.TARGET 0 UNDEF	DIR N/A deg
	HEADING 0 deg	
	POSITION N/A	3.BKGD 0 UNDEF
	OP STATE N/A	SLOPE 0 deg
	SPEED N/A kts	DIR N/A deg

Soil Parameters: Type Surface Moisture Depth Moisture
 Sand Dry Dry

**APPENDIX C
(OUTPUT)**

TARGET 1: T80 TANK

TGT HEADING: 180 deg

DETECTION AND LOCK-ON RANGES (kft)

BACKGROUND 1: SOIL

NFOV TIME (Z)	DETECTION		LOCK-ON	
	DIRECT	DIFFUSE	DIRECT	DIFFUSE
06/1500	21.8	21.2	20.6	20.6
06/1600	21.8	21.2	20.6	20.6
06/1700	21.8	21.2	20.6	20.6
06/1800	22.4	21.8	20.6	20.6
06/1900	21.8	21.2	20.6	20.6
06/2000	21.8	21.2	20.6	19.9
06/2100	21.8	21.2	20.6	19.9
06/2200	21.8	20.6	20.6	19.3
06/2300	21.2	19.3	19.9	18.1
07/0000	20.6	19.3	19.3	18.1
07/0100	21.2	20.6	19.9	19.3
07/0200	-1.0	-1.0	-1.0	0.0
07/0300	-1.0	-1.0	-1.0	0.0
07/0400	-1.0	-1.0	-1.0	0.0
07/0500	-1.0	-1.0	-1.0	0.0
07/0600	-1.0	0.0	-1.0	0.0
07/0700	-1.0	0.0	-1.0	0.0
07/0800	-1.0	0.0	-1.0	0.0
07/0900	-1.0	0.0	-1.0	0.0
07/1000	-1.0	0.0	-1.0	0.0
07/1100	-1.0	0.0	-1.0	0.0
07/1200	0.0	-1.0	0.0	0.0
07/1300	0.0	-1.0	0.0	0.0
07/1400	21.2	0.0	20.6	0.0
07/1500	21.8	0.0	20.6	0.0

- 0.0 -> No value computed.
- 1.0 -> Range is < = sensor height.
- 2.0 -> Sensor is above overcast.

NORMALIZED BRIGHTNESS AT 4KM

BACKGROUND 1: SOIL

TIME (Z)	DIRECT LIGHT			DIFFUSE LIGHT		
	TARGET	SHADOW	BKGND	TARGET	SHADOW	BKGND
06/1500	0.38	0.71	1.00	0.48	0.99	1.00
06/1600	0.35	0.61	1.00	0.47	0.93	1.00
06/1700	0.34	0.56	1.00	0.46	0.87	1.00
06/1800	0.34	0.54	1.00	0.46	0.83	1.00
06/1900	0.36	0.54	1.00	0.48	0.82	1.00
06/2000	0.37	0.57	1.00	0.56	0.00	1.00
06/2100	0.42	0.61	1.00	0.60	0.00	1.00
06/2200	0.48	0.66	1.00	0.65	0.00	1.00
06/2300	0.50	0.69	1.00	0.66	0.00	1.00
07/0000	0.49	0.73	1.00	0.60	0.00	1.00
07/0100	0.48	0.86	1.00	0.51	0.00	1.00
07/0200	0.19	1.00	1.00	0.19	0.00	1.00
07/0300	0.34	0.64	1.00	0.47	0.00	1.00
07/0400	0.34	0.59	1.00	0.49	0.00	1.00
07/0500	0.34	0.58	1.00	0.50	0.00	1.00
07/0600	0.37	0.55	1.00	0.00	0.00	0.00
07/0700	0.42	0.58	1.00	0.00	0.00	0.00
07/0800	0.47	0.64	1.00	0.00	0.00	0.00
07/0900	0.52	0.70	1.00	0.00	0.00	0.00
07/1000	0.54	0.79	1.00	0.00	0.00	0.00
07/1100	0.50	0.95	1.00	0.00	0.00	0.00
07/1200	0.00	0.00	0.00	0.16	0.00	1.00
07/1300	0.00	0.00	0.00	0.21	0.00	1.00
07/1400	0.46	0.94	1.00	0.00	0.00	0.00
07/1500	0.39	0.70	1.00	0.00	0.00	0.00

TIME (Z)	PROB IN DIR	4KM TRAN	ILLUMINANCE (fc)
06/1500	64%	0.85	3.23e+005
06/1600	70%	0.85	5.75e+005
06/1700	73%	0.85	7.84e+005
06/1800	75%	0.85	9.23e+005
06/1900	76%	0.85	9.93e+005
06/2000	59%	0.85	9.52e+005
06/2100	57%	0.85	8.93e+005
06/2200	55%	0.85	7.64e+005
06/2300	51%	0.85	5.70e+005
07/0000	44%	0.85	3.38e+005

**APPENDIX C
(OUTPUT)**

TIME (Z)	PROB IN DIR	4KM TRAN	ILLUMINANCE (fc)
07/0100	28%	0.85	1.23e+005
07/0200	40%	0.85	2.88e+003
07/0300	48%	0.85	6.81e-001
07/0400	52%	0.85	8.93e-001
07/0500	54%	0.85	1.05e+000
07/0600	100%	0.85	1.24e+000
07/0700	100%	0.85	1.20e+000
07/0800	100%	0.85	1.05e+000
07/0900	100%	0.85	8.05e-001
07/1000	100%	0.85	4.85e-001
07/1100	100%	0.85	1.69e-001
07/1200	0%	0.85	2.60e-002
07/1300	0%	0.85	1.87e+002
07/1400	100%	0.85	1.08e+005
07/1500	100%	0.85	3.49e+005

SOLAR/LUNAR

TIME (Z)	SOLAR POSITION (deg)		LUNAR POSITION (deg)		
	ELEV	AZ	ELEV	AZ	PHASE
06/1500	20.8	95.8	-52.3	292.7	91%
06/1600	33.2	105.1	-62.5	310.5	92%
06/1700	45.0	116.9	-69.2	340.7	92%
06/1800	55.3	133.9	-69.0	20.4	93%
06/1900	62.4	159.6	-61.8	49.6	93%
06/2000	63.2	192.6	-51.5	66.8	93%
06/2100	57.4	220.7	-40.0	78.1	93%
06/2200	47.7	239.4	-27.9	86.8	94%
06/2300	36.2	252.2	-15.8	94.5	94%
07/0000	23.8	261.9	-3.7	101.9	94%
07/0100	11.2	270.3	8.1	109.8	94%
07/0200	-1.4	278.4	19.3	118.8	95%
07/0300	-13.7	286.8	29.6	129.8	95%
07/0400	-25.4	296.6	38.2	143.6	95%
07/0500	-36.1	308.8	44.1	161.1	95%
07/0600	-44.8	324.8	46.1	181.3	95%
07/0700	-50.1	345.5	43.8	201.5	95%
07/0800	-50.8	9.0	7.8	218.8	95%
07/0900	-46.5	30.7	29.1	232.6	96%
07/1000	-38.4	47.8	18.8	243.5	96%
07/1100	-28.2	60.8	7.6	252.6	96%
07/1200	-16.7	71.1	-4.2	260.7	96%
07/1300	-4.4	79.8	-16.2	268.5	96%
07/1400	8.1	87.9	-28.2	276.7	96%

SECURITY CLASSIFICATION:

TV EXECUTION SUMMARY

7 Sep 1995 0800 Z
32°39' N 114°37' W

Sen ID: 304
Sen Ht: 100.0 hft **View Dir:** 90 deg

MET INPUT

Comment: OAS I **Bndy Lyr** 1 hft
Date: 6/ 9/95 **UL Def?** Yes
Lat/Long: 32°39' N/114°37' W
Temperature: 79/103/80 F
Dewpoint: 52 F
Aer: 5 Desert

KNYL TAF 1515 VRB05KT 48000 SCT250 QNH2986INS
TEMPO 1602 BKN250 CIG250
BECMG 1820 16010KT 48000 SCT060 SCT250 QNH2979INS
BECMG 0406 VRB05KT 32000 SKC QNH2980INS;

=====

OPS/INTEL INPUT

COMMENT: OAS I

TYPE TV	ELEV 800.0 ft MSL	ALBEDO 3 DESERT
SENSOR ID 304	1.TARGET 11 T80 TANK	1.BKGD 2 SOIL
VIEW DIR 90 deg	HEADING 180 deg	SLOPE 0 deg
SENSOR HT 100.0 hft	POSITION N/A	DIR N/A deg
COMPLEXITY LOW	OP STATE EXER	
	SPEED 10 kts	2.BKGD 0 UNDEF
		SLOPE 0 deg
	2.TARGET 0 UNDEF	DIR N/A deg
	HEADING 0 deg	
	POSITION N/A	3.BKGD 0 UNDEF
	OP STATE N/A	SLOPE 0 deg
	SPEED N/A kts	DIR N/A deg

Soil Parameters:	Type	Surface Moisture	Depth	Moisture
	Sand	Dry		Dry

**APPENDIX C
(OUTPUT)**

TARGET 1: T80 TANK

TGT HEADING: 180 deg

DETECTION AND LOCK-ON RANGES (kft)

BACKGROUND 1: SOIL

VIEW DIR (deg)	NFOV DETECTION		LOCK-ON	
	DIRECT	DIFFUSE	DIRECT	DIFFUSE
0	18.7	17.5	17.5	16.3
45	21.2	20.6	19.9	19.3
90	21.8	21.2	20.6	19.9
135	21.8	20.6	20.6	19.9
180	18.7	18.1	17.5	16.9
225	21.8	20.6	20.6	19.9
270	21.8	21.2	20.6	19.9
315	21.8	20.6	19.9	19.3

0.0 -> No value computed.
 -1.0 -> Range is <= sensor height.
 -2.0 -> Sensor is above overcast.

