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TACTICAL TARGET ACQUISITION MODEL (TATAC)

VOLUME II

USERS' MANUAL

DECEMBER 1977

PREPARED FOR ASD BY

LULEJIAN AND ASSOCIATES, INC.

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Deputy for Development Planning

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PREFACE

This is one of two volumes of a report describing a target acquisition model developed under contract to Lulejian and Associates by the Deputy for Development Planning (XRO), of the Aeronautical Systems Division. The model was developed to support in-house studies of tactical air-to-ground attack.

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# TACTICAL TARGET ACQUISITION MODEL (TATAC)

## I. INTRODUCTION

This volume documents the operating procedures, input requirements, and output formats for the Tactical Target Acquisition (TATAC) computer model. After defining the problem this guide can be used to assist the user in setting up the necessary steps to make a computer run.

The computer program is comprised of the following sensor system models:

Visual Observer (VISOB)

Forward-Looking Infrared (FLIR)

Television (TV)

- Active (Illuminated)
- Passive (Daylight)

Forward-Looking Radar (FLR)

- Moving Target Indicator (MTI) Mode
- Non-MTI Mode

Synthetic Aperture Radar

Section II of this guide describes the operation and structure of the program in terms of:

Execution List (Input)

Output

Library Data

Fixed Data

Section III describes the logical structure of the programs. Section IV contains a listing of the fixed data. Section V contains a listing of the library data. Section VI contains sample problems including the execution list and output from the computer run for each problem to demonstrate the method of using the model. Section VII contains a listing of all programs in the model.

## II. PROGRAM OPERATION

This section describes the procedures necessary to run the TATAC computer model. Detailed in this section are:

- Description and form of the execution list;
- Form of output generated by a computer run;
- Library data description; and
- Fixed data description.

Figure 1 is a diagram of the program deck. Figure 2 summarizes the information flow in the program.

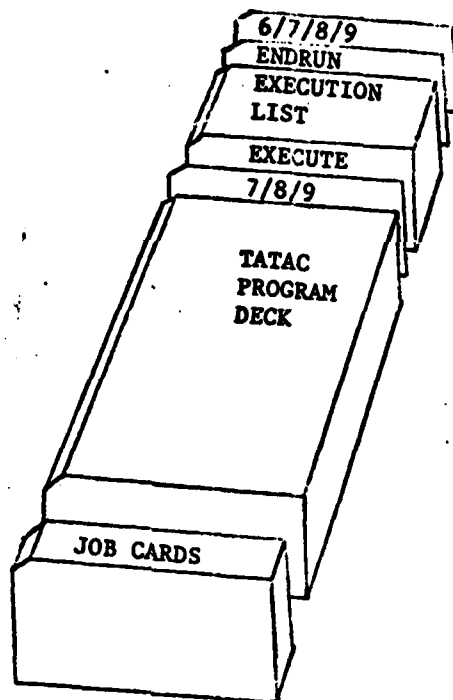


Figure 1. TATAC Deck Structure

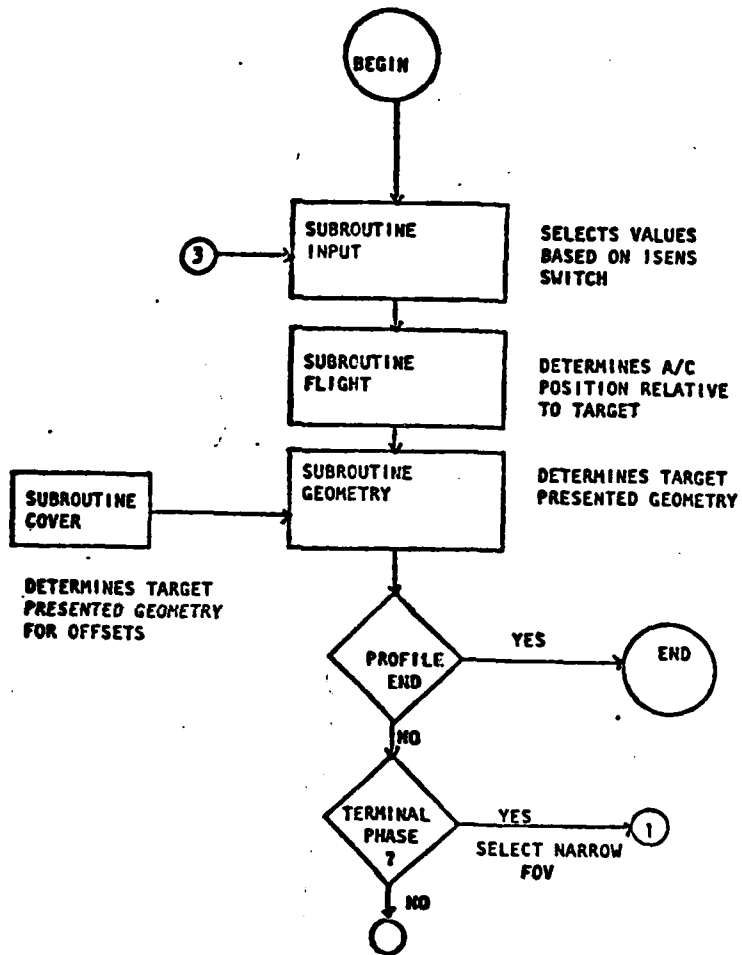


Figure 2. TATAC Program Information Flow

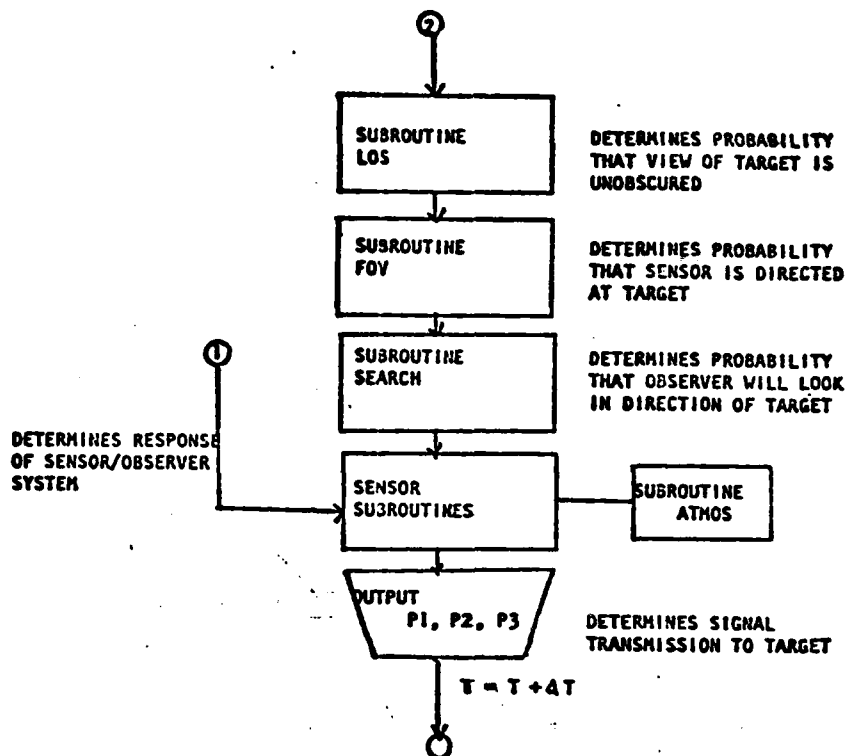


Figure 2. TATAC Program Information Flow (Continued)

#### A. EXECUTION LIST

The execution list follows the program deck as shown in Figure 1. It begins with an EXECUTE card and ends with an ENDRUN card. This list is the only portion of the data which must be formulated by the user before each computer run. As a reference to the following description, a sample execution list is shown in Figure 3.

The execution list performs the following functions in the model:

- Determines the type of run to be executed; and
- Denotes all data of the library to be modified.

These functions are described in the following paragraphs.

LINE	DESCRIPTION	AMOUNT	DATE	PERIOD
1	EXECUTIVE			
2	OPERATION			
3	SAVING	15000	E+04	
4	SAVING	20000	E+03	
5	SAVING			
6	SAVING			
7	SAVING			
8	SAVING			
9	SAVING			
10	SAVING			
11	SAVING			
12	SAVING			
13	SAVING			
14	SAVING			
15	SAVING			
16	SAVING			
17	SAVING			
18	SAVING			
19	SAVING			
20	SAVING			
21	SAVING			
22	SAVING			
23	SAVING			
24	SAVING			
25	SAVING			
26	SAVING			
27	SAVING			
28	SAVING			
29	SAVING			
30	SAVING			
31	SAVING			
32	SAVING			
33	SAVING			
34	SAVING			
35	SAVING			
36	SAVING			
37	SAVING			
38	SAVING			
39	SAVING			
40	SAVING			
41	SAVING			
42	SAVING			
43	SAVING			
44	SAVING			
45	SAVING			
46	SAVING			
47	SAVING			
48	SAVING			
49	SAVING			
50	SAVING			

Figure 3. Sample Execution List

## 1. Determining the Run

The first card in the execution list is the EXECUTE card (Figure 3, card 1). Besides indicating to the computer model that this is the beginning of the execution list, this card conveys the type of run to be executed. The following sensor runs may be executed:

- Visual Observer (1);
- Forward-Looking Infrared (2);
- Active (illuminated) Television (3);
- Passive (daylight) Television (4);
- Forward-Looking Radar, MTI Mode (5);
- Forward-Looking Radar, non-MTI Mode (6); and
- Synthetic Aperture Radar (7).

To indicate the sensor run being set up, the user places one of the single-integer codes, shown in parenthesis in the above list, into column 11 of the EXECUTE card.

## 2. Data Entry

Besides the EXECUTE and ENDRUN cards the only other types of cards that may be needed are "data name" and "data modification" cards. A "data modification" card(s) is used in conjunction with a "data name" card. That is, a "data name" card need never be used unless a "data modification" card(s) immediately follows it.

### a. Data Name Cards

The "data name" card (Figure 3, Card 2) has the legal name of the data being modified in columns 1-15 (left justified). Legal names for data used in the program are given in Table 1. The user then places an integer in columns 20-30 (right justified). This integer tells the input program how many modifications are to be made to that particular library entry. Then for each modification a "data modification" card follows. Recall that a "data name" card is only used if one or more modifications are made to that particular library "data name."

TABLE 1. LEGAL DATA NAMES \*

OPERATIONAL VAR	* Only the first four characters are checked
TARGET	by the program. Thus, all data names in
BACKGROUND	the list may be shortened.
ENVIRONMENTAL **	** Environmental and terrain data are com-
TERRAIN **	combined into one array - either name may be
SEARCH	used as a legal data name for this array.
SENSOR	

### b. Data Modification Cards

Each of these cards (Figure 3, cards 3 - 4) contains the number of the variable to be modified in columns 9 - 10 (right justified) and the new value assigned to it in columns 11 - 20 in E10.4 format (right justified). The variable number and its type are found in the library data tables in Subsection C of this Section. The number of "data modification" cards which follow a "data name" card must agree with the integer placed in columns 29 - 30 of the "data name" card.

### 3. Setting Up an Execution List

This subsection lists the steps which the user should follow when setting up an execution list to run the TATAC computer model.

Defining the problem:

- (1) Define the problem to be run including the sensor system, operational variables, target, background, environmental/terrain, and search variables.
- (2) Determine if the data needed is in the library. If not, "data name" and "data modification" cards for new entries will be required.

Filling out the execution list:

- (3) List the EXECUTE card including the sensor number in column 11 for the run to be made.
- (4) Insert all "data name" cards along with the proper number of "data modification" cards for each.
- (5) List the ENDRUN card.

### B. OUTPUT

There are basically three categories of output from the computer model:

List of data modifications;  
Error messages; and  
Standard model output.

Types of each output applicable to a specific run will be automatically generated by the program. A discussion of the categories

of output will be given in the next three subsections. Following these discussions will be a discussion on variations of standard model output among the sensor models. Reference will be made at that point to sample problems which illustrate the distinctions in output generated by computer runs.

### 1. List of Data Modifications

Preceding all standard output, a listing of data modifications made through the use of "data modification" cards in the execution list will be given. If no data modifications have been made, no output of this category will be generated. The list will include the legal data name for which modifications were made, the number of the variable modified, IVAR (found in the library data table for the applicable data name), and the value assigned to that variable. Space for output is reserved for as many as ten modifications per data name used. If more than ten "data modification" cards follow a "data name" card, a message is printed alerting the user to this occurrence. This in no way affects the program run. It simply means that all changes made after the tenth one, will not be listed on the output. There are two ways to avoid this situation. One is to repunch the entire portion of the library data array applicable to the library data name in question. The other is to distribute the "data modification" cards behind multiple "data name" cards containing the same data name. For example: if 15 data modifications are to be made to a library entry, set up a "data name" card with a "10" in columns 29 - 30, followed by ten "data modification" cards for the first 10 modifications and place the remaining five behind another "data name" card with a "5" in columns 29 - 30.

### 2. Error Messages

At a number of points in the program, checks are made on various input data to determine if it is in the correct form. If there is an error the program will print out a message. Generally, the program will attempt to assign a default value so as to continue with the run. These messages may appear anywhere in the output and usually give an indication of where the problem occurred. These messages are listed below, followed by an explanation of the cause.

#### EXECUTE CARD MISSING OR OUT OF ORDER

The first card of the execution list must be the EXECUTE card which includes the sensor number. If the first card read is not the EXECUTE card then the above message is printed and the sensor number defaults to the value "1".

#### INVALID SENSOR NUMBER - (value)

Valid sensor numbers range from "1" to "7". Any sensor number input outside this range will result in the above message. The invalid sensor number read is printed. The sensor number defaults to "1".

**INVALID DATA NAME - (name)**

The name read does not match one of the legal data names given in Table 1. The invalid name read is printed.

**VARIABLE NUMBER OUTSIDE RANGE OF DATA NAME ARRAY - (value)**

The variable number in columns 9 - 10 of a "data modification" card is outside the range of the array reserved for the data name appearing on the previous "data name" card. The read value is printed.

**MORE MODIFICATIONS THAN LISTED**

This refers only to the data modification "listing." It does not imply an error in the run. Space is reserved to print out a maximum of 10 data modifications per "data name" card. If more than 10 "data modification" cards are required for one "data name" card, the user should place the remaining "data modification" cards after another "data name" card containing the same data name as for the first 10 modifications. For many modifications it may be more efficient to repunch that section of the library.

**DEPRESSION ANGLE TOO STEEP, PHID RESET = (value)**

This message is applicable to all non-radar, fixed sensor depression angle runs. If the input depression angle, PHID, is too large, the computed dive profile point may be reached before the target enters the sensor footprint. The program will then set the angle back to where the target just enters the footprint when the dive profile point is reached. The new angle, in degrees, is printed.

**OFFSET (Y) GREATER THAN YMAX. SET Y = (value)**

This message is applicable to all models using a fixed sensor depression angle with the exception of the Synthetic Aperture Radar model. For a given depression angle, horizontal beamwidth, and vertical beamwidth, a ground sensor footprint is calculated. The cross-track distance of the footprint at the leading edge is calculated as YMAX. If the input offset (Y) is greater than YMAX, the target never passes into the ground footprint. If such a condition is encountered, Y defaults to the value printed.

**ONLY POSITIVE OFFSETS CONSIDERED, USED ABS. VALUE**

Offsets are considered to be symmetric with respect to flight path. Therefore, if a negative offset is input the program will convert it to its absolute value.

**TUBE SATURATION, NEW FNUM = (value)**

Illumination level great enough to saturate tube. Lens is stopped down and another trial is made to see if the illumination is within tube operating limits.

**THRESHOLD SPEED IS GREATER THAN 1/2 BLIND SPEED**

The MTI filter threshold velocity exceeds one-half the calculated value of blind speed. This means that the filter has no passband and that detection is impossible.

**AN MF VALUE WAS NOT INPUT SO MF IS SET - 12**

For Forward-Looking Radar (MTI mode) a filter rolloff value, MF, was not input (or input as zero). The program defaults to a value of 12.

**Y TOO SMALL, INCREASED TO BE 1.5 SWATH WIDTHS**

The offset, Y, is measured to the far edge of the swath width. No information is obtained from the area below or close to the aircraft. For offsets less than 1 - 1/2 swath width, Y is reset to 1.5 times the input swath width. Typical offset values for SAR are on the order of 10 - 30 nautical miles.

**3. Standard Model Output**

There are basically three types of standard model output generated by a computer run. All three may not be applicable to all sensor models. The discussion below and reference to Figure 4 should familiarize the user with this output. Standard model output follows the list of data modifications (if any).

**a. Variable Description**

The first lines in this output section (Figure 4, lines 12 - 27) for any run consist of a brief description of the variables which head a given column. Further description may be found in Volume I of this report.

SENSE NUMBER = 2

- 1= VISUAL OBSERVER
- 2= FORWARD-LOOKING INFRARED
- 3= ACTIVE (ILLUMINATED) TV
- 4= PASSIVE (DAYLIGHT) TV
- 5= FORWARD-LOOKING RADAR, MTI
- 6= FORWARD-LOOKING RADAR, NON-MTI
- 7= SYNTHETIC APERTURE RADAR

```
NAME  IVAR  VALUE
OPER  3     .5000E+04
OPER  4     .2000E+03
```

- I = MINIMUM LAUNCH POINT
- II = DIVE BEGINS
- III = (DUMMY POSITION)
- IV = TARGET PASSES OUT OF FOV(FIXED DEPRESSION ANGLE)
- V = SEARCH ALTITUDE ACHIEVED
- VI = CLIMB TO ALTITUDE BEGINS

- X = ALONG-TRACK GROUND DISTANCE TO TARGET, FT.
- XY = GROUND RANGE TO TARGET, FT.
- TIME = TIME BEFORE LAUNCH, SEC.
- PLQS = PROBABILITY TARGET IS WITHIN LOS
- PEQV = PROBABILITY TARGET IS WITHIN FOV
- P2 = SEARCH TERM PROBABILITY
- P3D = DISCRIMINABILITY(DEFLECTION)
- P3R = DISCRIMINABILITY(RECOGNITION)
- PAD = CUMULATIVE PROBABILITY OF DETECTION
- PAR = CUMULATIVE PROBABILITY OF RECOGNITION

	I	II	III	IV	V	VI			
	2762.	9815.	9815.	9815.	59791.	97019.			
	2762.	9815.	9815.	9815.	59791.	97019.			
X	XY	TIME	PLQS	PEQV	P2	P3D	P3R	PAD	PAR
2963.	2963.	.33	1.000	1.000	1.000	1.000	1.000	1.000	1.000
9773.	9773.	11.66	1.000	1.000	1.000	1.000	.017	1.000	1.000
9993.	9993.	11.99	.995	.997	.983	.150	0.000	.146	0.000
10668.	10668.	12.99	.993	.999	.976	.086	0.000	.149	0.000
11342.	11342.	13.99	.991	1.000	.967	.052	0.000	.149	0.000
12016.	12016.	14.99	.989	1.000	.958	.029	0.000	.149	0.000
12691.	12691.	15.99	.986	1.000	.947	.017	0.000	.149	0.000
13365.	13365.	16.99	.983	1.000	.936	.011	0.000	.149	0.000
14040.	14040.	17.98	.980	1.000	.924	.008	0.000	.149	0.000
14714.	14714.	18.99	.977	1.000	.911	.006	0.000	.149	0.000

Figure 4. Sample Computer Output

#### b. Flight Profile Points

The first two rows of numbers following the variable description (Figure 4, lines 29 - 30) display profile points along the flight path for all computer runs except the Synthetic Aperture Radar\*. The first of these rows represent the along-track ground range, in feet, from target to aircraft position for the various profile points listed. The second row represents ground range, in feet, from target to aircraft position for the same profile points. In case of zero offset these two rows are equivalent.