=====

SOLAR/LUNAR

TIME (Z)	SOLAR POSITION (deg)		LUNAR POSITION (deg)		
	ELEV	AZ	ELEV	AZ	PHASE
06/2000	63.2	192.6	51.5	66.8	93%

TV EOTDA OUTPUT DESCRIPTION

- 1. Detection Range (Diffuse)** - Distance from the television or direct view sensor to the target where probability of target detection is 50% when the target is in the shade from a cloud.
- 2. Detection Range (Direct)** - Distance from the television or direct view sensor to the target where probability of target detection is 50% when the target is in sunlight.
- 3. Lock-On Range (Diffuse)** - Distance from sensor to the target where a 50% probability of acquisition exists when the target is in the shade of a cloud.
- 4. Lock-On Range (Direct)** - Distance from sensor to the target where a 50% probability of acquisition exists when the target is in sunlight.
- 5. Normalized Brightness** - Comparison of brightness of target, background, and shadow, such that the brightest object equals one (1.00) and the darkest object equals zero (0.00).
- 6. Illuminance** - Ground illuminance in millilux.
- 7. 4 km Transmissivity** - Probability of transmission through a 4 km slant path at a sensor of 125 meters.
- 8. Solar Position** - Azimuth angle and elevation angle of the sun.
- 9. Lunar Position** - Azimuth angle and elevation angle of the moon.

**APPENDIX C
(OUTPUT)**

LASER ALPHANUMERIC OUTPUT PRODUCTS

The Product Selection Menu (PSM) is shown in Figure C-3.

<ul style="list-style-type: none"> • MET INPUT • OPS INPUT 	Target
	<ul style="list-style-type: none"> • T80 TANK BRDM
<ul style="list-style-type: none"> • DATE/LOCATION • RANGES 	Background
	<ul style="list-style-type: none"> • SOIL VEGETATION CONCRETE
4 KM TRANS	
<ul style="list-style-type: none"> • SOLAR/LUNAR 	

Figure C-3: A Sample Laser Product Selection Menu with various output products selected.

The mark (•) indicates which items are selected. Ranges are available for each target and, if applicable, each background. Solar/lunar information, including solar and lunar elevation and azimuth angles and lunar phase, are also provided. A sample Laser Planning Run follows:

SECURITY CLASSIFICATION:

LASER PLANNING SUMMARY

6 - 7 Sep 1995

32° 39' N 114° 37' W

MODE 1

Ranger - **Ranger Height:** - hft

Receiver 501 **Receiver Height:** 100.0 hft **Receiver Range** -km

Designator 703 **Designator Height:** 0.6 hft **Designator Range** 1.5 km

===== **Continued Next Page** =====

MET INPUT

Comment: OAS I **Bndy Lyr:** 1 hft
Date: 6/9/95 **UL Def?** Yes
Lat/Long: 32°39' N/114°37' W
Temperature: 79/103/ 80 F
Dewpoint: 52 F
Aer: 5 Desert

KNYL TAF 1515 VRB05KT 48000 SCT250 QNH2986INS
TEMPO 1602 BKN250 CIG250
BECMG 1820 16010KT 48000 SCT060 SCT250 QNH2979INS
BECMG 0406 VRB05KT 32000 SKC QNH2980INS;

OPS/INTEL INPUT

COMMENT: OAS I

TYPE LASER	ELEV 800.0 ft MSL	ALBEDO 3 DESERT
SYSTEM MODE 1	1.TARGET 11 T80 TANK	1.BKGD 2 SOIL
DESIGNATOR ID 703	HEADING 180 deg	SLOPE 0 deg
RECEIVER ID 501	POSITION N/A	DIR N/A deg
RANGER ID N/A	OP STATE EXER	
DESIGNATOR HT 0.6 hft	SPEED 10 kts	2.BKGD 0 UNDEF
RECEIVER HT 10.0 hft		SLOPE 0 deg
RANGER HT N/A hft	2.TARGET 0 UNDEF	DIR N/A deg
COLOCATED HT N/A hft	HEADING 0 deg	
DESIGNATOR RNG 4.9 kft	POSITION N/A	3.BKGD 0 UNDEF
RECEIVER RNG N/A kft	OP STATE N/A	SLOPE 0 deg
	SPEED N/A kts	DIR N/A deg

Soil Parameters:	Type	Surface Moisture	Depth	Moisture
	Sand	Dry		Dry

**APPENDIX C
(OUTPUT)**

TARGET 1: T80 TANK

TIME (Z)	RECEIVER RANGES (kft)
06/1500	142.0
06/1600	143.2
06/1700	144.2
06/1800	145.1
06/1900	145.7
06/2000	145.8
06/2100	146.0
06/2200	145.8
06/2300	145.4
07/0000	144.8
07/0100	143.9
07/0200	143.3
07/0300	142.9
07/0400	142.5
07/0500	142.2
07/0600	140.5
07/0700	140.1
07/0800	139.7
07/0900	139.4
07/1000	139.0
07/1100	138.6
07/1200	138.1
07/1300	138.2
07/1400	139.3
07/1500	140.5

- 0.0 -> No value computed.
- 1.0 -> Range is <= sensor height.
- 2.0 -> Sensor above overcast.
- 3.0 -> Receiver range too long for valid range.

SOLAR/LUNAR

TIME (Z)	SOLAR POSITION (deg)		LUNAR POSITION (deg)		PHASE
	ELEV	AZ	ELEV	AZ	
06/1500	20.8	95.8	-52.3	292.7	91%
06/1600	33.2	105.1	-62.5	310.5	92%
06/1700	45.0	116.9	-69.2	340.7	92%
06/1800	55.3	133.9	-69.0	20.4	93%
06/1900	62.4	159.6	-61.8	49.6	93%
06/2000	63.2	192.6	-51.5	66.8	93%
06/2100	57.4	220.7	-40.0	78.1	93%
06/2200	47.7	239.4	-27.9	86.8	94%
06/2300	36.2	252.2	-15.8	94.5	94%
07/0000	23.8	261.9	-3.7	101.9	94%
07/0100	11.2	270.3	8.1	109.8	94%
07/0200	-1.4	278.4	19.3	118.8	95%
07/0300	-13.7	286.8	29.6	129.8	95%
07/0400	-25.4	296.6	38.2	143.6	95%
07/0500	-36.1	308.8	44.1	161.1	95%
07/0600	-44.8	324.8	46.1	181.3	95%
07/0700	-50.1	345.5	43.8	201.5	95%
07/0800	-50.8	9.0	37.8	218.8	95%
07/0900	-46.5	30.7	29.1	232.6	96%
07/1000	-38.4	47.8	18.8	243.5	96%
07/1100	-28.2	60.8	7.6	252.6	96%
07/1200	-16.7	71.1	-4.2	260.7	96%
07/1300	-4.4	79.8	-16.2	268.5	96%
07/1400	8.1	87.9	-28.2	276.7	96%
07/1500	20.7	96.2	-39.9	286.4	97%

APPENDIX C (OUTPUT)

LASER EOTDA OUTPUT DESCRIPTION

- 1. Ranging Ranges** - Maximum effective distance from the ranging system to a target, computed by measuring the round trip travel time of the laser pulse. The EOTDA measures three (3) different ranging systems, all which have the designator and receiver in the same hardware package.
- 2. Receiver Range** - Slant range distance from the target to the receiver, tells the user the maximum effective lock-on range for the receiver. The user must specify the range from the target to the designator.
- 3. Lock-On Designator Range** - Slant range distance from the designator to the target, tells the user the maximum effective lock-on range for the designator. The user must specify the range from the target to the receiver.
- 4. 4 km Transmissivity** - Probability of transmission through a 4 kilometer slant path at a sensor height of 125 meters.
- 5. Solar Position** - Azimuth angle and elevation angle of the sun.
- 6. Lunar Position** - Azimuth angle, elevation angle, and phase of the moon.

IR GRAPHIC OUTPUT PRODUCTS

Table C-1 lists the IR graphic output products. These are the parameters that determine plot type. Note that not all of these selections are available for all sensors. Range plots and delta-T plots may contain information for one or two targets against a single background, or single target against one or more backgrounds. Temperature plots contain data for one or two targets and one background. Sample IR Planning & Execution Plots are shown in Figures C-4 and C-5.

TABLE C-1

IR Graphic Output Products

TYPE
MDT Range
MRT Range
Lock-On Range
MDT Temperature
MRT Temperature
Lock-On Temperature
MDT dT
MRT dT
Lock-On dT
IR Visibility
Absolute Humidity
4 km Transmittance
Solar Azimuth
Solar Elevation
Lunar Azimuth
Lunar Elevation

APPENDIX C
(OUTPUT)

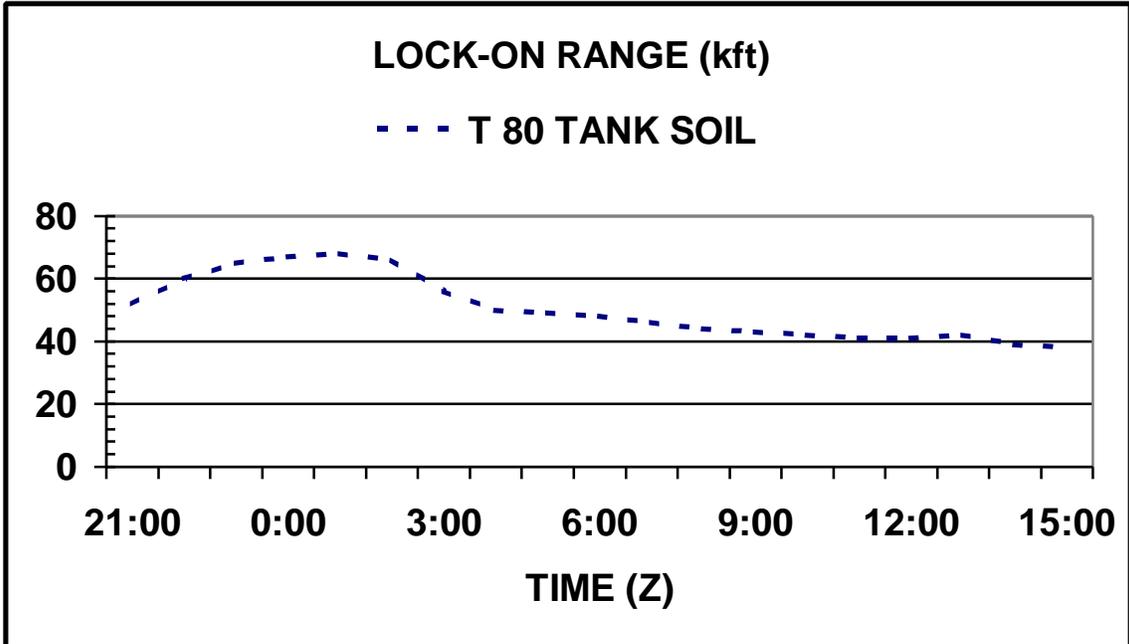


Figure C-4: Sample IR Planning Plot

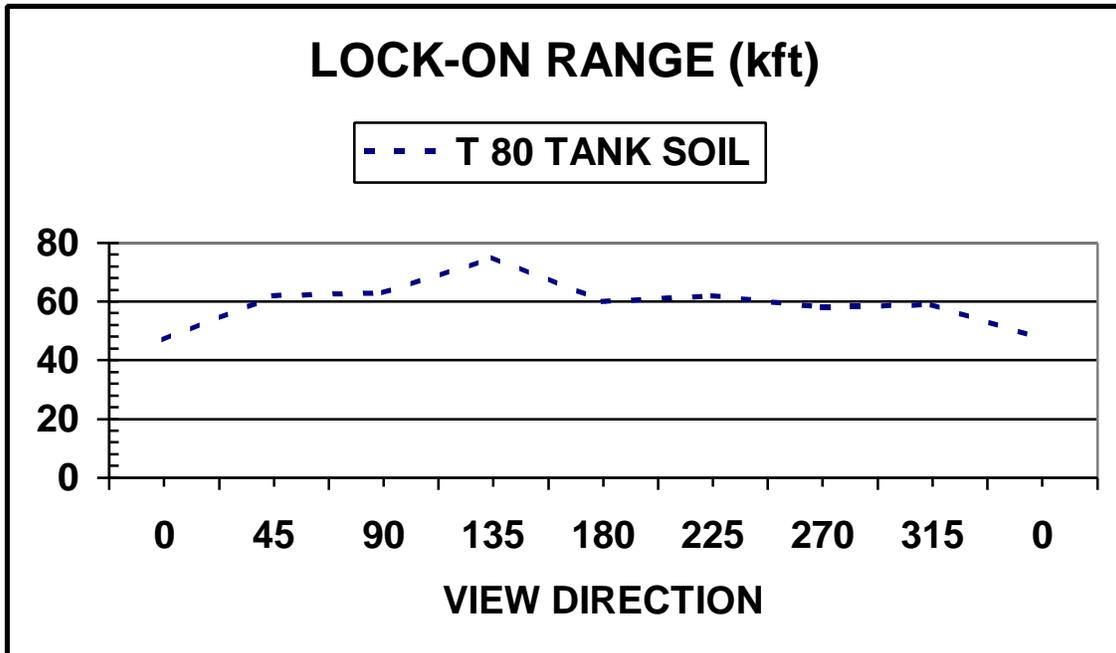


Figure C-5: Sample IR Execution Plot

TV GRAPHIC OUTPUT PRODUCTS

Table C-2 lists the TV graphic output products. These are the parameters that determine plot type. Note that not all of these selections are available for all sensors. Range plots may contain information for one or two targets against a single background, or a single target against one or more backgrounds. For passive sensors, ranges for the target in direct and diffuse light are available. For active systems, the lighting situation makes no difference. Therefore, only one set of ranges is available. Sample TV Planning & Execution Plots are shown in Figures C-6 and C-7.

TABLE C-2

TV Graphic Output Products

TYPE
Detection Range - Direct
Detection Range - Diffuse
Lock-On Range -Direct
Lock-On Range -Diffuse
4 km Transmissivity
Ground Illuminance
Solar Azimuth
Solar Elevation
Lunar Azimuth
Lunar Elevation

APPENDIX C
(OUTPUT)