#### c. Ranges, Time, and Probabilities

Beneath the rows indicating flight profile (or immediately beneath the variable description for the Synthetic Aperture run) is a row of variables (Figure 4, line 31) which head 10 columns of numerical data. These columns of numerical data represent a combination of ranges, time, and probabilities which correspond to the variable description of whichever variable heads a given column. All the data in one particular row is related in-so-far-as it was all generated by one iteration of the program. Each can be thought of as being a function of the range given in the first column.

#### 4. Variations in Standard Model Output

A few special points can be made regarding the output described in the above sections.

##### a. Non-Radar Cases

For all non-radar cases the following notes apply:

The first row of numerical output from the "ranges, time, and probabilities" output section was computed at a range which corresponded to one "glimpse" before launch point;

The second of these rows of output was computed at a range which corresponds to the first "glimpse" after the dive profile point; and

The third of these rows of output was computed at a range which corresponds to the first "glimpse" before the dive profile point.

---

\* Output generated by a Synthetic Aperture Radar run will be given special consideration in a following subsection.

#### b. Forward-Looking Radar

As discussed in Volume I to this report, all radar submodels are essentially taken from MARSAM\* with technology updates. Users familiar with MARSAM will recall that it utilized a fixed depression angle for radar sensors. Thus, for given horizontal and vertical beamwidths a sensor footprint on the ground was clearly defined. Results at one range between the leading and trailing edges of this footprint were output. In the TATAC version a footprint is clearly defined, however, output will be generated for intermittent ranges from the trailing edge up to the leading edge. The flight profile is straight and level throughout and no dive is assumed. Profile points normally printed thus appear as blanks in the dive phase. Refer to Problem B, Section VI for an example of output from the Forward-Looking Radar models.

#### c. Synthetic Aperture Radar

The Synthetic Aperture Radar is also a version of a MARSAM submodel. Again, there is no dive profile. Furthermore, the Synthetic Aperture Radar processes the doppler phase history of the illuminated ground area over the entire illumination period to generate the display. All returns from the target are integrated into this display. Thus, only one line of output is necessary to present the results. For an example, see Problem C, Section VI.

### C. PROGRAM LIBRARY DATA

The program library consists of a group of DATA declaration statements found in subroutine INPUT1. It contains information needed by the program to describe sensors, target, background, etc. The library may contain more information than is needed by the program for a particular run. A complete list of the library data supplied with the program is given in Section V. Tables 2 through 13 following this discussion define the sets of entries allowed in the library. These sets of library data are:

- Operational variables;
- Target data;
- Background data;
- Environmental/terrain data;
- Search data;
- Visual Observer sensor data;
- Forward-Looking Infrared sensor data;
- Television sensor data (active);

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\* "Multiple Airborne Reconnaissance Sensor Assessment Model", Honeywell Technical Report ASD-TR-68-3, February 1968, Unclassified.

Television sensor data (passive);  
 Forward-Looking Radar (MTI) sensor data;  
 Forward-Looking Radar (non-MTI) sensor data; and  
 Synthetic Aperture Radar sensor data.

Each of these tables lists the name of the type data which it describes, the number of integers in the data (NI), and the number of floating-point numbers (NF). For each integer and floating-point number used to define the entry, the table lists the type of data, the variable number, the FORTRAN symbol which is to represent the variable, the units in which the data is expressed, and a description of the entry.

TABLE 2. OPERATIONAL VARIABLES

NAME: OPERATIONAL VAR: NI - 1; NF - 14

VARIABLE NUMBER	VARIABLE TYPE	FORTRAN SYMBOL	UNITS	DESCRIPTION
1	ID	-	-	UNUSED
2	FD	Y	FEET	FLIGHT PATH OFFSET
3	FD	HL	FEET	SEARCH ALTITUDE
4	FD	HP	FEET	PENETRATION ALTITUDE
5	FD	SPD	KNOTS	SPEED IN DIVE
6	FD	SPL	KNOTS	SPEED IN LEVEL FLIGHT
7	FD	SPC	KNOTS	SPEED IN CLIMB
8	FD	SPP	KNOTS	SPEED IN PENETRATION
9	FD	SR1	FEET	SLANT RANGE, MINIMUM LAUNCH
10	FD	SR2	FEET	SLANT RANGE, POP-UP ATTAINED
11	FD	ANGLD	DEG	DIVE ANGLE
12	FD	ANGLC	DEG	CLIMB ANGLE
13	FD			
14	FD	-	-	UNUSED
15	FD	-	-	UNUSED

TABLE 3. TARGET DATA

NAME: TARGET; NI - 3; NF - 17

VARIABLE NUMBER	VARIABLE TYPE	FORTRAN SYMBOL	UNITS	DESCRIPTION
1	ID	NJ	-	TOTAL NUMBER OF TARGET ELEMENTS
2	ID	-	-	UNUSED
3	ID	-	-	UNUSED
4	FD	DTX	FEET	TARGET ALONG-TRACK DIMENSION
5	FD	DTY	FEET	TARGET CROSS-TRACK DIMENSION
6	FD	DTZ	FEET	TARGET HEIGHT
7	FD	RT	-	TARGET REFLECTANCE
8	FD	DELTT	°K	TARGET TEMPERATURE
9	FD	EMT	-	TARGET EMISSIVITY
10	FD	SIGTX	m <sup>2</sup>	MEDIAN TARGET RCS AT 1 GHZ
11	FD	-	-	UNUSED
12	FD	-	-	UNUSED
13	FD	TSPACE	FEET	SPACING BETWEEN TARGETS
14	FD	PSI	DEG	ANGULAR DIRECTION OF TARGET RELATIVE TO FLIGHT PATH
15	FD	VIT	KNOTS	TARGET VELOCITY
16	FD	-	-	UNUSED
17	FD	-	-	UNUSED
18	FD	-	-	UNUSED
19	FD	-	-	UNUSED
20	FD	-	-	UNUSED

TABLE 4. BACKGROUND DATA

NAME: BACKGROUND; NI - 1; NF - 6

VARIABLE NUMBER	VARIABLE TYPE	FORTRAN SYMBOL	UNITS	DESCRIPTION
1	ID	-	-	UNUSED
2	FD	RB	-	REFLECTANCE OF BACKGROUND
3	FD	DELTB	°K	TEMPERATURE OF BACKGROUND
4	FD	EMB	-	EMISSIVITY OF BACKGROUND
5	FD	-	-	UNUSED
6	FD	WP	METERS	EXTENT OF PRIMARY BACKGROUND AROUND TARGET
7	FD	-	-	UNUSED

TABLE 5. ENVIRONMENTAL/TERRAIN DATA

NAME: ENVIRONMENTAL OR TERRAIN; NI - 5; NF - 8

VARIABLE NUMBER	VARIABLE TYPE	FORTRAN SYMBOL	UNITS	DESCRIPTION
1	ID	ICLOUD	-	CLOUD COVERAGE (1 = CLEAR, 2 = PARTIAL OVERCAST, 3 = SOLID OVERCAST)
2	ID	ISUNAN	-	SUN ANGLE ABOVE HORIZON (1 = 90°, 2 = 30°, 3 = 11.5°)
3	ID	ICFLOS	-	SWITCH FOR CLOUD FREE LOS (0 = DO NOT CONSIDER, 1 = use tables)
4	ID	ITAT	-	SWITCH FOR ATMOSPHERIC TRANSMITTANCE (0 = USE ANALYTIC APPROXIMATION, 1 = USE EMPIRICAL DATA)
5	ID	IAZIM	-	SUN AZIMUTH, USED IF ITAT = 1 (1 = 90°, 2 = 0°)
6	FD	RTE	-	REFLECTANCE OF TERRAIN
7	FD	ANGLM	DEC.	AVERAGE MASKING ANGLE
8	FD	RATIO	-	CULTURAL MASKING RATIO
9	FD	VC	NM	METEOROLOGICAL VISIBILITY
10	FD	RH	-	RELATIVE HUMIDITY
11	FD	G	-	MEASURE OF SCENE COMPLEXITY
12	FD	VW	M/SEC	APPARENT RMS VELOCITY DUE TO WIND
13	FD	-	-	

TABLE 6. SEARCH DATA

NAME: SEARCH; NI - 1; NF - 9

VARIABLE NUMBER	VARIABLE TYPE	FORTRAN SYMBOL	UNITS	DESCRIPTION
1	ID	-	-	UNUSED
2	FD	-	-	UNUSED
3	FD	DSX	FEET	SEARCH LENGTH*
4	FD	DSY	FEET	SEARCH WIDTH*
5	FD	WLOC	FEET	LOC WIDTH
6	FD	SIGX	-	STANDARD DEVIATION OF ALONG-TRACK ERROR
7	FD	SIGY	-	STANDARD DEVIATION OF CROSS-TRACK ERROR
8	FD	-	-	UNUSED
9	FD	-	-	UNUSED
10	FD	-	-	UNUSED

\* ENTER -1 for these variables if FOV is to be searched. The visual case uses a unique geometry in search along a LOC as described in App A.

TABLE 7. VISUAL SENSOR DATA

NAME: VISOB; NI - 2; NF - 5

VARIABLE NUMBER	VARIABLE TYPE	FORTRAN SYMBOL	UNITS	DESCRIPTION
1	ID	ICMASK	-	SWITCH FOR COCKPIT MASKING (0 = NO, 1 = YES)
2	ID	-	-	UNUSED
3	FD	VISMAY	FEET	MAXIMUM VISUAL SEARCH RANGE
4	FD	-	-	UNUSED
5	FD	-	-	UNUSED
6	FD	XLAMDA	$\mu$ m	RESPONSIVE WAVE LENGTH
7	FD	-	-	UNUSED

TABLE 8. FORWARD-LOOKING INFRARED

NAME: FLIR; NI - 2; NF - 10

VARIABLE NUMBER	VARIABLE TYPE	FORTRAN SYMBOL	UNITS	DESCRIPTION
1	ID	ISTYPE	-	SWITCH FOR DEPRESSION ANGLE (1 = VARIABLE, 2 = FIXED)
2	ID	-	-	UNUSED
3	FD	ASPECT	-	RATIO OF THE VERTICAL FOV TO HORIZONTAL FOV
4	FD	THETA V	DEG	VERTICAL FOV (NARROW)
5	FD	THETA V	DEG	VERTICAL FOV (WIDE)
6	FD	PHID	DEG	SENSOR DEPRESSION ANGLE
7	FD	ZK1	-	LINEAR CONSTANT TO MRT CURVE
8	FD	ZK2	-	EXPONENTIAL CONSTANT TO MRT CURVE
9	FD	-	-	UNUSED
10	FD	-	-	UNUSED
11	FD	-	-	UNUSED
12	FD	-	-	UNUSED

TABLE 9. ACTIVE TV SENSOR DATA

NAME: TELEVISION; NI - 2; NF - 24

VARIABLE NUMBER	VARIABLE TYPE	FORTRAN SYMBOL	UNITS	DESCRIPTION
1	ID	ISTYPE	-	SWITCH FOR DEPRESSION ANGLE (1-VARIABLE, 2- FIXED)
2	ID	-	-	UNUSED
3	FD	ASPECT	-	RATIO OF THE VERTICAL FOV TO HORIZONTAL FOV
4	FD	THETAV	DEG	VERTICAL FOV (NARROW)
5	FD	THETAV	DEG	VERTICAL FOV (WIDE)
6	FD	PHID	DEG	SENSOR DEPRESSION ANGLE
7	FD	BAND	HZ	BANDWIDTH
8	FD	DIAG	MM	DIAGONAL OF EFFECTIVE PHOTOSURFACE AREA
9	FD	FNUM	-	F - NUMBER (NARROW FOV)
10	FD	FNUM	-	F - NUMBER (WIDE FOV)
11	FD	GAMMAT	-	SLOPE OF SIGNAL VS/ IRRADIANCE CHARACTERISTIC
12	FD	TRANSM	-	LENS SYSTEM TRANSMITTANCE
13	FD	XFC	FC	SENSITIVITY DATA ILLUMINANCE
14	FD	XI	AMPS	SIGNAL AT $H_1$
15	FD	XIMAX	AMPS	MAXIMUM SIGNAL CAPABILITY
16	FD	XIP	AMPS	PRE-AMP NOISE
17	FD	XLAMDA	$\mu$ m	RESPONSIVE WAVE LENGTH
18	FD	XNL	-	5% HORIZONTAL FREQUENCY RESPONSE
19	FD	XNR	-	RASTER COUNT
20	FD	POUT	WATTS	EFFECTIVE POWER OF THE ILLUMINATOR
21	FD	GAIN	-	BACKSCATTER GAIN RELATIVE TO ISOTROPIC ILLUMINATOR WAVE-LENGTH
22	FD	GT	-	TUBE GAIN
23	FD	-	-	UNUSED
24	FD	-	-	UNUSED
25	FD	-	-	UNUSED
26	FD	-	-	UNUSED

TABLE 10. PASSIVE TV

NAME: TELEVISION; NI - 2; NF - 24

VARIABLE NUMBER	VARIABLE TYPE	FORTRAN SYMBOL	UNITS	DESCRIPTION
1	ID	ISTYPE	-	SWITCH FOR DEPRESSION ANGLE (1-VARIABLE, 2- FIXED)
2	ID	-	-	UNUSED
3	FD	ASPECT	-	RATIO OF THE VERTICAL FOV TO HORIZONTAL FOV
4	FD	THETA V	DEG	VERTICAL FOV (NARROW)
5	FD	THETA V	DEG	VERTICAL FOV (WIDE)
6	FD	PHID	DEG	SENSOR DEPRESSION ANGLE
7	FD	BAND	HZ	BANDWIDTH
8	FD	DIAG	MM	DIAGONAL OF EFFECTIVE PHOTOSURFACE AREA
9	FD	FNUM	-	F - NUMBER (NARROW FOV)
10	FD	FNUM	-	F - NUMBER (WIDE FOV)
11	FD	GAMMAT	-	SLOPE OF SIGNAL VS/ IRRADIANCE CHARACTERISTIC
12	FD	TRANSM	-	LENS SYSTEM TRANSMITTANCE
13	FD	XFC	FC	SENSITIVITY DATA ILLUMINANCE
14	FD	XI	AMPS	SIGNAL AT $H_1$
15	FD	XIMAX	AMPS	MAXIMUM SIGNAL CAPABILITY
16	FD	XIP	AMPS	PRE-AMP NOISE
17	FD	XLAMDA	$\mu m$	RESPONSIVE WAVE LENGTH
18	FD	XNL	-	5% HORIZONTAL FREQUENCY RESPONSE
19	FD	XNR	-	MASTER COUNT
20	FD	POUT	WATTS	EFFECTIVE POWER OF THE ILLUMINATOR
21	FD	GAIN	-	BACKSCATTER GAIN RELATIVE TO ISOTROPIC ILLUMINATOR WAVE-LENGTH
22	FD	GT	-	TUBE GAIN
23	FD	-	-	UNUSED
24	FD	-	-	UNUSED
25	FD	-	-	UNUSED
26	FD	-	-	UNUSED

TABLE 11. FORWARD-LOOKING RADAR, MTI

NAME: FLR; NI - 2; NF - 23

VARIABLE NUMBER	VARIABLE TYPE	FORTRAN SYMBOL	UNITS	DESCRIPTION
1	ID	ISEAS	-	SEASON (1 - WINTER, 2 - SPRING, 3 - SUMMER, 4 - FALL)
2	ID	-	-	UNUSED
3	FD	FMF	db/oct	FILTER ROLLOFF VALUE
4	FD	GO	-	MAXIMUM ANTENNA GAIN
5	FD	PNR	WATTS	RECEIVER NOISE POWER
6	FD	PRF	PPS	PULSE REPETITION RATE
7	FD	PX	WATTS	PEAK TRANSMITTER POWER
8	FD	FLAMDA	METERS	WAVELENGTH
9	FD	WS	DEG/SEC	ANTENNA SCAN RATE
10	FD	PHIM	DEG	ANTENNA DEPRESSION ANGLE TO TOP OF BEAM
11	FD	THETAH	DEG	HORIZONTAL ANTENNA BEAMWIDTH
12	FD	THETAS	DEG	TOTAL HORIZONTAL SCAN ANGLE, MEASURE IN HORIZONTAL PLANE
13	FD	THETA V	DEG	VERTICAL ANTENNA BEAMWIDTH
14	FD	TAUPW	SEC	PULSEWIDTH
15	FD	TAUP1	-	TRANSMITTER PLUMBING ATTENUATION FACTOR
16	FD	TAUP2	-	RECEIVER PLUMBING ATTENUATION FACTOR
17	FD	VF	CPS	DOPPLER SPREAD DUE TO CARRIER FREQUENCY DEVIATION
18	FD	VPRF	CPS	DOPPLER SPREAD DUE TO PRF DEVIATION
19	FD	-	-	UNUSED
20	FD	-	-	UNUSED
21	FD	CAS	-	FRACTION OF TIME ATTENUATION NOT EXCEEDED
22	FD	-	-	UNUSED
23	FD	TSM	db	SIGNAL TO NOISE THRESHOLD
24	FD	-	-	UNUSED
25	FD	VTH	M/SEC	THRESHOLD VELOCITY (RADIAL)

TABLE 12. FORWARD-LOOKING RADAR, NON-MTI

NAME: FLR; NI - 2; NF - 23

VARIABLE NUMBER	VARIABLE TYPE	FORTRAN SYMBOL	UNITS	DESCRIPTION
1	ID	ISEAS	-	SEASON (1 - WINTER, 2 - SPRING, 3 - SUMMER, 4 - FALL)
2	ID	-	-	UNUSED
3	FD	FMF	db/oct	FILTER ROLLOFF VALUE
4	FD	GO	-	MAXIMUM ANTENNA GAIN
5	FD	PNR	WATTS	RECEIVER NOISE POWER
6	FD	PRF	PPS	PULSE REPETITION RATE
7	FD	PX	WATTS	PEAK TRANSMITTER POWER
8	FD	FLANDA	METERS	WAVELENGTH
9	FD	WS	DEG/SEC	ANTENNA SCAN RATE
10	FD	PHIM	DEG	ANTENNA DEPRESSION ANGLE TO TOP OF BEAM
11	FD	THETAH	DEG	HORIZONTAL ANTENNA BEAMWIDTH
12	FD	THETAS	DEG	TOTAL HORIZONTAL SCAN ANGLE, MEASURE IN HORIZONTAL
13	FD	THETA V	DEG	VERTICAL ANTENNA BEAMWIDTH PLANE
14	FD	TAUPW	SEC	PULSEWIDTH
15	FD	TAUP1	-	TRANSMITTER PLUMBING ATTENUATION FACTOR
16	FD	TAUP2	-	RECEIVER PLUMBING ATTENUATION FACTOR
17	FD	VF	CPS	DOPPLER SPREAD DUE TO CARRIER FREQUENCY DEVIATION
18	FD	VPRF	CPS	DOPPLER SPREAD DUE TO PRF DEVIATION
19	FD	-	-	UNUSED
20	FD	-	-	UNUSED
21	FD	CAS	-	FRACTION OF TIME ATTENUATION NOT EXCEEDED
22	FD	-	-	UNUSED
23	FD	TSM	db	SIGNAL TO NOISE THRESHOLD
24	FD	-	-	UNUSED
25	FD	VTH	M/SEC	THRESHOLD VELOCITY (RADIAL)

TABLE 13. SYNTHETIC APERTURE RADAR

NAME: SAR; NI - 2; NF - 23

VARIABLE NUMBER	VARIABLE TYPE	FORTRAN SYMBOL	UNITS	DESCRIPTION
1	ID	ISEAS	-	SEASON (1-WINTER, 2-SPRING, 3-SUMMER, 4-FALL)
2	ID	-	-	UNUSED
3	FD	DX	METERS	AZIMUTH GROUND RESOLUTION
4	FD	GZER	-	UNUSED
5	FD	PNR	WATTS	RECEIVER NOISE POWER
6	FD	PRF	PPS	PULSE REPETITION RATE
7	FD	PX	WATTS	PEAK TRANSMITTER POWER
8	FD	RC	-	CHIRP RATIO
9	FD	SNT	db	SIGNAL TO NOISE THRESHOLD
10	FD	-	-	UNUSED
11	FD	FLAMDA	METERS	WAVELENGTH
12	FD	-	-	UNUSED
13	FD	-	-	UNUSED
14	FD	THETAV	DEG	ANTENNA VERTICAL FOV
15	FD	TAUPW	SEC	PULSEWIDTH
16	FD	TAUF1	-	TRANSMITTER PLUMBING ATTENUATION FACTOR
17	FD	TAUF2	-	RECEIVER PLUMBING ATTENUATION FACTOR
18	FD	-	-	UNUSED
19	FD	ASPECT	-	
20	FD	SQ	DEG	SQUINT ANGLE
21	FD	CAS	-	FRACTION OF TIME ATTENUATION NOT EXCEEDED
22	FD	SL1	-	FIRST SIDELobe LEVEL WITH RESPECT TO MAINLOBE
23	FD	SL2	-	SECOND SIDELobe LEVEL WITH RESPECT TO MAINLOBE
24	FD	SL3	-	THIRD SIDELobe LEVEL WITH RESPECT TO MAINLOBE
25	FD	WS	NM	GROUND SWATH WHICH CAN BE PROCESSED IN REAL TIME

#### D. FIXED DATA

The fixed data consists of a group of DATA declaration statements found in subroutine INPUT1. It contains data which is constant for all sensor models in the program. It should not be modified by the user unless the program itself is modified or the user wishes to change some of the contained data which is discussed below. The only method of modifying the fixed data is to repunch the cards containing the data. As a reference for the discussion of this subsection, see the Fixed Data List in Section IV.