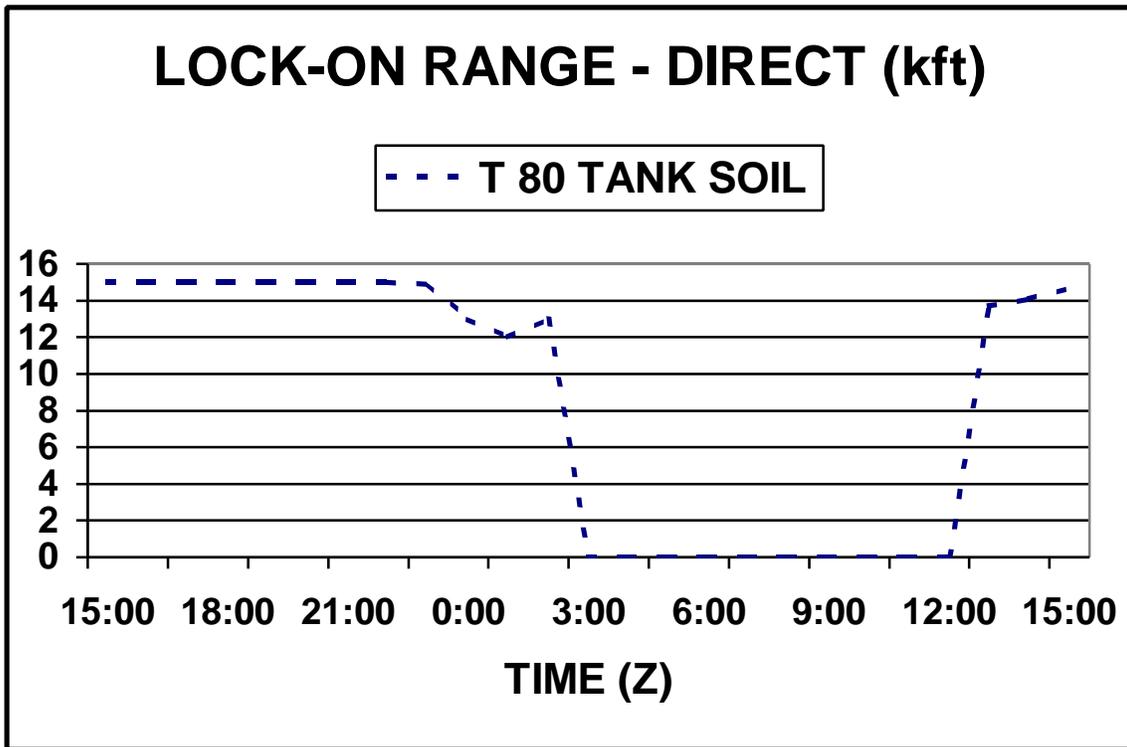


Figure C-6: Sample TV Planning Plot

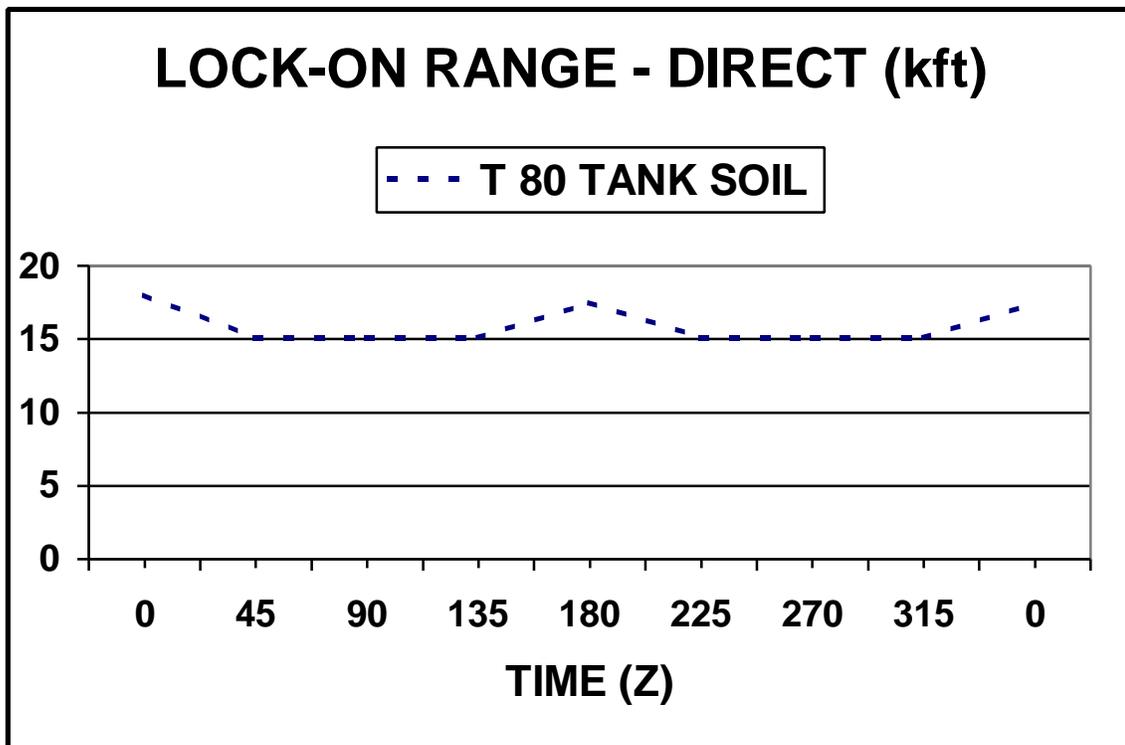


Figure C-7: Sample TV Execution Plot

LASER GRAPHIC OUTPUT PRODUCTS

Table C-3 lists the laser graphic output products. These are the parameters that determine the plot type. Note that not all of these selections are available for all sensors. Range plots may contain information for all of the targets and all of the backgrounds. A sample Laser Planning Plot is shown in Figure C-8.

TABLE C-3

Laser Graphic Output Products

TYPE
Lock-On Ranges
Ranging Ranges
4 km Transmissivity
Solar Azimuth
Solar Elevation
Lunar Azimuth
Lunar Elevation

APPENDIX C
(OUTPUT)

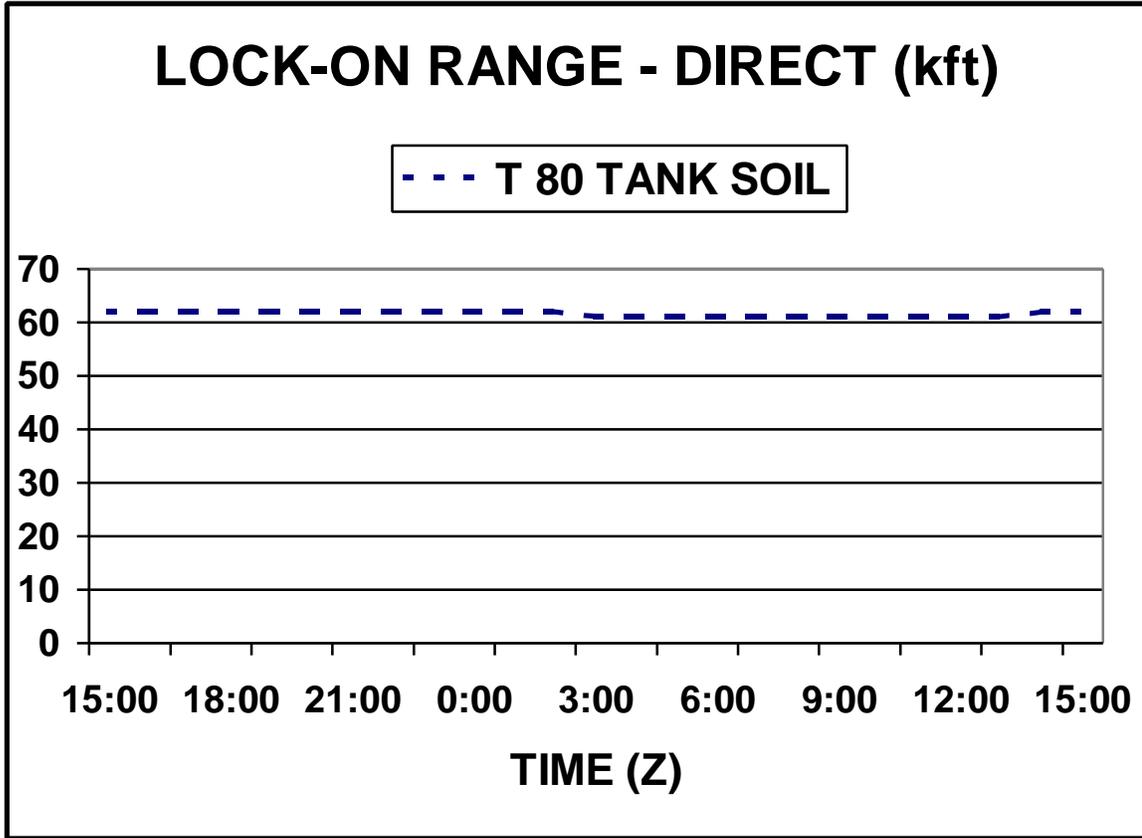


FIGURE C-8: Sample Laser Planning Plot

FIGURE C-9: Sample Fixed Wing Briefing Slide

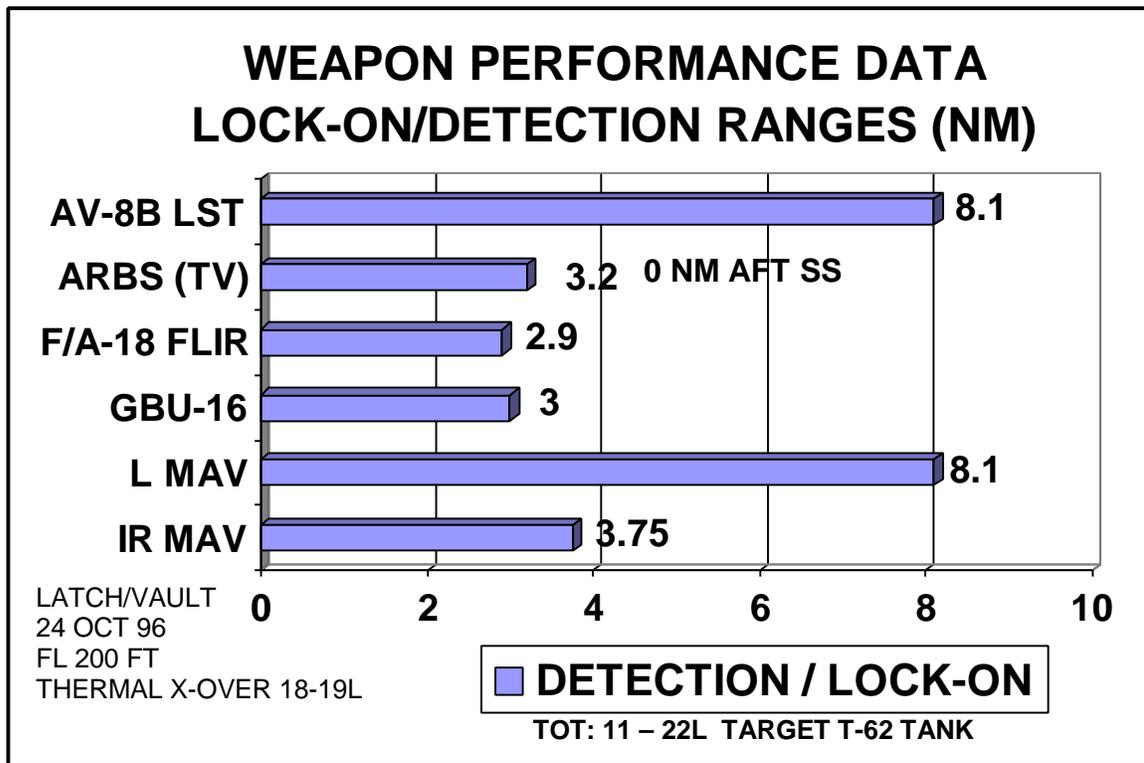


Figure C-9 is a typical fixed-wing briefing slide that is prepared and presented during WTI. The EOTDA software does not generate this slide. It is generated using Microsoft Power Point from the data taken from the alphanumeric output.

APPENDIX C
(OUTPUT)

FIGURE C-10: Sample Rotary Wing Briefing Slide

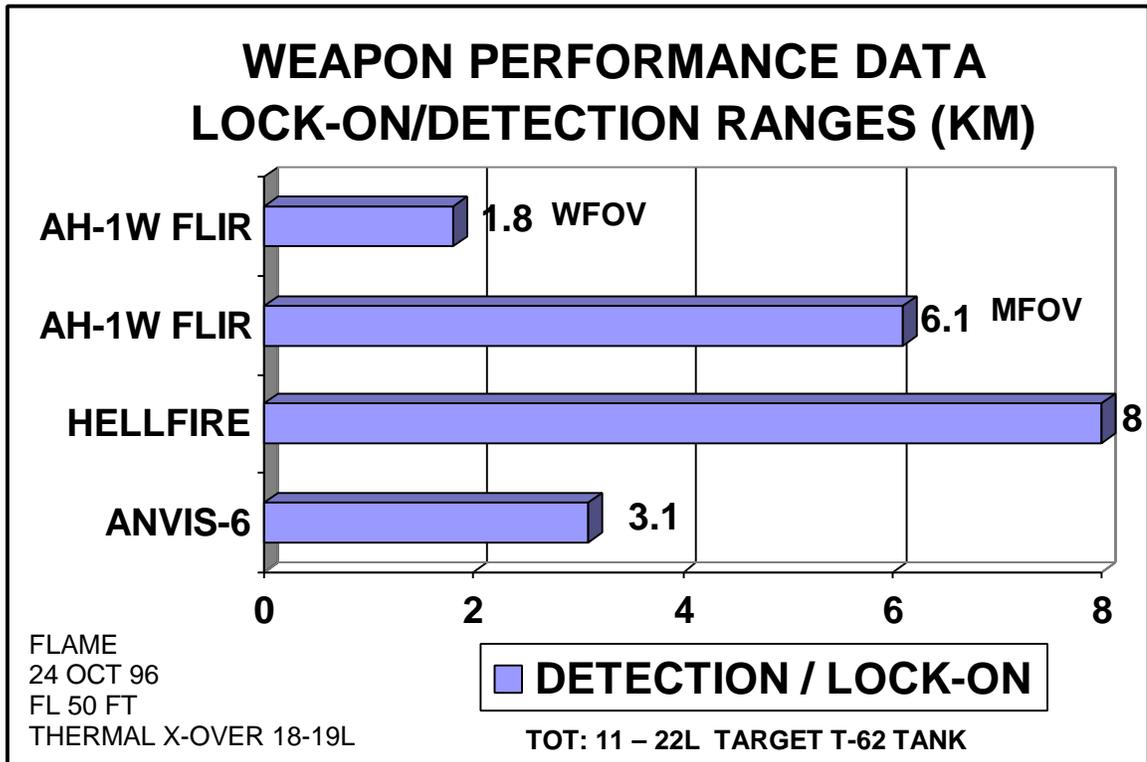


Figure C-10 is a typical rotary wing briefing slide that is prepared and presented during WTI. The EOTDA software does not generate this slide. It is generated using Microsoft Power Point from the data taken from the alphanumeric output.

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EOTDA WORKSHEET GUIDE

COMMENT:

A comment may be entered with up to twenty (20) numbers, letters, and spaces that are used to identify the Operational Data set.

SENSOR ID:

Check the box for each sensor that you would like an EOTDA for. Each sensor has a unique three-digit number associated with it. In most cases, the relationship between IR sensor ID numbers and specific systems names is classified at the **CONFIDENTIAL** level. For some of the IR sensors, system parameters and / or predicted ranges are classified at the **SECRET** level when associated with sensor name. This information is therefore classified, and located in the MAWTS-1 CMCC.

VIEW DIRECTION:

Describes the direction of the sensor heading in degrees clockwise relative to true north. For example, if the sensor is pointing westward, enter 270. Usually, this is the same as the "attack" heading of the aircraft. Because some systems are free to rotate, viewing direction is used for entry data rather than aircraft heading.

SENSOR HEIGHT:

Sensor height is the vertical distance above the earth's surface. If your operation involves a "pop-up" maneuver, choose the sensor height that best represents the situation at the point of anticipated detection or lock-on.

COMPLEXITY / CLUTTER:

The term "Complexity" is used for IR systems. Scene complexity characterizes the "Busyness" of the target scene and can have a significant effect on detection range. Complexity describes in general terms the number of objects or patterns in the immediate target vicinity that can be mistaken for the target.

-- A scene is considered to have no [none] complexity if it is virtually uniform on a scale comparable to target size.

-- A scene is considered to provide little [low] complexity if it has relatively few objects in the immediate target vicinity that can be mistaken for the target. Moreover, those objects will typically differ in shape from that of the target.

-- A scene is considered to have moderate [medium] complexity if it contains some confusing objects in the vicinity of the target. Generally the scene will tend to have fewer non-target candidates than highly complex scenes and the confusing objects will differ more in shape from the target.

-- A scene is considered to be complex [high], for purposes of target detection, if it contains many confusing objects or patterns which may be mistaken for targets. Moreover, the confusing patterns must be in the immediate target vicinity, usually within a few target dimensions of the actual target location.

The term "Clutter" is used for TV systems. TV clutter level describes the "busyness" of the target area, including both the number of objects comparable in size and shape to the target and the magnitude of the contrast between scene features. Judgments of clutter level must take both of these factors into consideration. Clutter is used only for Night Vision Goggles.

SYSTEM MODE:

This is used for Laser systems only. It is assumed that a laser designator is used to illuminate a target and a receiver picks up the reflected energy. The Laser TDA can be used to calculate ranging, designator, receiver, or collocated designator and receiver range. Mode defines the desired range:

-- Mode 1: Compute maximum lock-on receiver range; user specifies designator range; no ranging range.

-- Mode 2: Compute maximum designator range; user specifies lock-on receiver range; no ranging range.

-- Mode 3: Compute maximum range for collocated designator and lock-on receiver; no ranging range.

-- Mode 4: Compute maximum designator / ranger range; user specifies lock-on receiver range; designator and ranging system are collocated.

-- Mode 5: Compute maximum lock-on receiver / ranger range; user specifies designator range; lock-on receiver and ranging system are collocated.

-- Mode 6: Compute maximum range for collocated designator and lock-on receiver; compute ranging range; all sensors are collocated.

-- Mode 7: Compute ranging only.

DESIGNATOR / RECEIVER / COLLOCATED / RANGER ID:

Each system has a unique three-digit number associated with it. In most cases, the relationship between Laser sensor ID numbers and specific system names is classified at the **CONFIDENTIAL** level. For some of the Laser sensors, system parameters and / or predicted ranges are classified at the **SECRET** level when associated with sensor name. This information is therefore classified, and located in MAWTS - 1 CMCC.

ELEVATION:

Target elevation is the altitude above sea level of the target area. It is used in the IR model to compensate for the change in solar down-welling due to altitude.

TARGET ID:

Up to two targets can be considered simultaneously. There are two types of targets: (1) standard menu targets; and (2) user - specified generic targets. Each target has a unique number associated with it. The available targets and their associated numbers are listed on the bottom of the EOTDA worksheet.

HEADING:

The target heading is the direction that the front of the target is facing, in degrees clockwise relative to north. For example, enter 270 for a target that faces west. Heading is used as a reference in the computation of parameters such as apparent target size, viewable target facets, heating, and shadow size.

OPERATING STATE:

The EOTDA supports three operating states for ground vehicles: off, idle, and exercised. There are two operating states for the helicopters: off and hovering. The generator has two operating states: off and idle. Operating state is not required input for the ships, the F-4, or the high value targets.

SPEED:

Vehicle speed is required only for mobile targets. Wind speed and target motions have a cooling effect on the target.

BACKGROUND SLOPE / BACKGROUND DIRECTION:

The direction and slope of the immediate background is used in the TV model to account for the target masking (target hidden from view behind a terrain feature) and reflected illumination onto the target. The direction of the down-slope of a sloped background is specified in degrees relative to true north.

ALBEDO:

The general target area reflectivity is the albedo. Albedo has a weak influence in the computation of ranges for the IR model. The EOTDA supports five categories of terrain types. The available choices are listed on the second page of the EOTDA worksheet.

BACKGROUND ID:

The background is the area immediately surrounding the target. The EOTDA supports eight generic background types. Each background type has a set of entries that provide specific information. Refer to the second page of the EOTDA worksheet for generic background types and parameters.

EOTDA WORKSHEET

<p><u>SENSOR</u></p> <input type="checkbox"/> ANVIS-6 <input type="checkbox"/> CATSEYES <input type="checkbox"/> AV-8B (TV-ARBS) <input type="checkbox"/> WALLEYE I/II <input type="checkbox"/> AV-8B NAVFLIR <input type="checkbox"/> F/A-18 FLIR <input type="checkbox"/> CH-53E FLIR <input type="checkbox"/> NTS FLIR <input type="checkbox"/> WIDE <input type="checkbox"/> MEDIUM <input type="checkbox"/> NARROW <input type="checkbox"/> NTS LASER <input type="checkbox"/> HELLFIRE SEEKER <input type="checkbox"/> MAVERICK SEEKER <input type="checkbox"/> LASER <input type="checkbox"/> IR <input type="checkbox"/> MULE <input type="checkbox"/> F/A-18 LTDR <input type="checkbox"/> AV-8B (LST-ARBS) <input type="checkbox"/> LGB/GBU	VIEW DIRECTION = _____ DEG TRUE SENSOR/DESIGNATOR HEIGHT = _____ (10-40,000 FT AGL)	
	<p align="center"><u>COMPLEXITY/CLUTTER</u></p> NO. OF OBJECTS OR PATTERNS IN THE IMMEDIATE TARGET VICINITY THAT CAN BE MISTAKEN FOR THE TARGET <input type="checkbox"/> NONE <input type="checkbox"/> LOW <input type="checkbox"/> MEDIUM <input type="checkbox"/> HIGH	<p align="center"><u>REQUESTER INFORMATION</u></p> NAME: _____ DATE (FOR DATA): _____ TIME (NEEDED): _____
	TYPE LASER DESIGNATOR	RANGE FROM TARGET (KFT OR KM)
TYPE LASER RECEIVER	RANGE FROM TARGET (KFT OR KM)	LASER RECEIVER HEIGHT