The first portion of the fixed data contains 50 integers which are described in Table 14. This portion of the fixed data is addressed as array IC in the program.

TABLE 14. INTEGERS IN FIXED DATA ARRAY IC

INTEGER NUMBER	DESCRIPTION	TYPE OF DATA*
1	MEMORY ALLOCATED FOR OPERATIONAL VARIABLES	ID
2	MEMORY ALLOCATED FOR OPERATIONAL VARIABLES	FD
3	MEMORY ALLOCATED FOR A TARGET ENTRY	ID
4	MEMORY ALLOCATED FOR A TARGET ENTRY	FD
5	MEMORY ALLOCATED FOR A BACKGROUND ENTRY	ID
6	MEMORY ALLOCATED FOR A BACKGROUND ENTRY	FD
7	MEMORY ALLOCATED FOR AN ENVIRONMENTAL/TERRAIN ENTRY	ID
8	MEMORY ALLOCATED FOR AN ENVIRONMENTAL/TERRAIN ENTRY	FD
9	MEMORY ALLOCATED FOR SEARCH VARIABLES	ID
10	MEMORY ALLOCATED FOR SEARCH VARIABLES	FD
11	MEMORY ALLOCATED FOR A VISUAL SENSOR ENTRY	ID
12	MEMORY ALLOCATED FOR A VISUAL SENSOR ENTRY	FD
13	MEMORY ALLOCATED FOR A FLIR SENSOR ENTRY	ID
14	MEMORY ALLOCATED FOR A FLIR SENSOR ENTRY	FD
15	MEMORY ALLOCATED FOR AN ACTIVE TV SENSOR ENTRY	ID
16	MEMORY ALLOCATED FOR AN ACTIVE TV SENSOR ENTRY	FD
17	MEMORY ALLOCATED FOR A PASSIVE TV SENSOR ENTRY	ID
18	MEMORY ALLOCATED FOR A PASSIVE TV SENSOR ENTRY	FD
19	MEMORY ALLOCATED FOR A MTI FLR SENSOR ENTRY	ID
20	MEMORY ALLOCATED FOR A MTI FLR SENSOR ENTRY	FD
21	MEMORY ALLOCATED FOR A NON-MTI FLR SENSOR ENTRY	ID
22	MEMORY ALLOCATED FOR A NON-MTI FLR SENSOR ENTRY	FD
23	MEMORY ALLOCATED FOR A SAR SENSOR ENTRY	ID
24	MEMORY ALLOCATED FOR A SAR SENSOR ENTRY	FD
25-50	UNUSED LOCATIONS	-

\* ID - INTEGER; FD - FLOATING-POINT

The second portion of the fixed data contains 50 additional integers which are described in Table 15. This portion of the fixed data is addressed as array ICT in the program.

TABLE 15. INTEGERS IN FIXED DATA ARRAY ICT

INTEGER NUMBER	DESCRIPTION *
1	MEMORY ALLOCATED FOR TABLE NUMBER 1 OF FDTAB ARRAY
2	NUMBER OF FIRST INDEPENDENT VARIABLES IN TABLE 1
3	NUMBER OF SECOND INDEPENDENT VARIABLES IN TABLE 1
4	MEMORY ALLOCATED FOR TABLE NUMBER 2 OF FDTAB ARRAY
5	NUMBER OF FIRST INDEPENDENT VARIABLES IN TABLE 2
6	NUMBER OF SECOND INDEPENDENT VARIABLES IN TABLE 2
7	MEMORY ALLOCATED FOR TABLE NUMBER 3 OF FDTAB ARRAY
8	NUMBER OF FIRST INDEPENDENT VARIABLES IN TABLE 3
9	NUMBER OF SECOND INDEPENDENT VARIABLES IN TABLE 3
10	MEMORY ALLOCATED FOR TABLE NUMBER 4 OF FDTAB ARRAY
11	NUMBER OF FIRST INDEPENDENT VARIABLES IN TABLE 4
12	NUMBER OF SECOND INDEPENDENT VARIABLES IN TABLE 4
13	MEMORY ALLOCATED FOR TABLE NUMBER 5 OF FDTAB ARRAY
14	NUMBER OF FIRST INDEPENDENT VARIABLES IN TABLE 5
15	NUMBER OF SECOND INDEPENDENT VARIABLES IN TABLE 5
16	MEMORY ALLOCATED FOR TABLE NUMBER 6 OF FDTAB ARRAY
17	NUMBER OF FIRST INDEPENDENT VARIABLES IN TABLE 6
18	NUMBER OF SECOND INDEPENDENT VARIABLES IN TABLE 6
19	MEMORY ALLOCATED FOR TABLE NUMBER 7 OF FDTAB ARRAY
20	NUMBER OF FIRST INDEPENDENT VARIABLES IN TABLE 7
21	NUMBER OF SECOND INDEPENDENT VARIABLES IN TABLE 7
22	MEMORY ALLOCATED FOR TABLE NUMBER 8 OF FDTAB ARRAY
23	NUMBER OF FIRST INDEPENDENT VARIABLES IN TABLE 8
24	NUMBER OF SECOND INDEPENDENT VARIABLES IN TABLE 8
25	MEMORY ALLOCATED FOR TABLE NUMBER 9 OF FDTAB ARRAY
26	NUMBER OF FIRST INDEPENDENT VARIABLES IN TABLE 9
27	NUMBER OF SECOND INDEPENDENT VARIABLES IN TABLE 9
28	MEMORY ALLOCATED FOR TABLE NUMBER 10 OF FDTAB ARRAY
29	NUMBER OF FIRST INDEPENDENT VARIABLES IN TABLE 10
30	NUMBER OF SECOND INDEPENDENT VARIABLES IN TABLE 10

TABLE 15. INTEGERS IN FIXED DATA ARRAY ICT (Continued)

INTEGER NUMBER	DESCRIPTION *
31	MEMORY ALLOCATED FOR TABLE NUMBER 11 OF FDTAB ARRAY
32	NUMBER OF FIRST INDEPENDENT VARIABLES IN TABLE 11
33	NUMBER OF SECOND INDEPENDENT VARIABLES IN TABLE 11
34	MEMORY ALLOCATED FOR TABLE NUMBER 12 OF FDTAB ARRAY
35	NUMBER OF FIRST INDEPENDENT VARIABLES IN TABLE 12
36	NUMBER OF SECOND INDEPENDENT VARIABLES IN TABLE 12
37	MEMORY ALLOCATED FOR TABLE NUMBER 13 OF FDTAB ARRAY
38	NUMBER OF FIRST INDEPENDENT VARIABLES IN TABLE 13
39	NUMBER OF SECOND INDEPENDENT VARIABLES IN TABLE 13
40	MEMORY ALLOCATED FOR TABLE NUMBER 14 OF FDTAB ARRAY
41	NUMBER OF FIRST INDEPENDENT VARIABLES IN TABLE 14
42	NUMBER OF SECOND INDEPENDENT VARIABLES IN TABLE 14
43-50	UNUSED LOCATIONS

\* A LIST OF THE TABLE NUMBERS AND DESCRIPTION FOR THE FDTAB ARRAY CAN BE FOUND IN TABLE 16.

The third portion of the fixed data contains all the tables used in the program. The original 14 tables are described in Table 16. This portion of the fixed data is addressed by the array FDTAB.

The floating-point, third portion of the fixed data contains all the tables used in the program. The original 14 tables are described in Table 16. This portion of the fixed data is addressed by the array FDTAB.

TABLE 16. TABLES IN FIXED DATA ARRAY FDTAB

TABLE NUMBER	TABLE SIZE	DESCRIPTION
1	88	TABULAR VALUES FOR $E_2(z)$ where $E_2(z) = \int_1^{\infty} e^{-z\tau} / \tau^2 d\tau$
2	8	PROBABILITY OF CLOUD-FREE LOS VERSUS ZENITH ANGLE (DEG.) FOR ALTITUDES LESS THAN OR EQUAL TO 5000 FT.
3	8	PROBABILITY OF CLOUD-FREE LOS VERSUS ZENITH ANGLE (DEG.) FOR ALTITUDES GREATER THAN 5000 FEET
4	15	BACKGROUND RCS ( $m^{-2}$ ) VERSUS DEPRESSION ANGLE (DEG.) AND RADAR BAND.
5	31	ATTENUATION RATE VERSUS RAIN RATE (MM/HR) AND RADAR BAND.
6	14	ALTITUDE OF CLOUD LAYER (CEILING OR FLOOR) VERSUS SEASON
7	49	LIQUID WATER CONTENT ( $g/m^3$ ) VERSUS SEASON AND OCTALS OF CLOUD COVER
8	49	PERCENTAGE FREQUENCY OF CLOUD COVER VERSUS SEASON AND OCTALS OF CLOUD COVER.
9	39	FREQUENCY OF RAINFALL RATE VERSUS SEASON AND RAINFALL RATE (MM/HR.) SLANT RANGE FROM BOTTOM OF CLOUD COVER TO GROUND GREATER THAN OR EQUAL TO 10 KM.
10	39	FREQUENCY OF RAINFALL RATE VERSUS SEASON AND RAINFALL RATE (MM/HR.) SLANT RANGE FROM BOTTOM OF CLOUD COVER TO GROUND LESS THAN 10 KM.
11	181	DIRECTIONAL PATH REFLECTANCE VERSUS ALTITUDE (FT.) AND SLANT RANGE (FT.) FOR 90° AZIMUTH.
12	181	DIRECTIONAL PATH REFLECTANCE VERSUS ALTITUDE (FT) AND SLANT RANGE (FT) FOR 0° AZIMUTH.
13	8	REFLECTANCE FACTOR VERSUS ZENITH ANGLE (DEG.) FOR 90° AZIMUTH.
14	8	REFLECTANCE FACTOR VERSUS ZENITH ANGLE (DEG.) FOR 0° AZIMUTH.

### III. LOGICAL STRUCTURE

This program is arranged modularly with respect to the sensor models. The control section is independent, allowing sensor models to be added or changed without changing the whole program.

Four main data arrays form the basic structure of the TATAC model. They are the IC, ICT, FDTAB, and FD arrays. The first three array names stored the fixed data as discussed in the previous section. These three arrays (IC, ICT, and FDTAB) are contained in the labeled common blocks ARRSET, TABSET, and TABLES, respectively. The information is available to all programs in which the common block appears.

The array FD contains the input library data used by the program to execute the model for a particular run. This array is contained in the common block ARRAYS. The information is passed through the program using the subroutine call statements. Integer values in this array are addressed by the array ID which shares storage with the FD array through the use of an EQUIVALENCE statement. In the main program, the data in the FD array is identified by pointers to the section reserved for each data type. These pointers are listed in Table 17.

TABLE 17. DATA IDENTIFICATION POINTERS

FORTRAN SYMBOL	TYPE OF DATA *	TYPE OF DATA IDENTIFIED
IIO	ID	OPERATIONAL VARIABLES
IFO	FD	OPERATIONAL VARIABLES
IIT	ID	TARGET
IFT	FD	TARGET
IIB	ID	BACKGROUND
IFB	FD	BACKGROUND
IIEVT	ID	ENVIRONMENTAL/TERRAIN
IFEVT	FD	ENVIRONMENTAL/TERRAIN
IITS	ID	SEARCH
IPTS	FD	SEARCH
ISETID	ID	SENSORS
ISETFD	FD	SENSORS

The data is passed through the call handler using the following procedure:

CALL TEST (.....ID(IIO),FD(IFO),FD(IFT),.....)  
and is received in the subroutine as follows:

SUBROUTINE TEST (.....IDO, FDO,FDT,.....)  
DIMENSION IDO(1),FDO(1),FDT(1)

Table 18 lists the internal representatives for all the sections of the data used in the subroutines.

TABLE 18. INTERNAL ARRAY NAMES

ARRAY NAME	TYPE OF DATA*	LIBRARY DATA
IDO	ID	OPERATIONAL VARIABLES
FDO	FD	OPERATIONAL VARIABLES
IDT	ID	TARGET
FDT	FD	TARGET
IDS	ID	BACKGROUND
FDS	FD	BACKGROUND
IDVT	ID	ENVIRONMENTAL/TERRAIN
FDEVT	FD	ENVIRONMENTAL/TERRAIN
IDTS	ID	SEARCH
FDTs	FD	SEARCH
IDS	ID	SENSORS
FDS	FD	SENSORS

\* ID - INTEGER; FD - FLOATING-POINT NUMBER.

#### IV. FIXED DATA LISTING

The following is a listing of the TATAC fixed data. For an explanation of listing content, see Section II-D of this Volume.

##### IC ARRAY

1	2	16	19	36	37	43	48	56	57
66	68	73	75	85	87	111	113	136	138
161	163	186	188	211	211	211	211	211	211
211	211	211	211	211	211	211	211	211	211
211	211	211	211	211	211	211	211	211	211

##### ICT ARRAY

1	44	0	89	4	0	97	4	0	105
3	3	120	3	7	151	2	4	165	4
9	214	4	9	263	4	7	302	4	7
341	6	25	522	6	25	703	4	0	711
4	0	719	719	719	719	719	719	719	719

##### FDTAB ARRAY

0.00	.05	.10	.15	.20	.25	.30	.35	.40	.45
.50	.55	.60	.65	.70	.75	.80	.85	.90	.95
1.00	1.05	1.10	1.15	1.20	1.25	1.30	1.35	1.40	1.45
1.50	1.55	1.60	1.65	1.70	1.75	1.80	1.85	1.90	1.95
2.00	2.50	4.00	5.00						
1.0000000	.8278345	.7225450	.6410387	.5742006					
.5177301	.4691153	.426727	.3893680	.3562290					
.3266439	.3000996	.2761839	.2545597	.2349471					
.2171109	.2008517	.1859986	.1724041	.1599404					
.1484955	.1379713	.1282811	.1193481	.1111041					
.1034881	.0964455	.0899275	.0838899	.0782930					
.0731008	.0682807	.0638032	.0596413	.0557706					
.0521687	.0488153	.0456915	.0427803	.0400660					
.0375343	.0197976	.0031982	.0009964						
100.	120.	140.	180.	.3000	.4050	.4675	.5000		
100.	120.	150.	180.	.5130	.6330	.6930	.7000		
5.	40.	75.	1.	2.	3.	-43.	-29.	-25.	-39.
-25.	-20.	-23.	-17.	-10.					
.0320000	.0180000	.0086000	0.0000000	.2500000					
.5100000	2.5400000	6.3500000	12.7000000	25.4000000					
0.0000000	.0000014	.0000042	.0000270	.0000920					
.0002200	.0005600	0.0000000	.0000086	.0000200					
.0001400	.0003500	.0009000	.0019000	0.0000000					
.0000620	.0001100	.0008500	.0016000	.0043000					
.0076000									
2.	1.	1.	2.	3.	4.	1823.	3414.	4816.	4333.
366.	914.	1829.	1524.						
1.000	2.000	3.000	4.000	0.000	.125	.250	.375	.500	.625
.750	.875	1.000	0.000	.250	.250	.250	.400	.500	.500
.500	.500	0.000	.200	.200	.200	.400	.400	.600	.600
.600	0.000	.200	.200	.400	.400	.600	.600	.800	1.000
.200	.200	.200	.400	.400	.600	.600	.600		
1.000	2.000	3.000	4.000	0.000	.125	.250	.375	.500	.625
.750	.875	1.000	.141	.061	.039	.038	.028	.038	.053
.140	.462	.226	.120	.057	.078	.050	.067	.091	.105
.207	.154	.177	.087	.092	.071	.085	.095	.149	.090
.216	.113	.052	.052	.046	.048	.062	.125	.286	
.2160	.1130	.0520	.0520	.0460	.0480	.0620	.1250	.2860	
.2860									

IC ARRAY (Continued)

1.0000	2.0000	3.0000	4.0000	0.0000	.2500	.5100	2.5400
6.3500	12.7000	25.4000	.9240	.0560	.0200	0.0000	0.0000
0.0000	0.0000	.9290	.0480	.0210	.0020	0.0000	0.0000
0.0000	.8937	.0580	.0390	.0080	.0010	.0003	0.0000
.8890	.0640	.0420	.0050	0.0000	0.0000	0.0000	
1.00000	2.00000	3.00000	4.00000	0.00000	.25000	.51000	
2.54000	6.35000	12.70000	25.40000	.92110	.00780	.00640	
.00300	.00140	.00030	0.00000	.97940	.00790	.00680	
.00370	.00180	.00040	0.00000	.97710	.00680	.00660	
.00550	.00320	.00080	0.00000	.97762	.00690	.00680	
.00510	.00290	.00068	0.00000				
1000.00	1500.00	5000.00	10000.00	20000.00	30000.00	1.00	
1.50	2.00	3.00	4.00	5.00	6.00	7.00	
8.00	9.00	10.00	15.00	20.00	25.00	30.00	
35.00	40.00	50.00	60.00	70.00	80.00	90.00	
100.00	150.00	200.00	.02	.02	.03	.04	
.08	.12	.16	.20	.24	.30	.35	
.73	1.35	2.25	3.50	5.40	8.40	21.50	
90.00	90.00	90.00	90.00	90.00	90.00	90.00	
0.00	.02	.03	.06	.09	.13	.17	
.22	.28	.34	.42	.58	1.65	3.00	
5.60	10.50	23.00	80.00	80.00	80.00	80.00	
80.00	80.00	80.00	80.00	0.00	0.00	0.00	
0.00	0.00	.08	.10	.13	.16		
.20	.24	.51	.94	1.55	2.50	3.80	5.80
13.00							
38.50	100.00	100.00	100.00	100.00	100.00	100.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
.18	.31	.49	.72	1.00	1.36	2.35	3.85
6.30							
10.00	16.00	25.50	100.00	100.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
.14							
.20	.27	.37	.50	.84	1.30	1.92	2.75
3.75							
5.20	21.00	100.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
.22							
.27	.34	.56	.90	1.38	2.05	2.88	3.95
12.00							
26.00							
1000.00	1500.00	5000.00	10000.00	20000.00	30000.00	1.00	
1.50	2.00	3.00	4.00	5.00	6.00	7.00	
8.00	9.00	10.00	15.00	20.00	25.00	30.00	
35.00	40.00	50.00	60.00	70.00	80.00	90.00	
100.00	150.10	200.00	.01	.03	.04	.09	
.16	.24	.33	.47	.53	8.65	.78	
1.70	3.10	0.20	8.20	12.25	17.75	38.00	
84.00	100.00	100.00	100.00	100.00	100.00	100.00	
0.00	.02	.04	.08	.15	.22	.32	
.44	.56	.70	.88	2.07	4.10	7.40	
12.50	20.50	32.00	72.00	100.00	100.00	100.00	
100.00	100.00	100.00	100.00	0.00	0.00	0.00	
0.00	0.00	.07	.11	.15	.19		
.25	.32	.80	1.60	2.85	4.80	7.60	12.25
30.00							
66.00	100.00	100.00	100.00	100.00	100.00	100.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
.10							
.21	.40	.67	1.05	1.55	2.23	4.10	7.00
11.20							
18.20	31.50	60.00	120.00	120.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
.14							
.22	.34	.46	.64	1.10	1.75	2.60	3.90
5.40							
7.60	34.00	160.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
.22							
.28	.36	.58	.89	1.30	1.90	2.70	3.65
15.00							
47.00							
95.	120.	150.	180.	1.95	1.10	.65	1.00
95.	120.	150.	180.	2.78	1.78	1.10	1.00
0.	0.	0.	0.	0.	0.		