LASER MODES

 MODE 1 COMPUTE THE MAX LOCK-ON RECEIVER RANGE, DESIGNATION RANGE = _____ KM
 MODE 2 COMPUTE MAX DESIGNATOR RANGE, LOCK-ON RECEIVER RANGE = _____ KM
 MODE 3 COMPUTE MAX RANGE FOR CO-LOCATED DESIGNATOR AND LOCK-ON RECEIVER
 MODE 4 COMPUTE MAX DESIG/RNGFIND RANGE, LOCK-ON RECEIVER RANGE = _____ KM
 MODE 5 COMPUTE MAX LOCK-ON RECEIVER/RNGFIND RANGE, DESIGNATOR RANGE = _____ KM
 MODE 6 COMPUTE MAX RANGE FOR CO-LOCATED DESIG, LOCK-ON RECEIVER, AND RANGEFINDER
 MODE 7 COMPUTE RANGEFINDER RANGE ONLY

<p align="center"><u>TARGET INFORMATION</u></p> HEADING = _____ DEG TRUE LOCATION _____ SPEED = _____ (0-40 KTS) (LAT/LONG) ELEVATION = _____ MSL TIME ON TARGET _____ (ZULU)		<p align="center"><u>OPERATING STATE</u></p> <p><u>HELICOPTERS</u></p> <input type="checkbox"/> OFF <input type="checkbox"/> HOVERING
	<p><u>TARGET TYPE</u></p> <input type="checkbox"/> T-62 TANK (#1) <input type="checkbox"/> BRDM – 2 (#5) <input type="checkbox"/> F-4 FIGHTER (#9) <input type="checkbox"/> T-72 TANK (#2) <input type="checkbox"/> GENERATOR (#6) <input type="checkbox"/> SCUD LAUNCHER (#10) <input type="checkbox"/> T-80 TANK (#11) <input type="checkbox"/> FRIGATE (#7) <input type="checkbox"/> BUNKER (#15) <input type="checkbox"/> ZIL TRUCK (#3) <input type="checkbox"/> GUN BOAT (#13) <input type="checkbox"/> LOCK & DAM (#16) <input type="checkbox"/> APC – FSU (#4) <input type="checkbox"/> AH-64 HELO (#8) <input type="checkbox"/> HYD/ELEC PLANT (#17) <input type="checkbox"/> MICV – US (#12) <input type="checkbox"/> HIND HELO (#14) <input type="checkbox"/> BRIDGE (#18)	<p><u>GENERATORS</u></p> <input type="checkbox"/> OFF <input type="checkbox"/> IDLE <p><u>OTHER TARGETS</u></p> <input type="checkbox"/> OFF <input type="checkbox"/> IDLE <input type="checkbox"/> EXERCISED

BACKGROUND DATA

ALBEDO

- CONTINENTAL
- URBAN
- DESERT
- OCEAN
- SNOW

GROWING STATE

- DOMANT
- INTERMEDIAT
- GROWING

COVERAGE

- DENSE
- INTERMEDIATE
- SPARSE

SOIL MOISTURE

- DRY
- INTERMEDIATE
- WET

BACKGROUND

- 1 VEGETATION
- 2 SOIL
- 3 SNOW
- 4 WATER
- 5 CONCRETE
- 6 ASPHALT
- 7 SWAMP/MARSH
- 8 ROCKY FIELD

QUARTZ CONTENT

- NONE
- LOW
- HIGH

SURFACE MOISTURE

- DRY
- INTERMEDIATE
- WET

DEPTH MOISTURE

- DRY
- INTERMEDIATE
- WET

TARGET POSITION FOR SLOPED BACKGROUND

- AT BASE OF SLOPE
 - ON SLOPE
- DOWN-SLOPE DIRECTION = _____ DEGREES TRUE
- DEGREE OF SLOPE = _____ (0-89 DEGREES)

TYPE	SFC MOISTURE	DEPTH MOISTURE
<input type="checkbox"/> AVERAGE	<input type="checkbox"/> DRY	<input type="checkbox"/> DRY
<input type="checkbox"/> LOAM	<input type="checkbox"/> INTERMED	<input type="checkbox"/> INTERMED
<input type="checkbox"/> SAND	<input type="checkbox"/> WET	<input type="checkbox"/> WET
<input type="checkbox"/> CLAY		
<input type="checkbox"/> PEAT		
<input type="checkbox"/> GRAVEL		
<input type="checkbox"/> DESERT		

TYPE	DEPTH	CONDITION
<input type="checkbox"/> FRESH	<input type="checkbox"/> ___ INCHES	<input type="checkbox"/> COMPACTED
<input type="checkbox"/> OLD		<input type="checkbox"/> WINDY AREA
<input type="checkbox"/> RAINED ON		<input type="checkbox"/> LATE SEASON
<input type="checkbox"/> MELTING		<input type="checkbox"/> TUNDRA
		<input type="checkbox"/> UNDISTURBED

DEPTH	CLARITY
<input type="checkbox"/> ___ FEET	<input type="checkbox"/> CLEAR
	<input type="checkbox"/> TURBID

TYPE	CONCRETE	WETNESS
<input type="checkbox"/> ROAD	<input type="checkbox"/> UNCOLORED	<input type="checkbox"/> DRY
<input type="checkbox"/> SIDEWALK	<input type="checkbox"/> BLACK	<input type="checkbox"/> INTERMED
<input type="checkbox"/> RUNWAY		<input type="checkbox"/> WET
<input type="checkbox"/> PARKG LOT	ASPHALT	
<input type="checkbox"/> BRIDGE	<input type="checkbox"/> AGED	
<input type="checkbox"/> HEAVY PAD	<input type="checkbox"/> NEW	

GROWING STATE	COVERAGE	WATER DEPTH
<input type="checkbox"/> DORMANT	<input type="checkbox"/> DENSE	<input type="checkbox"/> ___ FEET
<input type="checkbox"/> INTERMED	<input type="checkbox"/> INTERMED	
<input type="checkbox"/> GROWING	<input type="checkbox"/> SPARSE	

GENERIC BUILDING MODEL WORKSHEET

BUILDING NAME _____ WIDTH _____ (M/FT) LENGTH _____ (M/FT)

ROOF TYPE	TEMPERATURE CONTROLLED	NUMBER OF LEVELS
<input type="checkbox"/> INS FRAME WALL	<input type="checkbox"/> YES	<input type="checkbox"/> 1
<input type="checkbox"/> INS LTWT WDFRAME	<input type="checkbox"/> NO TEMP _____ (F/C)	<input type="checkbox"/> 2
<input type="checkbox"/> MASON W/INT INS	INSULATION QUALITY	<input type="checkbox"/> 3 LEVEL HEIGHT _____ (M/FT)
<input type="checkbox"/> MASON W/SANDWICH	<input type="checkbox"/> GOOD	<input type="checkbox"/> 4
<input type="checkbox"/> WDFRAME W/BRICK	<input type="checkbox"/> AVERAGE	<input type="checkbox"/> 5
<input type="checkbox"/> ASH SHINGLE ON WD	<input type="checkbox"/> POOR	NO OF WINDOWS PER LEVEL _____
SURFACE FINISH	STRUCTURE TYPE	WINDOW TYPE
<input type="checkbox"/> WHITE PAINT	<input type="checkbox"/> INS FRAME WALL	<input type="checkbox"/> PLATE GLASS
<input type="checkbox"/> GREEN PAINT	<input type="checkbox"/> INS LTWT WDFRAME	<input type="checkbox"/> PANE GLASS
<input type="checkbox"/> BLACK PAINT	<input type="checkbox"/> MASON W/INT INS	NO OF DOORS PER LEVEL _____
<input type="checkbox"/> PLYWOOD	<input type="checkbox"/> MASON W/SANDWICH	DOOR TYPE
<input type="checkbox"/> CONCRETE, ROUGH	<input type="checkbox"/> WDFRAME W/BRICK	<input type="checkbox"/> SINGLE DOOR
<input type="checkbox"/> BRICK, RED	<input type="checkbox"/> ASH SHINGLE ON WD	<input type="checkbox"/> DOUBLE DOOR
<input type="checkbox"/> MASONRY		
<input type="checkbox"/> GRANITE		
<input type="checkbox"/> SLATE		
<input type="checkbox"/> MARBLE, WHITE		
<input type="checkbox"/> GLASS		
<input type="checkbox"/> ASPHALT		
<input type="checkbox"/> GRAVEL		
<input type="checkbox"/> GALVANIZED, CLEAN		
<input type="checkbox"/> GALVANIZED, WEATHERED		

THE GENERIC BUILDING MODEL ALLOWS YOU TO DEFINE A BOX STRUCTURE WITH A FLAT ROOF. ALL EOTDA BUILDINGS MUST HAVE FOUR SIDES. HOWEVER, BUILDINGS MAY HAVE BETWEEN ONE AND FIVE LEVELS.

LEVEL 2	FRONT	BACK	RIGHT	LEFT
NO OF WINDOWS				
WINDOW TYPE				
NO OF DOORS				
DOOR TYPE				
SURFACE FINISH TYPE				
STRUCTURE TYPE				
LEVEL 3	FRONT	BACK	RIGHT	LEFT
NO OF WINDOWS				
WINDOW TYPE				
NO OF DOORS				
DOOR TYPE				
SURFACE FINISH TYPE				
STRUCTURE TYPE				

GENERIC BRIDGE MODEL WORKSHEET

BRIDGE NAME _____

BRIDGE DIMENTIONS

LENGTH	(M/FT)
WIDTH	(M/FT)
HEIGHT	(M/FT)
OUTER SUPPORT WIDTH	(M/FT)
CENTRAL SUPPORT WIDTH	(M/FT)
SUPPORT DEPTH	(M/FT)
RAIL HEIGHT	(M/FT)

<p align="center">BRIDGE RAILS SURFACE</p> <p><input type="checkbox"/> BARE CONCRETE – UNCOLORED</p> <p><input type="checkbox"/> BARE CONCRETE – DARKENED</p> <p><input type="checkbox"/> BARE CONCRETE – BLACKENED</p> <p><input type="checkbox"/> WHITE PAINT – ACRYLIC</p> <p><input type="checkbox"/> WHITE PAINT – ZNOXIDE</p> <p><input type="checkbox"/> GREEN PAINT</p> <p><input type="checkbox"/> BLACK PAINT – PARSONS</p> <p><input type="checkbox"/> UNPAINTED WOOD</p> <p><input type="checkbox"/> TAR – ASPHALT – CREOSOTE</p> <p align="center">BRIDGE RAILS MATERIAL</p> <p><input type="checkbox"/> CONCRETE – NORMAL</p> <p><input type="checkbox"/> CONCRETE – VERY DRY</p> <p><input type="checkbox"/> CONCRETE – WET</p> <p><input type="checkbox"/> HARDWOOD</p> <p><input type="checkbox"/> SOFTWOOD</p>	<p align="center">BRIDGE SUPPORTS SURFACE</p> <p><input type="checkbox"/> BARE CONCRETE – UNCOLORED</p> <p><input type="checkbox"/> BARE CONCRETE – DARKENED</p> <p><input type="checkbox"/> BARE CONCRETE – BLACKENED</p> <p><input type="checkbox"/> WHITE PAINT – ACRYLIC</p> <p><input type="checkbox"/> WHITE PAINT – ZNOXIDE</p> <p><input type="checkbox"/> GREEN PAINT</p> <p><input type="checkbox"/> BLACK PAINT – PARSONS</p> <p><input type="checkbox"/> UNPAINTED WOOD</p> <p><input type="checkbox"/> TAR – ASPHALT – CREOSOTE</p> <p align="center">BRIDGE SUPPORTS MATERIAL</p> <p><input type="checkbox"/> CONCRETE – NORMAL</p> <p><input type="checkbox"/> CONCRETE – VERY DRY</p> <p><input type="checkbox"/> CONCRETE – WET</p> <p><input type="checkbox"/> HARDWOOD</p> <p><input type="checkbox"/> SOFTWOOD</p>
<p align="center">BRIDGE SIDES SURFACE</p> <p><input type="checkbox"/> BARE CONCRETE – UNCOLORED</p> <p><input type="checkbox"/> BARE CONCRETE – DARKENED</p> <p><input type="checkbox"/> BARE CONCRETE – BLACKENED</p> <p><input type="checkbox"/> WHITE PAINT – ACRYLIC</p> <p><input type="checkbox"/> WHITE PAINT – ZNOXIDE</p> <p><input type="checkbox"/> GREEN PAINT</p> <p><input type="checkbox"/> BLACK PAINT – PARSONS</p> <p><input type="checkbox"/> UNPAINTED WOOD</p> <p><input type="checkbox"/> TAR – ASPHALT – CREOSOTE</p> <p align="center">BRIDGE SIDES MATERIAL</p> <p><input type="checkbox"/> CONCRETE – NORMAL</p> <p><input type="checkbox"/> CONCRETE – VERY DRY</p> <p><input type="checkbox"/> CONCRETE – WET</p> <p><input type="checkbox"/> HARDWOOD</p> <p><input type="checkbox"/> SOFTWOOD</p>	<p align="center">BRIDGE ROADWAYS SURFACE</p> <p><input type="checkbox"/> BARE CONCRETE – UNCOLORED</p> <p><input type="checkbox"/> BARE CONCRETE – DARKENED</p> <p><input type="checkbox"/> BARE CONCRETE – BLACKENED</p> <p><input type="checkbox"/> WHITE PAINT – ACRYLIC</p> <p><input type="checkbox"/> WHITE PAINT – ZNOXIDE</p> <p><input type="checkbox"/> GREEN PAINT</p> <p><input type="checkbox"/> BLACK PAINT – PARSONS</p> <p><input type="checkbox"/> UNPAINTED WOOD</p> <p><input type="checkbox"/> TAR – ASPHALT – CREOSOTE</p> <p align="center">BRIDGE ROADWAYS MATERIAL</p> <p><input type="checkbox"/> CONCRETE – NORMAL</p> <p><input type="checkbox"/> CONCRETE – VERY DRY</p> <p><input type="checkbox"/> CONCRETE – WET</p> <p><input type="checkbox"/> HARDWOOD</p> <p><input type="checkbox"/> SOFTWOOD</p>

GENERIC BUNKER MODEL WORKSHEET

BUNKER NAME _____

BUNKER DIMENTIONS

LENGTH	(M/FT)
WIDTH	(M/FT)
HEIGHT	(M/FT)
DOOR RADIUS	(M/FT)
DOOR THICKNESS	(M/FT)

<p style="text-align: center;">DOOR SURFACES</p> <p><input type="checkbox"/> BARE CONCRETE – UNCOLORED</p> <p><input type="checkbox"/> BARE CONCRETE – DARKENED</p> <p><input type="checkbox"/> BARE CONCRETE – BLACKENED</p> <p><input type="checkbox"/> WHITE PAINT – ACRYLIC</p> <p><input type="checkbox"/> WHITE PAINT – ZNOXIDE</p> <p><input type="checkbox"/> GREEN PAINT</p> <p><input type="checkbox"/> BLACK PAINT – PARSONS</p> <p><input type="checkbox"/> TAR – ASPHALT – CREOSOTE</p> <p><input type="checkbox"/> GALVANIZED – CLEAN</p> <p><input type="checkbox"/> GALVANIZED – WEATHERED</p> <p><input type="checkbox"/> RUSTED STEEL</p> <p style="text-align: center;">DOOR MATERIAL</p> <p><input type="checkbox"/> STEEL</p>	<p style="text-align: center;">SURFACE OF SIDES, FRONT & REAR</p> <p><input type="checkbox"/> BARE CONCRETE – UNCOLORED</p> <p><input type="checkbox"/> BARE CONCRETE – DARKENED</p> <p><input type="checkbox"/> BARE CONCRETE – BLACKENED</p> <p><input type="checkbox"/> WHITE PAINT – ACRYLIC</p> <p><input type="checkbox"/> WHITE PAINT – ZNOXIDE</p> <p><input type="checkbox"/> GREEN PAINT</p> <p><input type="checkbox"/> BLACK PAINT – PARSONS</p> <p><input type="checkbox"/> TAR – ASPHALT – CREOSOTE</p> <p style="text-align: center;">MATERIAL</p> <p><input type="checkbox"/> CONCRETE – NORMAL</p> <p><input type="checkbox"/> CONCRETE – VERY DRY</p> <p><input type="checkbox"/> CONCRETE – WET</p>
<p style="text-align: center;">EARTH SUBSURFACE LAYER MATERIAL</p> <p><input type="checkbox"/> NORMAL AVERAGE SOIL</p> <p style="padding-left: 20px;"><input type="checkbox"/> DRY</p> <p style="padding-left: 20px;"><input type="checkbox"/> WET</p> <p><input type="checkbox"/> NORMAL LOAM</p> <p style="padding-left: 20px;"><input type="checkbox"/> DRY</p> <p style="padding-left: 20px;"><input type="checkbox"/> WET</p> <p><input type="checkbox"/> NORMAL SAND/SANDY SOIL</p> <p style="padding-left: 20px;"><input type="checkbox"/> DRY</p> <p style="padding-left: 20px;"><input type="checkbox"/> WET</p> <p><input type="checkbox"/> NORMAL CLAY</p> <p style="padding-left: 20px;"><input type="checkbox"/> DRY</p> <p style="padding-left: 20px;"><input type="checkbox"/> WET</p> <p><input type="checkbox"/> NORMAL PEAT</p> <p style="padding-left: 20px;"><input type="checkbox"/> DRY</p> <p style="padding-left: 20px;"><input type="checkbox"/> WET</p>	<p style="text-align: center;">EARTH SURFACE LAYER MATERIAL</p> <p><input type="checkbox"/> VERY DRY MID-EAST SAND</p> <p><input type="checkbox"/> VERY DRY SOIL SURFACE</p> <p><input type="checkbox"/> NORMAL SOIL SURFACE</p> <p><input type="checkbox"/> WET SOIL SURFACE</p> <p style="text-align: center;">MATERIAL</p> <p><input type="checkbox"/> NORMAL AVERAGE SOIL</p> <p style="padding-left: 20px;"><input type="checkbox"/> DRY</p> <p style="padding-left: 20px;"><input type="checkbox"/> WET</p> <p><input type="checkbox"/> NORMAL LOAM</p> <p style="padding-left: 20px;"><input type="checkbox"/> DRY</p> <p style="padding-left: 20px;"><input type="checkbox"/> WET</p> <p><input type="checkbox"/> NORMAL SAND/SANDY SOIL</p> <p style="padding-left: 20px;"><input type="checkbox"/> DRY</p> <p style="padding-left: 20px;"><input type="checkbox"/> WET</p> <p><input type="checkbox"/> NORMAL CLAY</p> <p style="padding-left: 20px;"><input type="checkbox"/> DRY</p> <p style="padding-left: 20px;"><input type="checkbox"/> WET</p> <p><input type="checkbox"/> NORMAL PEAT</p> <p style="padding-left: 20px;"><input type="checkbox"/> DRY</p> <p style="padding-left: 20px;"><input type="checkbox"/> WET</p>