## V. LIBRARY DATA LISTING

The following is a listing of the TATAC library data. For an explanation of listing content, see Section II-C of this Volume.

### FD ARRAY

```

0
0.      .4000E+04 .5000E+03 .4000E+03 .4000E+03
.4000E+03 .4000E+03 .3100E+04 .6000E+05 .2700E+02
.1000E+02 .3330E+00 0.      0.
    
```

```

10 0 0
.2050E+02 .1070E+02 .8200E+01 .1600E+00 .3060E+03
.9000E+00 .1170E+02 .1170E+02 .1170E+02 .9000E+02
0.      .2500E+02 0.      0.      0.
0.      0.
    
```

```

0
0.8000E-01 .3000E+03 .9100E+00 0.      .6000E+01
0.
    
```

```

2 2 0 0 0
.1000E+00 .5000E+01 0.      .6000E+01 .4000E+00
.4000E+01 .2500E+00 0.
    
```

```

0
0.      .3600E+05 .1000E+03 .2000E+02 .2550E+03
.2550E+03 0.      0.      0.
    
```

```

1 0
.3600E+05 0.      0.      .5500E+00 0.
    
```

```

1 0
.1333E+01 .1860E+01 .7440E+01 .3000E+02 .3060E-01
.1039E-01 0.      0.      0.      0.
    
```

```

1 0
.1000E+01 .1000E+01 .1000E+01 .3000E+02 .4500E+07
.2500E+02 .5600E+01 .5600E+01 .1000E+01 .6000E+00
.4500E-02 .2000E-04 .2000E-01 .2000E-08 .8400E+00
.4000E+03 .5110E+03 .5000E+02 .2400E+00 .1000E+01
0.      0.      0.      0.
    
```

```

1 0
.1000E+01 .1000E+01 .4000E+01 .3000E+02 .9250E+07
.1570E+02 .5600E+01 .5600E+01 .1000E+01 .6000E+00
.4500E-02 .6000E-08 .8000E-05 .7000E-08 .5500E+00
.6000E+03 .5110E+03 0.      0.      .1000E+01
0.      0.      0.
    
```

FD ARRAY (Continued)

1	0				
.2400E+02	.1000E+04	.2000E-12	.3600E+04	.6000E+05	
.3000E-01	.9000E+02	.1000E+02	.2500E+01	.9000E+02	
.3000E+02	.2000E-05	.5000E+00	.8000E+00	0.	
0.	0.	0.	.9500E+00	0.	
.1500E+02	0.	.8000E+01			

1	0				
.2400E+02	.1000E+04	.2000E-12	.3600E+04	.6000E+05	
.3000E-01	.9000E+02	.1000E+02	.2500E+01	.9000E+02	
.3000E+02	.2000E-05	.5000E+00	.8000E+00	0.	
0.	0.	0.	.9500E+00	0.	
.1500E+02	0.	.8000E+01			

1	0				
.6000E+01	.1000E+04	.2000E-12	.3600E+04	.6000E+05	
.5000E+02	.1500E+02	0.	.3000E-01	0.	
0.	.3000E+02	.1000E-05	.5000E+00	.8000E+00	
0.	.1000E+01	.1000E+02	.9500E+00	.3600E+02	
.3600E+02	.3600E+02	.1000E+01			

## VI. SAMPLE PROBLEMS

This section, containing sample problems, is provided to assist the user in setting up problems for interpreting the outputs of the computer model. It does not present a comprehensive list of all possible representative uses of the model. Each sample briefly describes the problem, presents the execution list and computer printout, and discusses the results.

### A. VISUAL OBSERVER (VISOB) - SAMPLE PROBLEM A

This sample problem exemplifies the use of the Visual Observer model. The aircraft search altitude is 6,000 feet with a meteorological visibility of 4 nautical miles.

The specific variables which were entered into the program are shown in the execution list of Figure 5. Two "data name" cards were required with one "data modification" card following each. All other stored library values remain unchanged.

The results of the computer run can be seen from the computer output of Figure 6. The cumulative probability of detection (PAD) was .196 up to the dive point and 1.0 at the minimum launch point.

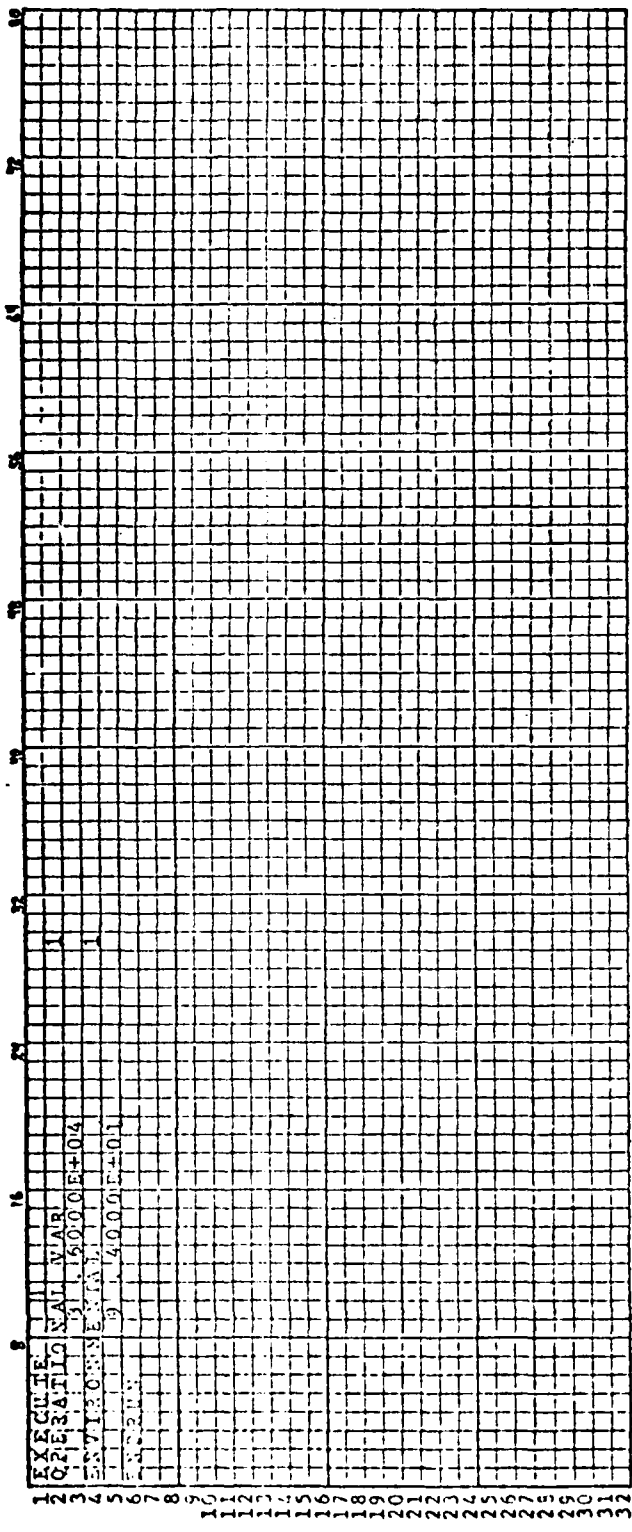


Figure 5. Execution List - Sample Problem A

SENSOR NUMBER = 1

- 1= VISUAL OBSERVER
- 2= FORWARD-LOOKING INFRARED
- 3= ACTIVE (ILLUMINATED) TV
- 4= PASSIVE (DAYLIGHT) TV
- 5= FORWARD-LOOKING RADAR, MTI
- 6= FORWARD-LOOKING RADAR, NON-MTI
- 7= SYNTHETIC APERTURE RADAR

NAME	IVAR	VALUE
OPFR	3	.6000E+04
ENV1	9	.4000E+01

- I = MINIMUM LAUNCH POINT
- II = DIVE BEGINS
- III = (DUMMY POSITION)
- IV = TARGET PASSES OUT OF FOV (FIXED DEPRESSION ANGLE)
- V = SEARCH ALTITUDE ACHIEVED
- VI = CLIMB TO ALTITUDE BEGINS

- X = ALONG-TRACK GROUND DISTANCE TO TARGET, FT.
- XY = GROUND RANGE TO TARGET, FT.
- TIME = TIME BEFORE LAUNCH, SEC.
- PLCS = PROBABILITY TARGET IS WITHIN LOS
- PF0V = PROBABILITY TARGET IS WITHIN FOV
- P2 = SEARCH TERM PROBABILITY
- P3D = DISCRIMINABILITY (DETECTION)
- P3R = DISCRIMINABILITY (RECOGNITION)
- PAD = CUMULATIVE PROBABILITY OF DETECTION
- PAR = CUMULATIVE PROBABILITY OF RECOGNITION

I	II	III	IV	V	VI
2762.	11778.	11778.	26166.	36000.	36000.
2762.	11778.	11778.	26166.	36000.	36000.

X	XY	TIME	PLCS	PF0V	P2	P3D	P3R	PAD	PAR
2963.	2963.	.33	1.000	1.000	1.000	1.000	1.000	1.000	1.000
11777.	11777.	14.99	1.000	1.000	1.000	.217	.005	1.000	1.000
12001.	12001.	15.32	1.000	1.000	1.000	.196	.002	.196	.002
12676.	12676.	16.32	1.000	1.000	1.000	.146	0.000	.196	.002
13350.	13350.	17.32	1.000	1.000	1.000	.109	0.000	.196	.002
14024.	14024.	18.32	1.000	1.000	1.000	.083	0.000	.196	.002
14699.	14699.	19.31	1.000	1.000	1.000	.064	0.000	.196	.002
15373.	15373.	20.31	1.000	1.000	1.000	.050	0.000	.196	.002
16048.	16048.	21.31	1.000	1.000	1.000	.040	0.000	.196	.002
16722.	16722.	22.31	1.000	1.000	1.000	.032	0.000	.196	.002
17397.	17397.	23.31	1.000	1.000	1.000	.027	0.000	.196	.002
18071.	18071.	24.31	1.000	1.000	1.000	.023	0.000	.196	.002
18746.	18746.	25.31	1.000	1.000	1.000	.019	0.000	.196	.002
19420.	19420.	26.31	1.000	1.000	1.000	.017	0.000	.196	.002
20094.	20094.	27.31	1.000	1.000	1.000	.015	0.000	.196	.002
20769.	20769.	28.30	1.000	1.000	1.000	.013	0.000	.196	.002
21443.	21443.	29.30	1.000	1.000	1.000	.012	0.000	.196	.002
22118.	22118.	30.30	1.000	1.000	1.000	.011	0.000	.196	.002
22792.	22792.	31.30	1.000	1.000	1.000	.010	0.000	.196	.002
23467.	23467.	32.30	1.000	1.000	1.000	.009	0.000	.196	.002
24141.	24141.	33.30	1.000	1.000	1.000	.008	0.000	.196	.002
24815.	24815.	34.30	1.000	1.000	1.000	.008	0.000	.196	.002
25490.	25490.	35.30	1.000	1.000	1.000	.007	0.000	.196	.002
26164.	26164.	36.30	1.000	1.000	1.000	.007	0.000	.196	.002
26839.	26839.	37.30	.920	1.000	1.000	.007	0.000	.196	.002
27513.	27513.	38.29	.915	1.000	1.000	.007	0.000	.196	.002

Figure 6. Computer Output - Sample Problem A

## B. FORWARD-LOOKING RADAR (FLR) - SAMPLE PROBLEM B

This sample problem exemplifies the use of the Forward-Looking Radar model with MTI mode. The radar is operated against a target which has a median RCS of 50 M<sup>2</sup>.

The specific variables entered into the program are shown in the execution list of Figure 7. Only one "data name" card and one "data modification" card were required. All other stored library values remain unchanged.

The results of the computer run can be seen from the computer output of Figure 8. As can be seen by the flight profile printout (lines 28-29), the aircraft achieved search altitude at a ground range of 22,689 feet and the target passed out of the sensor field of view at a ground range of 4768 feet. The cumulative probability of detection (PAD) reached a maximum of .994 which was achieved on the first "glimpse" at 22,528 feet. Closing to the target did not improve the PAD and at a ground range below 8365 feet the MTI could not discriminate the target for detection. This situation occurred due to the following reasons:

1. The area of the resolution cell increases as the range decreases, and
2. The unit background RCS increases with increasing depression angle to target.



SENSOR NUMBER = 5

- 1= VISUAL OBSERVER
- 2= FORWARD-LOOKING INFRARED
- 3= ACTIVE (ILLUMINATED) TV
- 4= PASSIVE (DAYLIGHT) TV
- 5= FORWARD-LOOKING RADAR,MTI
- 6= FORWARD-LOOKING RADAR,NON-MTI
- 7= SYNTHETIC APERTURE RADAR

NAME IVAR VALUE  
TARG 10 .5000E+02

- I = MINIMUM LAUNCH POINT
- II = DIVE REGINS
- III = (DUMMY POSITION)
- IV = TARGET PASSES OUT OF FOV(FIXED DEPRESSION ANGLE)
- V = SEARCH ALTITUDE ACHIEVED
- VI = CLIMB TO ALTITUDE REGINS

- X = ALONG-TRACK GROUND DISTANCE TO TARGET,FT.
- XY = GROUND RANGE TO TARGET,FT.
- TIME = TIME BEFORE LAUNCH,SEC.
- PL0S = PROBABILITY TARGET IS WITHIN LOS
- PF0V = PROBABILITY TARGET IS WITHIN F0V
- P2 = SEARCH TERM PROPABILITY
- P3D = DISCRIMINABILITY(DETECTION)
- P3R = DISCRIMINABILITY(RECOGNITION)
- PAD = CUMULATIVE PROBABILITY OF DETECTION
- PAR = CUMULATIVE PROBABILITY OF RECOGNITION

			I	II	III	IV	V	VI		
						4768.	22689.			
						4768.	22689.			
X	XY	TIME	PL0S	PF0V	P2	P3D	P3R	PAD	PAR	
4993.	4993.	.33	1.000	1.000	1.000	0.000	0.000	0.000	0.000	
5668.	5668.	1.33	.999	1.000	1.0000	0.000	0.000	0.000	0.000	
6342.	6342.	2.33	.998	1.000	1.000	0.000	0.000	0.000	0.000	
7016.	7016.	3.33	.997	1.000	1.000	0.000	0.000	0.000	0.000	
7691.	7691.	4.33	.996	1.000	1.000	0.000	0.000	0.000	0.000	
8365.	8365.	5.33	.994	1.000	1.000	1.000	.604	.994	.600	
9040.	9040.	6.33	.992	1.000	1.000	1.000	.604	.994	.600	
9714.	9714.	7.33	.989	1.000	1.000	1.000	.603	.994	.600	
10389.	10389.	8.33	.985	1.000	1.000	1.000	.603	.994	.600	
11063.	11063.	9.32	.981	1.000	1.000	1.000	.603	.994	.600	
11737.	11737.	10.32	.977	1.000	1.000	1.000	.603	.994	.600	
12412.	12412.	11.32	.972	1.000	1.000	1.000	.603	.994	.600	
13086.	13086.	12.32	.967	1.000	1.000	1.000	.603	.994	.600	
13761.	13761.	13.32	.961	1.000	1.000	1.000	.603	.994	.600	
14435.	14435.	14.32	.955	1.000	1.000	1.000	.603	.994	.600	
15110.	15110.	15.32	.948	1.000	1.000	1.000	.603	.994	.600	
15784.	15784.	16.32	.942	1.000	1.000	1.000	.603	.994	.600	
16459.	16459.	17.32	.935	1.000	1.000	1.000	.603	.994	.600	
17133.	17133.	18.32	.928	1.000	1.000	1.000	.603	.994	.600	
17807.	17807.	19.31	.921	1.000	1.000	1.000	.603	.994	.600	
18482.	18482.	20.31	.913	1.000	1.000	1.000	.603	.994	.600	
19156.	19156.	21.31	.906	1.000	1.000	1.000	.603	.994	.600	
19831.	19831.	22.31	.898	1.000	1.000	1.000	.603	.994	.600	
20505.	20505.	23.31	.890	1.000	1.000	1.000	.603	.994	.600	
21180.	21180.	24.31	.882	1.000	1.000	1.000	.603	.994	.600	
21854.	21854.	25.31	.874	1.000	1.000	1.000	.603	.994	.600	
22528.	22528.	26.31	.867	1.000	1.000	1.000	.603	.994	.600	

Figure 8. Computer Output - Sample Problem B

### C. SYNTHETIC APERTURE RADAR (SAR) - SAMPLE PROBLEM C

This sample problem exemplifies the use of the Synthetic Aperture Radar model. The search aircraft is flying at an altitude of 10,000 feet and looking at an offset of 150,000 feet.

The specific variables which were entered into the program are shown in the execution list of Figure 9. One "data name" card and two "data modification" cards were required. All other library values remain unchanged.

The results of the computer run can be seen in the computer output of Figure 10. The Synthetic Aperture Radar processes the doppler phase history of the illuminated ground area over the entire illumination period to generate the display. All returns from the target are integrated into this display. Thus, only one line of output is necessary to present the results. The radar beam was directed 26,509 feet ahead of the flight path and 152,323 feet from the aircraft. The cumulative probability of detection (PAD) achieved was .178.