GENERIC POWER PLANT MODEL WORKSHEET

POWER PLANT NAME _____

WATERWAY DIMENTIONS

LENGTH	(M/FT)
WIDTH	(M/FT)
HEIGHT	(M/FT)

BUILDING DIMENSIONS

LENGTH	(M/FT)
HEIGHT	(M/FT)
WIDTH	(M/FT)

<p style="text-align: center;">DECKS SURFACE</p> <p><input type="checkbox"/> BARE CONCRETE – UNCOLORED</p> <p><input type="checkbox"/> BARE CONCRETE – DARKENED</p> <p><input type="checkbox"/> BARE CONCRETE – BLACKENED</p> <p><input type="checkbox"/> WHITE PAINT – ACRYLIC</p> <p><input type="checkbox"/> WHITE PAINT – ZNOXIDE</p> <p><input type="checkbox"/> GREEN PAINT</p> <p><input type="checkbox"/> BLACK PAINT – PARSONS</p> <p style="text-align: center;">MATERIAL</p> <p><input type="checkbox"/> CONCRETE</p> <p style="padding-left: 20px;"><input type="checkbox"/> NORMAL</p> <p style="padding-left: 20px;"><input type="checkbox"/> WET</p> <p style="padding-left: 20px;"><input type="checkbox"/> DRY</p>	<p style="text-align: center;">UPPER LEVEL WALLS SURFACE</p> <p><input type="checkbox"/> BARE CONCRETE – UNCOLORED</p> <p><input type="checkbox"/> BARE CONCRETE – DARKENED</p> <p><input type="checkbox"/> BARE CONCRETE – BLACKENED</p> <p><input type="checkbox"/> WHITE PAINT – ACRYLIC</p> <p><input type="checkbox"/> WHITE PAINT – ZNOXIDE</p> <p><input type="checkbox"/> GREEN PAINT</p> <p><input type="checkbox"/> BLACK PAINT – PARSONS</p> <p><input type="checkbox"/> TAR – ASPHALT – CREOSOTE</p> <p><input type="checkbox"/> GRAVEL (POLISHED)</p> <p style="text-align: center;">MATERIAL</p> <p><input type="checkbox"/> ASPHALT</p> <p><input type="checkbox"/> CONCRETE – NORMAL</p>
<p style="text-align: center;">WINDOWS</p> <p><input type="checkbox"/> WHITE PAINT – ACRYLIC</p> <p><input type="checkbox"/> WHITE PAINT – ZNOXIDE</p> <p><input type="checkbox"/> GREEN PAINT</p> <p><input type="checkbox"/> BLACK PAINT – PARSONS</p> <p><input type="checkbox"/> COMMON GLASS</p>	<p style="text-align: center;">ROOF SURFACE</p> <p><input type="checkbox"/> BARE CONCRETE – UNCOLORED</p> <p><input type="checkbox"/> BARE CONCRETE – DARKENED</p> <p><input type="checkbox"/> BARE CONCRETE – BLACKENED</p> <p><input type="checkbox"/> WHITE PAINT – ACRYLIC</p> <p><input type="checkbox"/> WHITE PAINT – ZNOXIDE</p> <p><input type="checkbox"/> GREEN PAINT</p> <p><input type="checkbox"/> BLACK PAINT – PARSONS</p> <p style="text-align: center;">MATERIAL</p> <p><input type="checkbox"/> CONCRETE</p> <p style="padding-left: 20px;"><input type="checkbox"/> NORMAL</p> <p style="padding-left: 20px;"><input type="checkbox"/> WET</p> <p style="padding-left: 20px;"><input type="checkbox"/> VERY DRY</p>
<p style="text-align: center;">FLOW EXIT AREA SURFACE</p> <p><input type="checkbox"/> BARE CONCRETE – UNCOLORED</p> <p><input type="checkbox"/> BARE CONCRETE – DARKENED</p> <p><input type="checkbox"/> BARE CONCRETE – BLACKENED</p> <p><input type="checkbox"/> WHITE PAINT – ACRYLIC</p> <p><input type="checkbox"/> WHITE PAINT – ZNOXIDE</p> <p><input type="checkbox"/> GREEN PAINT</p> <p><input type="checkbox"/> BLACK PAINT – PARSONS</p> <p style="text-align: center;">MATERIAL</p> <p><input type="checkbox"/> CONCRETE</p> <p style="padding-left: 20px;"><input type="checkbox"/> NORMAL</p> <p style="padding-left: 20px;"><input type="checkbox"/> WET</p> <p style="padding-left: 20px;"><input type="checkbox"/> VERY DRY</p>	

USMC WX POINTS OF CONTACT

RANK	NAME	TITLE / UNIT	PHONE/E-MAIL
LtCol.	Resavy, William J. Jr.	Meteorological Specialist CMC	224-1835 FAX COMM 703 697-7343 William_J_Resavy@notes.hqi.usmc.mil
Maj.	Banks, Ernest D.	Weather Service Officer SPAWARS	577-0168 FAX COMM 619 524-3034 bankse@spawars.navy.mil
Maj.	Davis, Scott E.	Weather Service Officer/WTI CNMOC	485-4897 FAX 5332 daviss@cnmoc.navy.mil
Capt.	Dixon, James J	Weather Service Officer/WTI MAWTS-1	951-2534 FAX 2637 dixonj@yuma.usmc.mil
Capt.	Englert, Dave C.	Staff Weather Officer/WTI II MEF	751-8558 FAX 8597 englertd@clb.usmc.mil
Capt.	Colby, Brian K.	Weather Service Officer/WTI COMCAB EAST	582-2346 FAX 5628 colbyb@cherrypt.usmc.mil
Capt.	Webb, Michael J.	Weather Service Officer/WTI COMCAB WEST	577-4030 FAX 4031 webbm@miramar.usmc.mil
Capt.	Hutchison, Carl J.	Staff Weather Officer/WTI I MEF	365-9127 FAX 9170 hutchisonca@pendleton.usmc.mil
CWO4	Swosinski, Michael S.	Weather Service Officer/WTI KEESLER	597-3288 FAX swosinskim@cnet.navy.mil
CWO3	Usher, Ronald, S. Jr.	Weather Service Officer MCAF KANEOHE BAY	457-0404 FAX 2150 usherrs@mcbh.usmc.mil
CWO3	McBee, Eric R.	Staff Weather Officer/WTI III MEF	622-7773 FAX 7769 mcbeee1@okinawa.usmc.mil
CWO3	Smith, William B.	Weather Service Officer/WTI MWSS 27	582-2358 FAX 5691 smithw2@cherrypt.usmc.mil
CWO3	Bohannon, Donald L.	Weather Service Officer/WTI MWSS 171/MCAS IWAKUNI	253-4435 FAX 4801 bohannond@iwakuni.usmc.mil
CWO2	Hartman, John M.	Weather Service Officer/WTI MWSS 272/MCAS NEW RIVER	750-6828 FAX 6315 hartmanj@clb.usmc.mil
CWO2	Gepp, Andrew E.	Weather Service Officer/WTI MWSS 37	997-6502 FAX 6504 geppa@pendleton.usmc.mil
CWO2	Symes, Michael A.	Weather Service Officer/WTI MWSS 17	645-2752 FAX 7723 symesm@1maw.usmc.mil
CWO2	Boogerd, William E.	Weather Service Officer MWSS 274/MCAS CHERRY PT	582-4442 FAX 5628 boogerdw@cherrypt.usmc.mil
CWO2	Smith, Joe A.	Weather Service Officer MWSS 371/MCAS YUMA	951-3230 FAX 2250 smithj@yuma.usmc.mil
CWO2	Wiker, Phillip L.	Weather Service Officer MWSS 172/MCAS FUTENMA	636-3071 FAX 2656 wikerp@okinawa.usmc.mil
CWO2	Haley, Jay F.	Weather Service Officer MWSS 273/MCAS BEAUFORT	832-7868 FAX 6303 haleyj@bft.usmc.mil
CWO2	Horn, Raymond J.	Weather Service Officer MWSS 271	582-0603 FAX 0698 (Call first) hornr@cherrypt.usmc.mil
CWO2	Wooldridge, Jeffrey P.	Weather Service Officer MWSS 374/TUSTIN	997-7885 FAX 7894 Wooldridgej@pendleton.usmc.mil
CWO2	Hillman, David W.	Weather Service Officer MWSS 274 MST	582-2703 hillman@cherrypt.usmc.mil
CWO2	Lewis, James D. Jr.	Weather Service Officer AGSE 29 PALMS	957-7831 FAX 7834 lewisj@mcagcc.usmc.mil
WO	Sims, Shannon W.	Weather Service Officer MWSS 172 MST	Simss1@okinawa.usmc.mil
WO	Vallada, John	Weather Service Officer MWSS 372/MCAS CAMP PEN	365-8373 FAX 8012 Valladaj@pendleton.usmc.mil

* = WEAPONS AND TACTICS INSTRUCTOR, SECONDARY MOS 6877