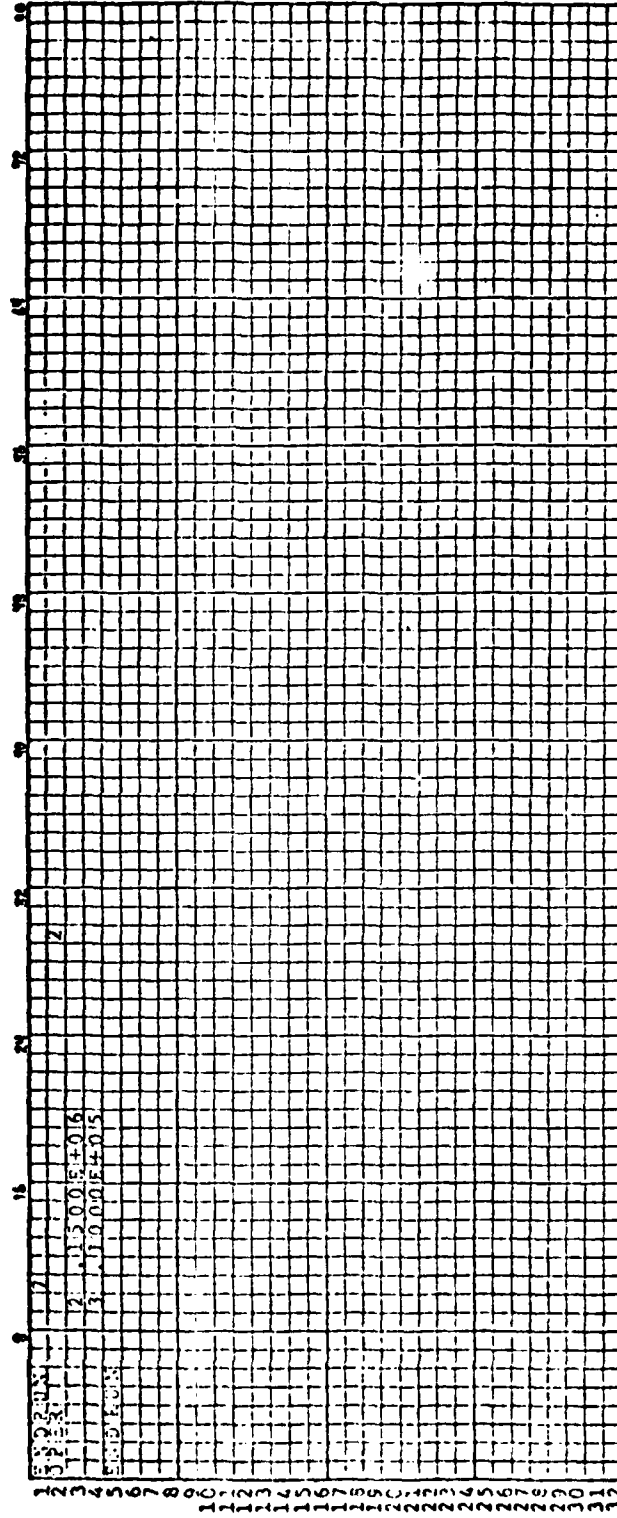


Figure 9. Execution List - Sample Problem C

SENSOR NUMBER = 7  
 1= VISUAL OBSERVER  
 2= FORWARD-LOOKING INFRARED  
 3= ACTIVE (ILLUMINATED) TV  
 4= PASSIVE (DAYLIGHT) TV  
 5= FORWARD-LOOKING RADAR,MTI  
 6= FORWARD-LOOKING RADAR,NON-MTI  
 7= SYNTHETIC APERTURE RADAR

NAME	IVAR	VALUE
OPER	2	.1500E+06
OPER	3	.1000E+05

X = ALONG-TRACK GROUND DISTANCE TO TARGET,FT.  
 XY = GROUND RANGE TO TARGET,FT.  
 TIME = TIME BEFORE LAUNCH,SEC.  
 PLOS = PROBABILITY TARGET IS WITHIN LOS  
 PF0V = PROBABILITY TARGET IS WITHIN FOV  
 P2 = SEARCH TERM PROBABILITY  
 P3D = DISCRIMINABILITY(DEFLECTION)  
 P3R = DISCRIMINABILITY(RECOGNITION)  
 PAD = CUMULATIVE PROBABILITY OF DEFLECTION  
 PAR = CUMULATIVE PROBABILITY OF RECOGNITION

X	XY	TIME	PLOS	PF0V	P2	P3D	P3R	PAD	PAR
26509.	152323.		.508	1.000	.350	1.000	.431	.178	.077

Figure 10. Computer Output - Sample Problem C

## VII. TATAC PROGRAM LISTINGS

This section contains the listings of the TATAC computer programs written in FORTRAN IV. The following listing includes all routines needed to run the TATAC model.

```
PROGRAM TATAC(INPUT,OUTPUT)
COMMON/ARRAYS/FD(250)
COMMON/ARRSET/IC(50)
COMMON/TABLES/FDTAB(725)
COMMON/TABSET/ICT(50)
COMMON/BLCK1/THETA, THETA, PHID
COMMON/BLCK3/X, Y, XY, H, SR, SP, ANGLE, ANGLT, DELTAT
COMMON/BLCK4/X1, X2, X3, X4, X5, X6, XY1, XY2, XY3, XY4, XY5, XY6
DIMENSION ID(250)
EQUIVALENCE (FD, ID)
ISNUMB=1
CR=.01745
CALL INPUT1
IIO=IC(1)
IF0=IC(2)
IIT=IC(3)
IFT=IC(4)
IIR=IC(5)
IFB=IC(6)
IEVT=IC(7)
IFEVT=IC(8)
IITS=IC(9)
IFTS=IC(10)
CALL INPUT2(ISNUMB)
GO TO (10,20,30,40,50,60,70), ISNUMB
10 ISETID=IC(11)
   ISETFD=IC(12)
   ISFNS=1
   ISTYPF=1
   GO TO 200
20 ISETID=IC(13)
   ISETFD=IC(14)
   ISFNS=2
   GO TO 75
30 ISETID=IC(15)
   ISETFD=IC(16)
   ISFNS=3
   GO TO 75
40 ISETID=IC(17)
   ISETFD=IC(18)
   ISFNS=4
   GO TO 75
50 ISETID=IC(19)
   ISETFD=IC(20)
   ISFNS=5
   ISTYPF=2
   GO TO 80
60 ISETID=IC(21)
   ISETFD=IC(22)
   ISFNS=6
```

```

      ISTYFF=2
      GO TO 80
70  ISFTID=IC(23)
      ISFTFD=IC(24)
      ISFNS=7
      ISTYFF=2
      GO TO 100
75  ISTYFF=ID(ISFTID)
      ASPECT=FD(ISFTFD)
      THETAU=FD(ISFTFD+2)*CR
      THETAH=ASPECT+THETAU
      PHID=FD(ISFTFD+3)*CR
      GO TO 200
80  THETAU=FD(ISFTFD+10)*CR
      THETAH=FD(ISFTFD+8)*CR
      PHID=FD(ISFTFD+7)*CR+THETAU/2.
      CALL FLIGHT(ISENS,ISTYFF,FD(IF0),ID(ISFTID),FD(ISFTFD))
      PRINT 202
      PRINT 203
      PRINT 204
      PRINT RS,X4,X5
      PRINT RS,XY4,XY5
85  FORMAT(1X,34X,2(F7.0,1X))
      PRINT 206
      TIME=0.
      IPRNT=-1
      IPRVT=-1
      PAD=0.
      PAR=0.
90  CALL GEOM(ISENS,ISTYFF,FD(IF0),ISTOP)
      IF(ISTOP.EQ.1) GO TO 600
      TIME=TIME+DELTAT
      PFOV=1.0
      CALL LOS(ISENS,ISTYFF,ID(IIFVT),FD(IFFVT),PL0S)
      P1=PL0S+PFOV
      CALL SFNCLR(ISENS,ID(IIT),FD(IFT),FD(IFR),FD(IFFVT),
      $ FD(IFS),ID(ISFTID),FD(ISFTFD),P2,P3D,P3R)
      IF(P3D.GT.0.) GO TO 380
      IPRNT=IPRNT+1
      IF(((IPRNT/3)+3).NE.IPRVT) GO TO 90
      PRINT 425,X,XY,TIME,PL0S,PFOV,P2,P3D,P3R,PAD,PAR
      GO TO 90
100 CONTINUE
      PFOV=1.0
      CALL SAR(FD(IF0),ID(IIT),FD(IFT),FD(IFR),FD(IFFVT),
      $ ID(ISFTID),FD(ISFTFD),P2,P3D,P3R)
      CALL LOS(ISENS,ISTYFF,ID(IIFVT),FD(IFFVT),PL0S)
      P1=PL0S+PFOV
      PAD=P1+P2+P3D
      PAR=P1+P2+P3R

```

```

PRINT 203
PRINT 206
PRINT 105,X,XY,PL0S,PF0V,P2,P3D,P3R,PAD,PAR
105 FORMAT(1X,2(F7.0,1X),6X,7(F5.3,1X))
GO TO 600

```

C

```

200 CALL FLIGHT(ISENS,ISTYPE,FD(IF0),ID(ISTID),FD(ISTFD))
PRINT 202
202 FORMAT(1X,/,1X,*I = MINIMUM LAUNCH POINT*,
$,1X,*II = DIVE REGINS*,
$,1X,*III = (DUMMY POSITION)*,
$,1X,*IV = TARGET PASSES OUT OF FOV(FIXED DEPRESSION*,
$* ANGLE)*,
$,1X,*V = SEARCH ALTITUDE ACHIEVED*,
$,1X,*VI = CLIMB TO ALTITUDE REGINS*)
PRINT 203
PRINT 204
PRINT 205,X1,X2,X3,X4,X5,X6
PRINT 205,XY1,XY2,XY3,XY4,XY5,XY6
203 FORMAT(1X,/,1X,*X = ALONG-TRACK GROUND DISTANCE TO *,
$*TARGET,FT.*,/,1X,*XY = GROUND RANGE TO TARGET,FT.*,
$,1X,*TIME= TIME BEFORE LAUNCH,SFC.*,
$,1X,*PL0S= PROBABILITY TARGET IS WITHIN L0S*,
$,1X,*PF0V= PROBABILITY TARGET IS WITHIN FOV*,
$,1X,*P2 = SEARCH TERM PROBABILITY*,
$,1X,*P3D = DISCRIMINABILITY(DETECTION)*,
$,1X,*P3R = DISCRIMINABILITY(RECOGNITION)*,
$,1X,*PAD = CUMULATIVE PROBABILITY OF DETECTION*,
$,1X,*PAR = CUMULATIVE PROBABILITY OF RECOGNITION*,/)
204 FORMAT(1X,14X,*I*,6X,*II*,6X,*III*,5X,*IV*,6X,*V*,7X,*VI*)
205 FORMAT(1X,10X,6(1X,F7.0))
PRINT 206
206 FORMAT(1X,/,4X,*X*,6X,*XY*,5X,*TIME*,2X,*PL0S*,2X,*PF0V*,
$2X,*P2*,4X,*P3D*,3X,*P3R*,3X,*PAD*,3X,*PAR*)
IPHASE=0
TIME=0.
IPRNT1=1
X0=0.
XY0=0.
TIME0=0.
PL0S0=0.
PF0V0=0.
P20=0.
P3D0=0.
P3R0=0.
PAD0=PAD
PAR0=PAR
CALL CF0M(ISENS,ISTYPE,FD(IF0),ISTOP)
IF(ISTOP.F0.1) GO TO 600
TIME=TIME+DFLTAT

```

```

300 IPHASE=IPHASE+1
    IF(IPHASE.GT.2) GO TO 600
    IF(IPHASE.EQ.2) PRINT 425,X0,XY0,TIMF0,PL0S0,PF0V0,
    $ P20,P3D0,P3R0,PAD0,PAR0
    IPRNT2=-1
    IF(ISENS.EQ.1) GO TO 305
    IF0V=IPHASE
    ASPECT=FD(ISETFD)
    THETA=FD(ISETFD+IF0V)*CR
    THETAH=ASPECT*THETA
    ISTYPE=ID(ISETID)
305 CONTINUE
    CALL SEARCH(ISENS,ISTYPE,ID(IIT),FD(IFT),
    $ FD(IFEVT),FD(IFTS),P2)
    CALL F0V(ISENS,ISTYPE,FD(IFTS),PF0V)
    CALL L0S(ISENS,ISTYPE,ID(IEVT),FD(IFEVT),PL0S)
    P1=PL0S*PF0V
    GO TO(310,320,330,330,340,340,350),ISNUMB
310 CALL VIS0R(FD(IFT),FD(IFB),ID(IEVT),FD(IFEVT),
    $ ID(ISETID),FD(ISETFD),P3D,P3R)
    GO TO 380
320 CALL FLIR(FD(IFT),FD(IFR),FD(IFEVT),
    $ ID(ISETID),FD(ISETFD),P3D,P3R)
    GO TO 380
330 CALL TV(ISENS,FD(IFT),FD(IFR),ID(IEVT),FD(IFEVT),
    $ ID(ISETID),FD(ISETFD),IF0V,P3D,P3R)
    GO TO 380
340 CALL SENFLR(ISENS,ID(IIT),FD(IFT),FD(IFR),FD(IFEVT),
    $ FD(IFTS),ID(ISETID),FD(ISETFD),P2,P3D,P3R)
    GO TO 380
350 CONTINUE
    GO TO 100
380 QR=P1*P2
    PAD=P3D*QR
    PAR=P3R*QR
400 IF(ISENS.GT.4) GO TO 410
    IF((X.LE.X2).AND.(IPRNT1.EQ.0)) GO TO 450
    IF((X.GT.X2).AND.(P3D.LT..005)) GO TO 600
    GO TO 420
410 IF((P1.OR.P2.OR.P3D).LT..005) GO TO 600
420 IPRNT2=IPRNT2+1
    IF(((IPRNT2/3)*3).NE.IPRNT2) GO TO 450
    PRINT 425,X,XY,TIME,PL0S,PF0V,P2,P3D,P3R,PAD,PAR
425 FORMAT(1X,2(F7.0,1X),F5.2,7(1X,F5.3))
    IPRNT1=0
450 CONTINUE
    QRN1=QR
    PADN1=PAD
    PARN1=PAR
    CALL CF0M(ISENS,ISTYPE,FD(IF0),ISTOP)

```

```

IF(ISTOP.FO.1) GO TO 600
TIME=TIME+DELTAT
IF(ISENS.GT.4) GO TO 460
IF((X.GT.X2).AND.(IPHASE.FO.1)) GO TO 300
CALL SEARCH(ISENS,ISTYPE,ID(IIT),FD(IFT),
$ FD(IEVVT),FD(IFTS),P2)
CALL FOV(ISENS,ISTYPE,FD(IFTS),PF0V)
460 CALL LOS(ISENS,ISTYPE,ID(IEVVT),FD(IEVVT),PL0S)
PI=PL0S+PF0V
GO TO(510,520,530,530,540,540,550),ISNUMB
510 CALL VIS0B(FD(IFT),FD(IFB),ID(IEVVT),FD(IEVVT),
$ ID(ISETID),FD(ISETFD),P3D,P3R)
GO TO 580
520 CALL FLIR(FD(IFT),FD(IFB),FD(IEVVT),
$ ID(ISETID),FD(ISETFD),P3D,P3R)
GO TO 580
530 CALL TV(ISENS,FD(IFT),FD(IFB),ID(IEVVT),FD(IEVVT),
$ ID(ISFTID),FD(ISFTFD),IF0V,P3D,P3R)
GO TO 580
540 CALL SENFLR(ISENS,ID(IIT),FD(IFT),FD(IFB),FD(IEVVT),
$ FD(IFTS),ID(ISFTID),FD(ISFTFD),P2,P3D,P3R)
GO TO 580
550 CONTINUE
GO TO 100
580 CR=PI*P2+(1.-P2)*CRN1
X0=X
XY0=XY
TIME0=TIME
PL0S0=PL0S
PF0V0=PF0V
P20=P2
P3D0=P3D
P3R0=P3R
DELTOR=CR-CRN1
IF(DELTOR.LE.0.) DELTOR=0.
PAD=PADN1+DELTOR*P3D
PAR=PARN1+DELTOR*P3R
PAD0=PAD
PAR0=PAR
GO TO 400
600 CONTINUE
END
SUBROUTINE INPUT1
COMMON/ARRAYS/FD(250)
COMMON/ARRSET/IC(50)
COMMON/TABLES/FDTAR(725)
COMMON/TARSET/ICT(50)
DIMENSION ID(250)
EQUIVALENCE (FD, ID)
DATA(IC(I),I=1,24)/1,2,16,19,36,37,43,48,56,57,

```

```

$ 66,68,73,75,85,87,111,113,136,138,161,163,186,188/
DATA(IG(I),I=25,50)/26*211/
DATA(IGT(I),I=1,12)/1,44,0,89,4,0,97,4,0,105,3,3/
DATA(IGT(I),I=13,42)/120,3,7,151,2,4,165,4,9,
$ 214,4,9,263,4,7,302,4,7,341,6,25,522,6,25,
$ 703,4,0,711,4,0/
DATA(IGT(I),I=43,50)/8*719/
DATA ID(1),ID(16),ID(17),ID(18),ID(36)/0,10,0,0,0/
DATA ID(43),ID(44),ID(45),ID(46),ID(47)/2,2,0,0,0/
DATA ID(56),ID(66),ID(67),ID(73),ID(74)/0,1,0,1,0/
DATA ID(85),ID(86),ID(111),ID(112),ID(136)/1,0,1,0,1/
DATA ID(137),ID(161),ID(162),ID(186),ID(187)/0,1,0,1,0/
DATA(FD(I),I=2,15)/0.,4000.,500.,400.,400.,400.,
$ 400.,3100.,60000.,27.,10.,.333,2*0./
DATA(FD(I),I=19,35)/20.5,10.7,8.8.,16,306.,.9,11.7,
$ 11.7,11.7,90.,0.,25.,5*0./
DATA(FD(I),I=37,42)/.08,300.,.91,0.,6.,0./
DATA(FD(I),I=48,55)/.1,5.,0.,6.,.4,4.,.25,0./
DATA(FD(I),I=57,65)/0.,34000.,100.,20.,255.,255.,3*0./
DATA(FD(I),I=68,72)/36000.,0.,0.,.55,0./
DATA(FD(I),I=75,84)/1.333,1.86,7.44,30.,.0306,
$ .01039,4*0./
DATA(FD(I),I=87,110)/1.,1.,1.,30.,.45F7,25.,5.6,5.6,
$ 1.,.6.,.45E-2.,.2E-4.,.2E-1.,.2E-8.,.84,400.,511.,
$ 50.,.24,1.,4*0./
DATA(FD(I),I=113,135)/1.,1.,4.,30.,.925F7,15.7,5.6,5.6,
$ 1.,.6.,.45E-2.,.8E-8.,.8E-5.,.7E-8.,.55,600.,511.,0.,
$ 0.,1.,3*0./
DATA(FD(I),I=138,160)/24.,1000.,.2E-12,3600.,60000.,.03,
$ 90.,10.,2.5,90.,30.,.2E-5.,.5.,.8,0.,0.,0.,0.,.95,
$ 0.,15.,0.,8./
DATA(FD(I),I=163,185)/24.,1000.,.2E-12,3600.,60000.,.03,
$ 90.,10.,2.5,90.,30.,.2E-5.,.5.,.8,0.,0.,0.,0.,.95,
$ 0.,15.,0.,8./
DATA(FD(I),I=188,210)/6.,1000.,.2E-12,3600.,60000.,50.,
$ 15.,0.,.03,0.,0.,30.,.1E-5.,.5.,.8,0.,1.,10.,.95,
$ 36.,36.,36.,1./
DATA(FD(I),I=211,250)/40*0./
DATA(FDTAR(I),I=1,44)/
$ 0.00,0.05,0.10,0.15,0.20,0.25,0.30,0.35,0.40,0.45,
$ 0.50,0.55,0.60,0.65,0.70,0.75,0.80,0.85,0.90,0.95,
$ 1.00,1.05,1.10,1.15,1.20,1.25,1.30,1.35,1.40,1.45,
$ 1.50,1.55,1.60,1.65,1.70,1.75,1.80,1.85,1.90,1.95,
$ 2.00,2.50,4.00,5.00/
DATA(FDTAR(I),I=45,88)/
$ 1.0000000,0.8278345,0.7225450,0.6410387,0.5742006,
$ 0.5177301,0.4691153,0.4267127,0.3893680,0.3562290,
$ 0.3266439,0.3000996,0.2761839,0.2545597,0.2349471,
$ 0.2171109,0.2009517,0.1859986,0.1724041,0.1599404,
$ 0.1484955,0.1379713,0.1282811,0.1193481,0.1111041,

```

\$ 0.1034RR1,0.0964455,0.0899275,0.0838899,0.0782930,  
 \$ 0.073100R,0.0682207,0.0638032,0.0596413,0.0557706,  
 \$ 0.0521687,0.0488153,0.0456915,0.0427803,0.0400660,  
 \$ 0.0375343,0.0197976,0.0031982,0.0009964/  
 DATA(FDTAR(I),I=P9,104)/100.,120.,140.,180.,.3.,.405,  
 \$ .4675.,.5.,100.,120.,150.,180.,.513.,.633.,.693.,7/  
 DATA(FDTAR(I),I=105,119)/5.,40.,75.,1.,2.,3.,-43.,-29.,  
 \$ -25.,-39.,-25.,-20.,-23.,-17.,-10./  
 DATA(FDTAR(I),I=120,150)/.032.,.018.,.0086,0.,.25.,.51,  
 \$ 2.54,6.35,12.70,25.40,0.,1.4E-6,4.2E-6,2.7E-5,9.2E-5,  
 \$ 2.2E-4,5.6E-4,0.,8.6E-6,2.0E-5,1.4E-4,3.5E-4,9.0E-4,  
 \$ 1.9E-3,0.,6.2E-5,1.1E-4,8.5E-4,1.6E-3,4.3E-3,7.6E-3/  
 DATA(FDTAR(I),I=151,164)/2.,1.,1.,2.,3.,4.,1823.,3414.,  
 \$ 4816.,4333.,366.,914.,1829.,1524./  
 DATA(FDTAR(I),I=165,213)/1.,2.,3.,4.,0.,.125.,.25.,.375.,.5.,  
 \$ .625.,.75.,.875,1.,0.,3\*.25.,.4,4\*.5,0.,3\*.2,2\*.4,3\*.6,  
 \$ 0.,2\*.2,2\*.4,2\*.6.,8,1.,0.,3\*.2,2\*.4,3\*.6/  
 DATA(FDTAR(I),I=214,262)/1.,2.,3.,4.,0.,.125.,.25.,.375.,.5.,  
 \$ .625.,.75.,.875,1.,.141.,.061.,.039.,.038.,.028.,.038.,.053,  
 \$ .140.,.462.,.226.,.120.,.057.,.078.,.050.,.067.,.091.,.105.,.207,  
 \$ .154.,.177.,.087.,.092.,.071.,.085.,.095.,.149.,.09.,.216.,.113,  
 \$ .052.,.052.,.046.,.048.,.062.,.125.,.286/  
 DATA(FDTAR(I),I=263,301)/1.,2.,3.,4.,0.,.25.,.51,  
 \$ 2.54,6.35,12.70,25.40.,924.,.056.,.02,4\*0.,.929.,.048,  
 \$ .021.,.002,3\*0.,.8937.,.058.,.039.,.008.,.001.,.0003,0.,.889,  
 \$ .064.,.042.,.005,3\*0./  
 DATA(FDTAR(I),I=302,340)/1.,2.,3.,4.,0.,.25.,.51,  
 \$ 2.54,6.35,12.70,25.4.,5811.,.0078.,.0064.,.0030.,.0014,  
 \$ .0003,0.,.9794.,.0079.,.0068.,.0037.,.0018.,.0004,0.,.9771,  
 \$ .0068.,.0066.,.0055.,.0032.,.0008,0.,.97762.,.0069.,.0068,  
 \$ .0051.,.0029.,.00068,0./  
 DATA(FDTAR(I),I=341,430)/1000.,1500.,5000.,10000.,  
 \$ 20000.,30000.,1.,1.5,2.,3.,4.,5.,6.,7.,8.,9.,10.,  
 \$ 15.,20.,25.,30.,35.,40.,50.,60.,70.,80.,90.,100.,  
 \$ 150.,200.,.02.,.02.,.03.,.06.,.08.,.12.,.16.,.20.,.24.,.30,  
 \$ .35.,.73,1.35,2.25,3.5,5.4,8.4,21.5,90.,6\*90.,  
 \$ 0.,.02.,.03.,.06.,.09.,.13.,.17.,.22.,.28.,.34.,.42.,.88,1.65,  
 \$ 3.,5.6,10.5,23.,80.,7\*80.,5\*0.,.08.,1.,.13.,.16/  
 DATA(FDTAR(I),I=431,521)/.20.,.24.,.51.,.94,1.55,2.5,  
 \$ 3.8,5.8,13.,38.5,100.,5\*100.,10\*0.,.09.,.18.,.31.,.49,  
 \$ .72,1.,1.36,2.35,3.85,6.3,10.,16.,25.5,100.,100.,  
 \$ 12\*0.,.14.,.20.,.27.,.37.,.50.,84,1.3,1.92,2.75,3.75,  
 \$ 5.2,21.,100.,14\*0.,.22.,.27.,.34.,.56.,.90,1.38,2.05,  
 \$ 2.88,3.95,12.,26./  
 DATA(FDTAR(I),I=522,611)/1000.,1500.,5000.,10000.,  
 \$ 20000.,30000.,1.,1.5,2.,3.,4.,5.,6.,7.,8.,9.,10.,  
 \$ 15.,20.,25.,30.,35.,40.,50.,60.,70.,80.,90.,100.,  
 \$ 150.,200.,.01.,.03.,.04.,.09.,.16.,.24.,.33.,.43.,.53.,.65,  
 \$ .78,1.7,3.1,5.2,8.2,12.25,17.75,38.,84.,100.,5\*100.,  
 \$ 0.,.02.,.04.,.08.,.15.,.22.,.32.,.44.,.56.,.7.,.88,2.07,4.1,

```

$ 7.4,12.5,20.5,32.,72.,100.,6*100.,5*0.,.07.,11.,15.
$ .19/
DATA(FDTAR(I),I=612,702)/.25.,.32.,.R,1.6,2.85,4.R,
$ 7.6,12.25,30.,66.,100.,5*100.,10*0.,.1.,.21.,.4.,.67,
$ 1.05,1.55,2.23,4.1,7.,11.2,18.2,31.5,60.,120.,120.,
$ 12*0.,.14.,.22.,.34.,.46.,.64,1.1,1.75,2.6,3.9,5.4,7.6,
$ 34.,160.,14*0.,.22.,.28.,.36.,.58.,.89,1.3,1.9,2.7,3.65,
$ 15.,.47./
DATA(FDTAR(I),I=703,710)/95.,120.,150.,180.,
$ 1.95,1.1.,.65,1./
DATA(FDTAR(I),I=711,718)/95.,120.,150.,180.,
$ 2.78,1.78,1.1,1./
DATA(FDTAR(I),I=719,725)/7*0./
RETURN
END
SUBROUTINE INPUT2(ISNUMB)
COMMON/ARRAYS/FD(250)
COMMON/ARRSET/IC(50)
DIMENSION ID(250),XTEMP(10),ITEMP1(10),ITEMP2(10,10),
$STEMP3(10,10)
EQUIVALENCE (FD, ID)
DATA XEXEC, XFNR, XOPER, XTARG/4HEXEC, 4HFNDR, 4HOPER, 4HTARG/
DATA XBACK, XFVVI, XSEAR, XSENS/4HBACK, 4HFVVI, 4HSEAR, 4HSENS/
DATA XBLANK, XTERR/4H ,4HTERR/
ISNUMB=1
NTEMP1=0
DO 1 J=1,10
1 XTEMP(J)=XBLANK
READ 5,AAA,KSNUMB
5 FORMAT(A4,6X,I1)
IF(AAA.EQ.XEXEC) GO TO 15
PRINT 10
10 FORMAT(* EXECUTE CARD MISSING OR OUT OF ORDER*)
GO TO 30
15 IF((KSNUMB.GT.0).AND.(KSNUMB.LT.8)) GO TO 25
PRINT 20,KSNUMB
20 FORMAT(* INVALID SENSOR NUMBER--*,I2)
GO TO 30
25 ISNUMB=KSNUMB
30 ISET=5+ISNUMB
35 READ 40,XNAME,IN
40 FORMAT(A4,24X,I2)
II=0
IF(XNAME.EQ.XFNDR) GO TO 200
IF(XNAME.EQ.XOPER) II=1
IF(XNAME.EQ.XTARG) II=2
IF(XNAME.EQ.XBACK) II=3
IF(XNAME.EQ.XFVVI) II=4
IF(XNAME.EQ.XTERR) II=4
IF(XNAME.EQ.XSEAR) II=5

```

```

IF(XNAME.EQ.XSFNS) II=ISFT
IF(II.NF.0) GO TO 50
PRINT 45,XNAME
45 FORMAT(* INVALID DATA NAME--*,A4)
GO TO 35
50 IL00P=0
NTEMP1=NTEMP1+1
XTEMP(NTEMP1)=XNAME
ITEMP1(NTEMP1)=IN
NTEMP2=0
II=2*II-1
I2=2*II
I3=2*II+1
III=IC(I1)-1
II2=IC(I2)-1
I13=IC(I3)
60 IL00P=IL00P+1
IF(IL00P.GT.IN) GO TO 35
READ 70,IVAR,VALUE
70 FORMAT(RX,I2,F10.4)
IF(IVAR.GT.0) GO TO 80
PRINT 75,IVAR
75 FORMAT(* VARIABLE NUMBER OUTSIDE RANGE OF DATA NAME*,
$* ARRAY--*,I2)
GO TO 60
80 IF(IVAR.LE.(I13-I12)) GO TO 100
PRINT 90,IVAR
90 FORMAT(* VARIABLE NUMBER OUTSIDE RANGE OF DATA NAME*,
$* ARRAY--*,I2)
GO TO 60
100 JJ=I11+IVAR
NTEMP2=NTEMP2+1
ITEMP2(NTEMP1,NTEMP2)=IVAR
TEMP3(NTEMP1,NTEMP2)=VALUE
IF(IVAR.GT.(I12-I11)) GO TO 110
ID(JJ)=IFIX(VALUE)
GO TO 60
110 FD(JJ)=VALUE
GO TO 60
200 PRINT 205,ISNUMB
205 FORMAT(IX,/,10X,*SENSOR NUMBER = *,II,
$/ ,IX,* 1= VISUAL OBSRVFR*,
$/ ,IX,* 2= FORWARD-LOOKING INFRARFD*,
$/ ,IX,* 3= ACTIVE (ILLUMINATED) TV*,
$/ ,IX,* 4= PASSIVE (DAYLIGHT) TV*,
$/ ,IX,* 5= FORWARD-LOOKING RADAR,MTI*,
$/ ,IX,* 6= FORWARD-LOOKING RADAR,NON-MTI*,
$/ ,IX,* 7= SYNTHETIC APERTURE RADAR*)
LOOP=0
210 LOOP=LOOP+1

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IF(L00P.GT.10) GO TO 240.
IF(XTEMP(L00P).NE.XFLANK) GO TO 215
RETURN
215 IF(L00P.EQ.1) PRINT 220
220 FORMAT(1X,/,1X,*NAME IVAR VALUE*)
NN=ITFMP1(L00P)
D0 230 J=1,NN
PRINT 225,XTEMP(L00P),ITEMP2(L00P,J),TEMP3(L00P,J)
225 FORMAT(1X,A4,3X,I2,3X,E10.4)
230 CONTINUE
GO TO 210
240 PRINT 245
245 FORMAT(* MORE MODIFICATIONS THAN LISTED*)
RETURN
END
SUBROUTINE FLIGHT(ISFNS,ISTYPE,FD0,IDS,FDS)
COMMON/BL0CK1/THETAH,THETAV,PHID
COMMON/BL0CK2/HL,HP,SPD,SPL,SPC,SPP
COMMON/BL0CK3/X,Y,XY,H,SR,SP,ANGLD,ANGLT,DELTAT
COMMON/BL0CK4/X1,X2,X3,X4,X5,X6,XY1,XY2,XY3,XY4,XY5,XY6
DIMENSION FD0(20),IDS(20),FDS(20)
CR=.01745
Y=FD0(1)
HL=FD0(2)
SPL=FD0(5)*1.687778
IF(ISFNS.GT.4) GO TO 500
ANGLD=FD0(10)*CR
SPD=FD0(4)*1.687778*COS(ANGLD)
SR1=FD0(8)
DELTAT=FD0(12)
XY2=HL/TAN(ANGLD)
X2=SQRT(XY2*XY2-Y*Y)
TEMP1=ATAN(Y/X2)
XY1=SR1*COS(ANGLD)
X1=XY1*COS(TEMP1)
IF(ISFNS.EQ.1) GO TO 300
IF(ISTYPE.EQ.2) GO TO 200
100 PHID=ANGLD
HP=FD0(3)
SPP=FD0(7)*1.687778
ANGLC=FD0(11)*CR
SPC=FD0(6)*1.687778*COS(ANGLC)
SR2=FD0(9)
XY3=XY2
X3=X2
XY4=XY2
X4=X2
XYS=SQRT(SR2*SP2-HL*HL)
X5=SQRT(XYS*XYS-Y*Y)
X6=X5*(HL-HP)/TAN(ANGLC)

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XYA=SQRT(XA*XA+Y*Y)
GO TO 400
200 CALL COVER(ISFNS,IDS,FDS,Y,HL,XMAX,XMIN)
IF(XMAX.GE.X2) GO TO 210
PHID=(ATAN(HL/X2)+THETA/2.)/CR
PRINT 205,PHID
205 FORMAT(* DEPRESSION ANGLE TOO STEEP. PHID RESET= *,
$ F5.2,* DEGREES *)
PHID=PHID*CR
CALL COVER(ISFNS,IDS,FDS,Y,HL,XMAX,XMIN)
210 X5=XMAX
XY5=SQRT(X5*X5+Y*Y)
SR2=SQRT(HL*HL+Y*Y+XY5*XY5)
X6=X5
XY6=XY5
X3=X2
XY3=XY2
X4=AMAX1(X2,XMIN)
XY4=SQRT(X4*X4+Y*Y)
HP=HL
SPP=SPL
SPC=SPL
ANCLC=0.
GO TO 400
300 CALL COVER(ISENS,IDS,FDS,Y,HL,XMAX,XMIN)
GO TO 210
400 X=X1
XY=XY1
SR=SR1
ANGL0=ACOS(X2/XY2)
ANCLT=ANCLD
H=XY*TAN(ANCLT)
SP=SPD
RETURN
500 IF(ISFNS.EQ.7) GO TO 600
CALL COVER(ISFNS,IDS,FDS,Y,HL,XMAX,XMIN)
X4=XMIN
XY4=SQRT(X4*X4+Y*Y)
X5=XMAX
XY5=SQRT(X5*X5+Y*Y)
GO TO 700
600 CONTINUE
700PX=X4
XY=XY4
H=HL
ANCL0=ATAN(Y/X4)
ANCLT=ATAN(H/XY)
SR=SQRT(XY*XY+H*H)
SP=SPL
DELTAT=FD0(12)

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```

RETURN
END
SUBROUTINE COVER(ISENS,IDS,FDS,Y,H,XMAX,XMIN)
EXTERNAL FUN1
COMMON/BLOCK1/THETAH,THETAU,PHID
COMMON/BLOCK5/X2MAX,X1MIN,VISMAX
DIMENSION IDS(20),FDS(20)
CB=.01745
IF(ISENS.EQ.1) GO TO 200
XMAX=H/TAN(PHID-THETAU/2.)
XMIN=H/TAN(PHID+THETAU/2.)
TEMP1=TAN(THETAH/2.)
YMIN=XMIN*TEMP1
IF(Y.GT.YMIN) GO TO 120
RETURN
120 YMAX=XMAX*TEMP1
IF(Y.GT.YMAX) GO TO 150
XMIN=XMAX-(YMAX-Y)/TEMP1
RETURN
150 Y=0.
PRINT 155,Y
155 FORMAT(* OFFSET(Y) GREATER THAN YMAX. SET Y= *,E10.4)
RETURN
200 VISMAX=FDS(1)
RMAX=VISMAX
ICMASK=IDS(1)
IF(Y) 210,220,230
210 Y=ABS(Y)
PRINT 215
215 FORMAT(* ONLY POSITIVE OFFSETS CONSIDERED, USED ABS. VALUE*)
GO TO 230
220 XMAX=RMAX
TEMP1=FUN1(0.)*CB
XMIN=H/TAN(TEMP1)
IF(ICMASK.EQ.0.) XMIN=0.
GO TO 300
230 IF(Y.LT.RMAX) GO TO 250
XMAX=0.
XMIN=0.
GO TO 300
250 XMAX=SQRT(RMAX*RMAX-Y*Y)
XMIN=0.
IF(ICMASK.EQ.0) GO TO 300
GUESS=ASIN(Y/RMAX)/CB
TEMP1=H/TAN(FUN1(GUESS)*CB)
TEMP2=Y/SIN(GUESS*CB)
IF(TEMP1.LE.TEMP2) GO TO 260
XMAX=0.
XMIN=0.
GO TO 300

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260 GUESS=GUESS+5.
   IF(GUESS.GT.90.) GUESS=90.
   TEMP1=H/TAN(FUN1(GUESS)*CR)
   TEMP2=Y/SIN(GUESS*CR)
   IF(TEMP1.GT.TEMP2) GO TO 270
   IF(GUESS.LT.90.) GO TO 260
   XMIN=0.
   GO TO 300
270 CALL APPROX(GUESS,THETAD,IFAIL)
   TEMP1=FUN1(THETAD)*CR
   TEMP2=H/TAN(TEMP1)
   XMIN=SQRT(TEMP1*TEMP1-Y*Y)
300 X2MAX=XMAX
   X1MIN=XMIN
   RETURN
END
SUBROUTINE APPROX(GUESS,ANS,IFAIL)
EXTERNAL FUNF,FUNDF
IFAIL=0
ANS=GUESS
DO 100 I=1,50
  TEMP1=ANS
  ANS=ANS-(FUNF(ANS)/FUNDF(ANS))
  TEMP2=ANS(ANS-TEMP1)
  IF(TEMP2.LE.1.E-4) RETURN
100 CONTINUE
IFAIL=1
RETURN
END
FUNCTION FUNF(THETAD)
EXTERNAL FUN1
COMMON/BLCK2/HL,HP,SPD,SPL,SPC,SPP
COMMON/BLCK3/X,Y,XY,H,SR,SP,ANGL0,ANGLT,DELTAT
CR=.01745
THETAR=THETAD*CR
TEMP1=FUN1(THETAD)*CR
FUNF=HL/TAN(TEMP1)-Y/SIN(THETAR)
END
FUNCTION FUNDF(THETAD)
EXTERNAL FUN1,FUN2
COMMON/BLCK2/HL,HP,SPD,SPL,SPC,SPP
COMMON/BLCK3/X,Y,XY,H,SR,SP,ANGL0,ANGLT,DELTAT
CR=.01745
THETAR=THETAD*CR
TEMP1=FUN1(THETAD)*CR
FUNDF=-HL*FUN2(THETAD)*CR/SIN(TEMP1)**2
      +HL*COS(THETAR)/SIN(THETAR)**2
END
FUNCTION FUN1(DEGREE)
FUN1=-.003142*DEGREE*DEGREE+.42309*DEGREE+12.9176

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END
FUNCTION FUN2(DEFRRF)
FTN2=-.0062R4*DEFRRF+.42309
END
SUBROUTINE GEOM(IFSNS, ISTYPE, F0, ISTOP)
COMMON/PL0CK2/HL, HP, SPD, SPL, SPC, SPP
COMMON/PL0CK3/X, Y, XY, H, SR, SP, ANGL0, ANGLT, DELTAT
COMMON/PL0CK4/X1, X2, X3, X4, X5, X6, XY1, XY2, XY3, XY4, XY5, XY6
DIMENSION F0(20)
ISTOP=0
CR=.01745
IF(IFSNS.GT.4) GO TO 200
ANGLD=F0(10)*CR
IF(XY.GT.XY2) GO TO 130
XY=XY+SPD*DELTAT
TFMP1=ATAN(Y/X2)
X=XY+COS(TFMP1)
H=XY*TAN(ANGLT)
IF(XY.LE.XY2) GO TO 120
TG0=(XY-XY2)/SPD
X=X2+SPL*TG0
SP=SPL
H=HL
110 XY=SQRT(X*X+Y*Y)
ANGL0=ATAN(Y/X)
ANGLT=ATAN(H/XY)
120 SR=SQRT(XY*XY+H*H)
RETURN
130 IF((IFSNS.EQ.1).OR.(ISTYPE.EQ.2)) GO TO 200
ANGLC=F0(6)*CR
IF(X.GT.X5) GO TO 140
X=X+SPL*DELTAT
IF(X.LE.X5) GO TO 110
TG0=(X-X5)/SPL
X=X5+SPC+TG0
SP=SPC
H=HL-SPC+TG0*TAN(ANGLC)
IF(X.LE.X6) GO TO 110
TG0=(X-X6)/SPC
X=X6+SPP+TG0
SP=SPP
H=HP
GO TO 110
140 IF(X.GT.X6) GO TO 150
X=X+SPC*DELTAT
SP=SPC
H=H-SPC*DELTAT*TAN(ANGLC)
IF(X.LE.X6) GO TO 110
TG0=(X-X6)/SPC
X=X6+SPP+TG0

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SP=SPP
H=HP
GO TO 110
150 X=X+SPP*DELTAT
GO TO 110
200 X=X+SPL*DELTAT
IF(X.LE.X5) GO TO 110
ISTOP=1
GO TO 110
END
SUBROUTINE SFARCH(ISENS, ISTYPE, IDT, FDT,
SFDEVT, FDT5, P2)
COMMON/BLOCK1/THETAH, THETAU, PHID
COMMON/BLOCK3/X, Y, XY, H, SR, SP, ANGL0, ANGLT, DELTAT
COMMON/BLOCK4/X1, X2, X3, X4, X5, X6, XY1, XY2, XY3, XY4, XY5, XY6
COMMON/BLOCK5/X2MAX, X1MIN, VISMAY
COMMON/BLOCK6/ALPHAH, ALPHAU, ALPHAV
DIMENSION IDT(20), FDT(20), FDEVT(20), FDT5(20)
F(D1, D2)=2.*ATAN((-D1-1.+SORT((D1+1.)**2+D1*D2+D2))/(D1+D2))
CPI=3.14159
DTX=FDT(1)
DTY=FDT(2)
DTZ=FDT(3)
NT=IDT(1)
TSPACE=FDT(10)
DSX=FDT5(2)
DSY=FDT5(3)
ANGTC=CPI/2.-ANGLT
TANGTC=TAN(ANGTC)
IF(ANGL0.LE.(ATAN(DTY/DTX))) GO TO 10
TEMP1=SIN(ANGL0)
DTXX=DTY/TEMP1
GO TO 20
10 TEMP1=COS(ANGL0)
DTXX=DTX/TEMP1
20 TEMP1=TANGTC*TANGTC
TEMP2=(DTXX+DTZ/TAN(ANGLT))/H
ALPHAV=F(TEMP1, TEMP2)
ALPHAH=2.*ATAN((DTX*SIN(ANGL0)+DTY*COS(ANGL0))/(2.*SR))
ALPHAU=2.*ATAN((DTX*COS(ANGL0)+SIN(ANGLT)+
$ DTY*SIN(ANGL0)*SIN(ANGLT)+DTZ*COS(ANGLT))/(2.*SR))
IF(X.LT.X4) GO TO 250
AT=DTX+DTY*SIN(ANGLT)+
$ (DTX+DTZ*SIN(ANGL0)+DTY*DTZ*COS(ANGL0))*COS(ANGLT)
AT=AT*(NT+(NT-1)*TSPACE/DTX)
IF(ISENS.FO.1) GO TO 100
IF(ISTYPE.FO.1) PHID=ANGLT
PHIC=CPI/2.-PHID
TPHIC=TAN(PHIC)
IF(DSX.LE.0.) GO TO 30

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TEMP1=TPHIC*TPHIC
TEMP2=DSX/H
BETAU=F(TMP1,TEMP2)
IF(BETAU.LT.THETAU) GO TO 40
30 BETAU=THETAU
40 IF(DSY.LF.0.) GO TO 50
BETAH=2.*ATAN(DSY/(2.*SR))
IF(BETAH.LT.THETAH) GO TO 60
50 BETAH=THETAH
60 OMEGA=BETAH*(SIN(PHID+BETAU/2.)-SIN(PHID-BETAU/2.))
SRPHID=H/SIN(PHID)
AS=OMEGA*SRPHID*SRPHID
GO TO 200
100 WLOC=FDTS(4)
TEMP1=X2MAX+SQRT(X2MAX*X2MAX+Y*Y+H*H)
TEMP2=X1MIN+SQRT(X1MIN*X1MIN+Y*Y+H*H)
AS=H*WLOC*AL0((TEMP1/TEMP2))
200 ARATIO=AT/AS
G=FDEVT(6)
TEMP1=(700./G)*ARATIO*DELTAT
IF(TEMP1.LT.100.) GO TO 270
250 P2=1.0
RETURN
270 P2=1.-EXP(-TEMP1)
RETURN
END
SUBROUTINE LOS(ISENS,ISTYF,IDEVT,FDEVT,PL0S)
COMMON/TARLFS/FDTAB(725)
COMMON/TARGET/ICT(50)
COMMON/BLOCK3/X,Y,XY,H,SP,SP,ANGL0,ANGLT,DELTAT
COMMON/BLOCK4/X1,X2,X3,X4,X5,X6,XY1,XY2,XY3,XY4,XY5,XY6
DIMENSION IDEVT(20),FDEVT(20)
IF(X.LT.X4) GO TO 35
CR=.01745
ICFLOS=IDEVT(3)
ANGLM=FDEVT(2)*CR
RATIOM=FDEVT(3)
PNMASK=1.0
IF(ASIN(H/SR).GT.ATAN(RATIOM)) GO TO 10
PL0S=0.
RETURN
10 IF(ANGLM.LF.0.) GO TO 20
PNMASK=PNMASK*(1.-EXP(-ANGLT/ANGLM))
20 PCFLOS=1.0
IF(ISENS.GT.4) GO TO 30
IF(ICFLOS.EQ.0) GO TO 30
ZENITH=ANGLT/CR+90.
JJ=ICT(4)
NX=ICT(5)
IX=JJ

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IY=IX+NX
IF(H.LF.5000.) GO TO 25
JJ=ICT(7)
NX=ICT(8)
IX=JJ
IY=IX+NX
25 CALL INTFRI(FDTAB(IX),FDTAB(IY),NX,ZFNITH,PCFL0S)
30 PL0S=PNMASK+PCFL0S
RETURN
35 PL0S=1.0
RETURN
END
SUBROUTINE INTFRI(XX,YY,NN,X,Y)
DIMENSION YY(1),XX(1)
Y=YY(1)
IF(NN.EQ.1) RETURN
DO 1 K=1,NN
IF(X.LE.XX(K)) GO TO 2
1 CONTINUE
Y=YY(NN)
RETURN
2 IF(K.EQ.1) RETURN
Y=((X-XX(K-1))/(XX(K)-XX(K-1)))+(YY(K)-YY(K-1))+YY(K-1)
RETURN
END
SUBROUTINE F0V(ISFNS,ISTYPE,FDT5,PF0V)
COMMON/BLOCK1/THETAH,THETAU,PHID
COMMON/BLOCK3/X,Y,XY,H,SR,SP,ANGL0,ANGLT,DFLTAT
COMMON/BLOCK4/X1,X2,X3,X4,X5,X6,XY1,XY2,XY3,XY4,XY5,XY6
DIMENSION FDT5(20)
CPI=3.14159
SIGX=FDT5(5)
SIGY=FDT5(6)
IF(ISFNS.EQ.1) GO TO 100
IF(ISTYPE.EQ.2) GO TO 100
IF(X.LT.X4) GO TO 100
ANGTC=CPI/2.-ANGLT
IF(SIGX.GT.0.) GO TO 40
PF0VX=1.0
GO TO 50
40 XW=2.*SR*TAN(THETAH/2.)/(2.828428*SIGX)
PF0VX=FRRFUN(XW)
50 IF(SIGY.GT.0.) GO TO 60
PF0VY=1.0
GO TO 90
60 IF((ANGTC+THETAU/2.).LT.(CPI/2.)) GO TO 70
PY1=.5
GO TO 80
70 XLI=H*(TAN(ANGTC+THETAU/2.)-TAN(ANGTC))/(2.828428*SIGY)
PY1=.5+ERRFUN(XLI)

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80 XL2=M*(TAN(ANGTC)-TAN(ANGTC-THETAU/2.))/(P.P2R42R+SIGY)
   PYP=.5+FRPFUN(XL2)
   PF0VY=PY1+PY2
90 PF0V=PF0VX+PF0VY
   RETURN
100 PF0V=1.0
   RETURN
   END
   FUNCTION FRRFUN(X)
   C=1.12R37916709551
   ERRFUN=-1.F50
   IF(X) 6,1,1
1   X2=X*X
   IF(X2.LT.180.) G0 T0 10
   DENS=0.
   G0 T0 11
10  DENS=C*FXP(-X2)
11  IF(X-2.25) 4,4,2
C   COMPUTE ERRFUN USING A CONTINUED FRACTION EXPANSION
2   N=76./X-4.
   A1=X2*(X2+4.5)+2.
   A2=X*(X2*(X2+7.)+R.25)
   B1=X*(X2*(X2+5.)+3.75)
   B2=X2*(X2*(X2+7.5)+11.25)+1.875
   T=3.
   D0 3 I=3,N
   A3=X*A2+T*A1
   A1=A2
   A2=A3
   B3=X*B2+T*B1
   B1=B2
   B2=B3
3   T=T+.5
   CERRF=DENS+A3/(P.+B3)
   ERRFUN=1.-CERRF
   RETURN
C   COMPUTE ERRFUN FROM THE MXLAURIN POWER SERIES
4   N=11.5*X+5.
   T=5.
   ERRFUN=X*(1.-X2*(3.333333333333333F-1-X2*
$     (1.-X2*(P.38095238095238F-2-X2*4.62962962962963F-3))))
   Y=X*X2*X2*X2*X2/216.
   D0 5 I=2,N
   Y=-X2*(P.*T-1.)*Y/(T*(P.*T+1.))
   ERRFUN=FRRFUN+Y
5   T=T+1
   FRRFUN=C+FRRFUN
   CERRF=1.-FRRFUN
6   RETURN
   END

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SUBROUTINE ATMOS(FDT,FDR,IDEVT,DFEVT,IDS,FDS,ISENS,
STAT,CA,CM)
COMMON/TABLES/EDTAR(725)
COMMON/TARGET/ICT(50)
COMMON/BLOCK1/THETAH,THETAU,PHID
COMMON/BLOCK3/X,Y,XY,H,SR,SP,ANGL0,ANGLT,DELTAT
DIMENSION FDT(20),FDR(20),IDEVT(20),DFEVT(20),
IDS(20),FDS(20)
VG=DFEVT(4)
IF(ISENS.EQ.2) GO TO 200
RT=FDT(4)
RB=FDR(1)
CI=ABS(RT-RB)/AMAX1(RT,RB)
TEMP1=.001*H
TEMP1=.44/(TEMP1+1.2)+.56*EXP(-.08*TEMP1)+.073
VS=VG/TEMP1
IF(ISENS.EQ.1) XLAMDA=FDS(4)
IF(ISENS.EQ.3) XLAMDA=FDS(15)
IF(ISENS.EQ.4) XLAMDA=FDS(15)
SIGMA=(3.912/(VS*6076.))*(XLAMDA/.55)
IF(ISENS.EQ.1) GO TO 5
GAMMAT=FDS(9)
IF(ISENS.EQ.3) GO TO 100
5 TAT=EXP(-SIGMA*SR)
ITAT=IDEVT(4)
IF(ITAT.EQ.1) GO TO 300
10 ICL0UD=IDEVT(1)
RTE=DFEVT(1)
TEMP1=.2
IF(ICL0UD.EQ.2) TEMP1=.6
IF(ICL0UD.EQ.3) TEMP1=1.
ZK=TEMP1/RTE
TEMP1=1.+ZK*(1.-TAT)/TAT
50 CA=CI/TEMP1
55 IF(ISENS.EQ.1) RETURN
60 CM=CA/(2.-CI)
CM=1.-(1.-CM)**GAMMAT
RETURN
100 GAIN=FDS(19)
ISTYPE=IDS(1)
IF(ISTYPE.EQ.1) PHID=ANGLT
TEMP1=PHID-THETAU/2.
TEMP2=PHID+THETAU/2.
SRMIN=H/SIN(TEMP1)
SRMAX=H/SIN(TEMP2)
ZMIN=2.*SIGMA*SRMIN
ZMAX=2.*SIGMA*SRMAX
TAT=EXP(-ZMAX)
JJ=ICT(1)
NX=ICT(2)

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IX=JJ
IY=IX+NX
CALL INTER1(FDTAB(IX),FDTAB(IY),NX,ZMIN,F2ZMIN)
CALL INTER1(FDTAB(IX),FDTAB(IY),NX,ZMAX,F2ZMAX)
XNA=(GAIN*SIGMA*SRMAX*.25)*
S (SRMAX/SRMIN*F2ZMIN-F2ZMAX)
XNT=XNA+RT*TAT
XNB=XNA+RP*TAT
CA=ABS(XNT/XNP-1.)
GO TO 60
200 RH=FDEVT(5)
DFLTR=FDR(2)
TEMP1=.00013*H
TEMP1=(1./TEMP1)*(1.-EXP(-TEMP1))
TEMP2=.0002R*H
TEMP2=(1./TEMP2)*(1.-EXP(-TEMP2))
XW0=1.432*RH*FXP(-.0652*(DFLTR-273.))
TEMP2=(.27R*TEMP2)/(VC*6.076)+.017*XW0*TEMP1
TAT=FXP(-TEMP2*SR*.001)
RETURN
300 IAZIM=IDEVT(5)
HM=H
SR1000=.001*SR
BMAX=AMAX1(RT,PP)
ZENITH=ANGLT/.01745+90.
IF(IAZIM.F0.2) GO TO 350
JJ=ICT(31)
NX=ICT(32)
NY=ICT(33)
IX=JJ
IY=IX+NX
IZ=IY+NY
CALL INTER2(HH,SR1000,FDTAB(IX),FDTAB(IY),FDTAB(IZ),
S NX,NY,DPR,XXXX,NX)
JJ=ICT(37)
NX=ICT(38)
IX=JJ
IY=IX+NX
CALL INTER1(FDTAB(IX),FDTAB(IY),NX,ZENITH,RF)
GO TO 360
350 JJ=ICT(34)
NX=ICT(35)
IX=JJ
IY=IX+NX
IZ=IY+NY
CALL INTER2(HH,SR1000,FDTAB(IX),FDTAB(IY),FDTAB(IZ),
S NX,NY,DPR,XXXX,NX)
JJ=ICT(40)
NX=ICT(41)
IX=JJ

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IY=IX+NX
CALL INTFR1(FDTAP(IX),FDTAP(IY),NX,ZFNITH,RF)
360 CA=CI/(1.+DPR/(RMAX*RF))
GO TO 55
END
SUBROUTINE VISOR(FDT,FDE,IDEVT,FDEVT,
$IDS,FDS,P3D,P3R)
COMMON/BLOCK3/X,Y,XY,H,SR,SP,ANGL0,ANFLT,DFLTAT
COMMON/BLOCK4/X1,X2,X3,X4,X5,X6,XY1,XY2,XY3,XY4,XY5,XY6
COMMON/BLOCK6/ALPHAH,ALPHAL,ALPHAV
DIMENSION FDT(20),FDB(20),IDEVT(20),FDEVT(20),
$IDS(20),FDS(20)
ISENS=1
THETA=.8
CR=.01745
XK1=.0265
XK2=.24
XK3=.44
XK4=1.6
CT=XK1*THETA**XK2+(XK3*THETA**XK4)/
$ ((AMINI(ALPHAH,ALPHAV)+60./CR)**2)
CALL ATMOS(FDT,FDB,IDEVT,FDEVT,XXX,FDS,ISENS,
$XXX,CA,XXX)
TEMP1=CA/CT
IF(TEMP1.LT..05) GO TO 90
IF(TEMP1.LT.1.) GO TO 40
AK=.43
GO TO 50
40 AK=-.57
50 TEMP1=4.2*((TEMP1-1.)**2)
P3D=.57+AK*SQRT(1.-EXP(-TEMP1))
A=3.
B=2.9E-6
IF(X.CE.X2) GO TO 55
VALPHA=0.
GO TO 60
55 VALPHA=(SP*SQRT(H*H+Y*Y)/(SR+SR))/CR
60 TVA=(A+B*(VALPHA**3))/2.
TFMPI=((AMINI(ALPHAH,ALPHAV)*60./CR)/TVA)**2
IF(TEMP1.LE.3.2) GO TO 100
TFMPI=((TEMP1-3.2)**2)/11.
IF(TEMP1.LT.180.) GO TO 70
P3R=1.0
RETURN
70 P3R=1.-EXP(-TEMP1)
RETURN
90 P3D=0.
100 P3R=0.
RETURN
END

```

```

SUBROUTINE FLIR(FDT,FDR,FDFVT,IDS,FDS,P3D,P3R)
COMMON/RLCK1/THETA,THETA,PHI
COMMON/RLCK3/X,Y,XY,H,SR,SP,ANGL,ANGLT,DELTAT
COMMON/RLCK6/ALPHA,ALPHA,ALPHA
DIMENSION FDT(20),FDB(20),FDFVT(20),
SID(20),FDS(20)
ISENS=2
DELTB=FDR(2)
EMMB=FDR(3)
DELT=FDT(5)
EMMT=FDT(6)
G=FDFVT(6)
ZK1=FDS(5)
ZK2=FDS(6)
CALL ATMOS(XXX,FDR,XXX,FDFVT,XXX,XXX,ISENS,
STAT,XXX,XXX)
XNV=AMINI(ALPHA,ALPHA)/AMAXI(ALPHA,ALPHA)
IX=1
100 TEMP1=0.
XN=2.*THETA/AMINI(ALPHA,ALPHA)
IF(XN.GT.500.) GO TO 320
IF(IX.NE.2) GO TO 110
XN=4.*XN
IF(XN.GT.500.) GO TO 320
GO TO 130
110 IF(XN.GT.300.) GO TO 120
SNRT=6.1R*EXP(-.00252*XN)
GO TO 150
120 SNRT=2.90176-.002*(XN-300.)
GO TO 150
130 IF(XN.GT.300.) GO TO 140
SNRT=8.2*EXP(-.0024R*XN)
GO TO 150
140 SNRT=3.89671-.002*(XN-300.)
150 SNRT=SNRT*(1.+.00R*G*G)
IF(XN.LT.100.) GO TO 160
SNMRT=3.-.002*XN
GO TO 170
160 SNMRT=5.-.002*XN
170 XMRT=ZK1*EXP(ZK2*XN)
TDIFF=ABS(DELT*EMMT-DELTB*EMMB)
SNRD=(SNMRT*TDIFF*TAT/XMRT)*((DELTB*EMMB/300.)*3)*
$ SORT(1./(7.*XNV))
SNR=SNRD-SNRT
IF(SNR.LT.5.) GO TO 310
TEMP1=1.0
GO TO 320
310 TEMP1=1.-FRFJN(ABS(SNR)/1.414214)
TEMP1=.5*TEMP1
IF(SNR.GT.0.) TEMP1=1.-TEMP1

```

```

320 IF(IX.F0.2) GO TO 390
330 P30=TFMPI
    IF(TEMP1.LE.0.) GO TO 390
    IX=2
    GO TO 100
390 P3R=TFMPI
    RETURN
    FND
SUBROUTINE TV(ISENS,FDT,FDB,IDEVT,FDEVT,
$IDS,FDS,IF0V,P3D,P3R)
COMMON/BL0CK1/THETAH,THETAU,PHID
COMMON/BL0CK3/X,Y,XY,H,SR,SP,ANGL0,ANGLT,DELTAT
COMMON/BL0CK6/ALPHAH,ALPHA,ALPHAU
DIMENSION FDT(20),FDB(20),IDEVT(20),FDEVT(20),
$IDS(20),FDS(20)
ASPECT=FDS(1)
BAND=FDS(5)
DIAG=FDS(6)
FNUM=FDS(6+IF0V)
GAMMAT=FDS(9)
XFC=FDS(11)
XI=FDS(12)
XIMAX=FDS(13)
XIP=FDS(14)
XLAMDA=FDS(15)
XNL=FDS(16)
XNR=FDS(17)
GT=FDS(20)
RTE=FDEVT(1)
G=FDFVT(6)
CALL ATMOS(FDT,FDB,IDEVT,FDEVT,IDS,FDS,ISENS,
$STAT,XXX,CM)
EAREA=ASPECT*DIAG*DIAG/(1.+ASPECT*ASPECT)
RESPON=10.**((ALOG10(XI)-ALOG10(FARFA))/GAMMAT
$-ALOG10(.674*XFC))
IFLAG=0
IF(ISENS.F0.3) GO TO 10
ICLOUD=IDEVT(1)
ISUNAN=IDEVT(2)
TRANSM=FDS(10)
CFAC=1.
IF(ICLOUD.F0.2) CFAC=3.1635
IF(ICLOUD.F0.3) CFAC=10.
HS=595.
IF(ISUNAN.F0.2) HS=465.
IF(ISUNAN.F0.3) HS=265.
XICON=RESPON*HS+RTE*TRANSM*TRANSM/(4.*CFAC)
GO TO 20
10 POUT=FDS(1R)
    ASTR=THETAU*THETAH

```

```

20 IF(ISFNS.F0.3) GO TO 30
   XIJVF=FAFEA*(XICON/(FNUM*FNUM))*GAMMAT
   GO TO 40
30 XICON2=RFSPON*PTF*PQUT*TAT*TRANSM/(4.*ASTR*SR*SR)
   XIJVF=EARFA*(XICON2/(FNUM*FNUM))*GAMMAT
40 IF(XIJVF.LR.(.85*XIMAX)) GO TO 50
   FNUM=1.414214*FNUM
   IFLAG=1
   GO TO 20
50 IF(IFLAG.F0.0) GO TO 60
   PRINT 55,FNUM
55 FORMAT(* TUFF SATURATION, NEW FNUM= *,F5.2)
60 XN0ISE=XIP*XIP/(2.*BAND)
   XF=SQRT(XNL*XNR/(1.414214*ASPECT))
   XN0E=1.24*XF
   XNET=.31*XF
   XNEL=545.*DIAG/(XLAMDA*FNUM*SQRT(1.+ASPECT*ASPECT))
   XN0L=3.66*XNEL
   XNV=AMINI(ALPHAH,ALPHAL)/AMAXI(ALPHAH,ALPHAL)
   IX=1
100 TEMPI=0.
   XN=2.*THETA/AMINI(ALPHAH,ALPHAV)
   IF(XN.GT.700.) GO TO 320
   IF(IX.NE.2) GO TO 110
   XN=4.*XN
   IF(XN.GT.700.) GO TO 320
   GO TO 130
110 IF(XN.GT.300.) GO TO 120
   SNRT=6.18*EXP(-.00252*XN)
   GO TO 150
120 SNRT=2.90176-.002*(XN-300.)
   GO TO 150
130 IF(XN.GT.300.) GO TO 140
   SNRT=8.2*EXP(-.00248*XN)
   GO TO 150
140 SNRT=3.89671-.002*(XN-300.)
150 SNRT=SNRT*(1.+.003*G*G)
   ZNET=(XN/(XNV*XNET))**2
   ZNEL=(XN/(XNV*XNEL))**2
   PSIIY=SQRT(1.+ZNET*ZNEL)
   GAMMAY=PSIIY/SQRT(1.+ZNEL+2.*ZNET)
   IF(XN.GT.(XN0E/3.)) GO TO 210
   BETAT=(.3*XF/XN)*ERRFUN(3.*XN/XE)
   GO TO 220
210 BETAT=(XF/XN)*(0.086+.233*ERRFUN(2.45*XN/XE))
220 IF(XN.LF.10.) GO TO 240
   IF(XN.GT.XN0F) GO TO 250
   I=-1
   RSOF=0.
225 I=1+2

```

```

IF(I.GT.50) GO TO 260
XIN=I*XN
IF(XIN.GT.XN0F) GO TO 260
PHIX=XIN/XN0L
RLN=.637*(AC0S(PHIX)-PHIX*SQRT(1.-PHIX*PHIX))
IF(XIN.GT.(XN0E/3.)) GO TO 230
RSOF=RSOF+(.811*RLN*EXP(-4.4*XIN*XIN/(XE*XE)))/(I+1)
GO TO 225
230 RSOF=RSOF+(.637*RLN*EXP(-3.*XIN*XIN/(XE*XE)))/(I+1)
GO TO 225
240 RSOF=1.0
GO TO 260
250 RSOF=0.
GO TO 320
260 SNRD=(?.*RSOF*CM*GT*XIAVE/XN)*SQRT(.1*XNV/(ASPECT*
$ PSII*(GT*GT*BFTAT*GAMMAY*XIAVF*1.6E-19*XNOISE)))
SNR=SNRD-SNRT
IF(SNR.LT.5.) GO TO 310
TEMP1=1.0
GO TO 320
310 TEMP1=1.-FRPFUN(ABS(SNR)/1.414214)
TEMP1=.5*TEMP1
IF(SNR.GT.0.) TEMP1=1.-TEMP1
320 IF(IX.EQ.2) GO TO 350
IF(RSOF.GT.0.) GO TO 330
P3D=0.
P3R=0.
RETURN
330 P3D=TEMP1
IX=2
GO TO 100
350 IF(RSOF.GT.0.) GO TO 390
P3R=0.
RETURN
390 P3R=TEMP1
RETURN
END
SUBROUTINE SENFLR(ISENS, IDT, FDT, FDB, FDEVT,
$ FDTS, IDS, FDS, P2, P3D, P3R)
COMMON/TABLES/FDTAB(725)
COMMON/TARSFT/ICT(50)
COMMON/BLACK1/THETAH, THETAU, PHID
COMMON/BLACK3/X, Y, XY, H, SR, SP, ANGLE, ANGLT, DELTAT
DIMENSION IDT(20), FDT(20), FDR(20), FDEVT(20),
$ FDTS(20), IDS(20), FDS(25)

```

C  
C

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CPI=3.14159265
C2=.3048
C3=1.689

```

CR=.01745  
SNDR=0.  
VC=0.  
NT=IDT(1)  
PN=0.  
VRT=0.  
VB=0.

C

G=FDEVT(6)  
VTI=FDT(12)  
C= 3.F 8  
H=H\*C2  
VG=SP/1.6R7778  
GO=FDS(2)  
PRF=FDS(4)  
PX=FDS(5)  
FLAMDA=FDS(6)  
WS=FDS(7)  
PHIM=PHID-THFTAV/2.  
VF=FDFVT(7)  
TAUPW=FDS(12)  
TAUP1=FDS(13)  
TAUP2=FDS(14)  
VF=FDS(15)  
VPRF=FDS(16)  
CAS=FDS(12)  
ISEAS=IDS(1)  
DTX=FDT(1)\*C2  
DTY=FDT(2)\*C2  
PSI=FDT(11)\*C8  
XXXX=0.  
WP=FDE(5)  
GG = 0.  
PNR=FDS(3)

C SELECT BAND

IRAND=1  
IF(FLAMDA.LT.(.025))IRAND=2  
IF(FLAMDA.LT.(.0125)) IBAND=3  
BAND=IRAND

C COVERAGE

Y=Y\*C2

C

P3D\*0.  
X=X\*C2

C

C GEOMETRY

SR=SR+C2  
PHI=ANCLT  
DCY=SR\*THFTAV  
DGX=C\*TAUPW/(2.\*COS(PHI))

```

TSPACF=FDT(10)*CP
RNJC=NT
DCMIN=AMINI(DGX,DCY)
RNJC1=DCMIN/(NT*(TSPACF+DTX))
RATSIG=AMINI(RNJC,RNJC1)
SIGFAC=AMAX1(1.,RATSIG)
XTE=AMINI(DTX,DCX)
YTE=AMINI(DTY,DCY)
AG=DCX*DCY
ATE=XTE+YTE
ABE=AMAX1((AG-ATE),0.)
TEMP1=COS(PHI)**2
TEMP1=SQRT(SR*SR*TEMP1-Y*Y)
ALPHA=ATAN2(Y,TEMP1)
VRT=VTI*COS(PHI)*COS(PSI-ALPHA)
TEMP1=SIN(PHI)**2
TEMP2=SIN(PHIM)**2
TEMP3=SQRT(COS(PHI))
TEMP4=SQRT(COS(PHIM))
GAF=G0*TEMP2*TEMP3/(TEMP1*TEMP4)
C RESOLUTION GEOMETRY
AG1=AG
ABE1=0.
C
C
IF(ABE.EQ.0.)GO TO 200
100 DX=AMAX1(DGX,DCY)
DN=AMINI(DGX,DCY)
IF(DX.LE.WP) GO TO 200
IF(DN.LE.WP) GO TO 110
AP=WP*(DX+DN)/2.
GO TO 120
110 AP=DN*(DX+WP)/2.
120 AL=AMAX1((AG-AP),0.)
F1=1.0
TEMP1=F1
F1=F1/TEMP1
A1=AP+F1*AL
IF(ATF.GT.AP) GO TO 130
ABE1=A1-ATF
GO TO 140
130 ATEL=ATF-AP
ABE1=A1-F1*ATEL-AP
140 AC1=F1*AG
C RADAR CROSS SECTION
200 TEMP1=SIN(PHI)
AT=DTX*DTY
I=6+IRAND
SIGTF=FDT(I)*(0.3/FLAMDA)**.3
SIGTE=10.*ALOG10(SIGTF)+PHI/(CR*15.)

```

```

TFMP5=PSI
IF(PSI.GT..7R54) TFMP5=CPI/2.-PSI
SIGTE=SIGTE-5/45.*PSI/CR
SIGTE=10.***(SIGTE/10.)
SIGTF=SIGFAC*SIGTE
210 TEMP2=AG/AT
IF(TEMP2.GE.1.) GO TO 220
SIGTE=SIGTE+TEMP2
C
P20 PHI=PHI/CR
JJ=ICT(10)
NX=ICT(11)
NY=ICT(12)
IX=JJ
IY=IX+NX
IZ=IY+NY
CALL INTER2(PHI,PAND,FDTAR(IX),FDTAR(IY),FDTAR(IZ),
$ NX,NY,SIGRI,XXXX,NX)
SIGRI=10.***(SIGBI/10.)
222 PHI=PHI*CR
SIGBF=TEMP1*(APF1*SIGRI)
SIGG=TEMP1*(AG1*SIGBI)
C
CALL ATTEN(IBAND,CAS,H,ISEAS,PHI,TAUAR)
TAUAR=1./(10.***(TAUAR/10.))
310 PNB=0.
C
C RECEIVER POWER
C
TEMP3=4*CPI*CPI*SR*SR
PD0=TAUPI*PX*CAF*TAUAR*CPI/TEMP3
PRIT=SIGTF*PD0
PRBT=SIGBF*PD0
PRRB=SIGG*PD0
TEMP1=TAUP2*CAF*TAUAR*FLAMDA**2/(4.*TFMP3)
PATT=TEMP1*PRIT
PART=TEMP1*PRBT
PARB=TEMP1*PRRB
TFMP1=THETAH*PRF/(WS*CR)
TFMP1=SQRT(TEMP1)
PTT=TEMP1*PATT
PTB=TEMP1*PART
PRB=TEMP1*PARB
SNRAT=(PTT+PTB)/(PRB+PNR)
IF(ISENS.FC.6) GO TO 361
C
C CLUTTER FREQUENCY
C
VR=0.
330 TEMP1=SIN(PHI)

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```

TEMP2=COS(PHI)
TEMP3=SIN(ALPHA)
TEMP4=COS(ALPHA)
VVY=C2*C3*VG*TAIIPW*TEMP4+TEMP1**3*C/(TEMP2*FLAMDA*H)
VVX=C2*C3*VG*THEETAH*TEMP3/FLAMDC
VK=2.*VV/FLAMDA
VS=FDS(7)*CR/(SORT(2.*CPI)*THEETAH)
VC=SORT(VVY**2+VVX**2+VV**2+VR**2+VS**2)

```

C

C CLUTTER ATTENUATION

C

```

VT=SORT(VC**2+VF**2+VPRF**2)
VTH=FDS(23)
VB=FLAMDA*PRF/(2.*C3*C2)
IF((2.*VTH).LT.VR) GO TO 333
PRINT 332,X,Y
332 F0RMA T(1X,35H THRESHOLD SPEED IS GREATER THAN 1/2,
$12H BLIND SPEED,5X,2HX=E12.5,2X,2HY=E12.5)
P3D=0.
GO TO 370
333 FN1=(VRT-VTH)/VB
N1=FN1+.00001
IF(FN1.LT.0.) N1=N1-1
N1=N1+1
FN1=N1
TEMP1=(VRT+VTH)/VR
IF(FN1.GE.TEMP1) GO TO 334
P3D=0.
GO TO 370
334 FTH=2.*C2*C3*VTH/FLAMDA.
FMF = FDS(1)
IF (FMF) 9,7,9
7 FMF = 12.
PRINT 8
8 F0RMA T(5X,42HAN MF VALUE WAS NOT INPUT SO MF IS SET=12.)
9 FII = FMF/6.
FKK = 1./(1.414 *FTH**FII)
FRT = 2.*C2 *C3 *VRT /FLAMDA
FBK = FTH *1.414 *(1./FII)
GG = FKK **2 *FRT *(2.*FII)
IF (FRT .GT. FBK) GG = 1.
PTT1 = PTT *GG
TEMP1=0.
CALL GAIN(TEMP1,FBK,TEMP2,VT,0,XXXX)
TEMP2=.5-(TEMP2/(VT*SORT(2.*CPI)))
IF (TEMP2.LT. 0.) TEMP2 = 0.
PN=2.*TEMP2
TEMP1 = 0.
CALL GAIN(TEMP1,FBK,TEMP2,VT,-1,FII)
PN = PN +2.*FKK **2 /(SORT(2.*CPI)*VT)*TEMP2

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```

PRC=PN*(PRP+PVR)
PTC=PN*(PTR+PVR)
SNRAT=(PTT1+PTC)/(PVR+PRC)
361 SNDR=10.*ALOG10(SVRAT)
365 TSN=FDS(21)
P3D=0.
P3R=0.
IF(SNDR.GF.TSN)P3D=1.
IF(P3D.LE.0.) GO TO 400
370 CONTINUE
XNR=AMIN1(DTX,DTY)/DGX
TEMP1=(XNR-3.2)**2/11.
IF(TEMP1.LT.180.) GO TO 390
P3R=1.0
GO TO 400
390 P3R=1.-EXP(-TEMP1)
400 AT=DGX*CGY
AT=AT+(NT+(NT-1)*TSPACE/DGX)
DSX=FDTS(2)
DSY=FDTS(3)
XMAX=H/TAN(PHID-THETA/2.)
XMIN=H/TAN(PHID+THETA/2.)
YMAX=2.*XMAX*TAN(THETA/2.)
YMIN=2.*XMIN*TAN(THETA/2.)
IF((DSX.GT.0.)OR.(DSY.GT.0.)) GO TO 450
AS=(XMAX-XMIN)*((YMAX+YMIN)/2.)
GO TO 500
450 DDX=XMAX-XMIN
IF(DSX.GT.0.) DDX=AMIN1(DSX,DDX)
DDY=(YMAX+YMIN)/4.-Y
IF(DSY.GT.0.) DDY=AMIN1((DSY/2.),DDY)
IF((DDY+Y).GT.(YMIN/2.)) GO TO 470
AS=2.*DDY*DDX
GO TO 500
470 AA=((DDY+Y)-(YMIN/2.))/TAN(THETA/2.)
BB=AA*TAN(THETA/2.)
AS=DDY*DDX-.5*AA*BB
DDY=(YMAX+YMIN)/4.+Y
IF(DSY.GT.0.) DDY=AMIN1((DSY/2.),DDY)
IF((DDY-Y).GT.(YMIN/2.)) GO TO 490
AS=AS+DSY*DSX
GO TO 500
490 AA=((DDY-Y)-(YMIN/2.))/TAN(THETA/2.)
BB=AA*TAN(THETA/2.)
AS=AS+DDY*DDX-.5*AA*BB
500 ARATIO=AT/AS
TEMP1=(700./G)*ARATIO*DFLTAT
IF(TEMP1.LT.180.) GO TO 510
P2=1.0
GO TO 520

```

```

510 P2=1.-EXP(-TEMP1)
520 X=X/C2
    Y=Y/C2
    H=H/C2
    SR=SR/C2
    RETURN
    END
    SUBROUTINE INTERP2(TARGX,TARGY,X,Y,TAB,NX,NY,ANS,IFLAG,N)

```

```

C
C PERFORMS BIVARIATE, INTERPOLATION
C

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```

    DIMENSION TAB(N,1),X(1),Y(1)
    IFLAG=0
    IF(TARGX-X(1)) 2,3,3
2   IFLAG=-1
    ARGX=X(1)
    GO TO 4
3   ARGX=TARGX
4   IF(TARGY-Y(1)) 5,6,6
5   IFLAG=-1
    ARGY=Y(1)
    GO TO 7
6   ARGY=TARGY
7   DO 8 II=2,NX
    IF(ARGX-XX(II)) 9,9,8
8   CONTINUE
    II=NX
    IFLAG=1
    ARGX=X(II)
9   I=II
    DO 10 JJ=2,NY
    IF(ARGY-Y(JJ)) 11,11,10
10  CONTINUE
    JJ=NY
    IFLAG=1
    ARGY=Y(JJ)
11  J=JJ
    DY=Y(J)-Y(J-1)
    CY1=-(ARGY-Y(J))/DY
    CY2=(ARGY-Y(J-1))/DY
    DX=X(I)-X(I-1)
    CX1=-(ARGX-X(I))/DX
    CX2=(ARGX-X(I-1))/DX
    ANS=CY1*(CX1*TAB(I-1,J-1)+CX2*TAB(I,J-1))
    +CY2*(CX1*TAB(I-1,J)+CX2*TAB(I,J))
    RETURN
    END
    SUBROUTINE GAIN(X1,X2,Y,VT,ITYP,FI)
    DX=(X2-X1)/100.
    Y=0.

```

```

X=X1
DO 40 I=1,101
IF(ITYPE) 5,5,6
5  TEMP=-X*X*.5/(VT*VT)
   TEMP=EXP(TEMP)
   IF(ITYPE.LT.0) TEMP=TEMP*X**(2.*FI)
   GO TO 7.
6  TEMP=SQRT(COS(X))/(SIN(X)**2)
7  IF(I.EQ.1) GO TO 30
   IF(I.EQ.101) GO TO 30
   IF((I/1)*2-I) 10,20,30
10  TEMP=2.*TEMP
   GO TO 30
20  TEMP=4.*TEMP
30  Y=Y+TEMP
40  X=X+DX
   Y=DX*Y/3.
   RETURN
   END
SUBROUTINE SAR(FDS, IDT, FDT, FDR, FDEVT,
&IDS, FDS, P2, P3D, P3R)
COMMON/TABLES/FDTAR(725)
COMMON/TARGET/ICT(50)
COMMON/PLACK3/X, Y, XY, H, SR, SP, ANGL0, ANGLT, DELTAT
DIMENSION FDS(20), IDT(20), FDT(20), FDR(20),
&FDEVT(20), IDS(20), FDS(25)
CAS=FDS(19)
ISEAS=IDS(1)
IBAND=1
FKT=1.
CPI=2*ASIN(1.)
C2=.3048
C3=1.689
CR=.01745
C=3.FR
DX=FDS(1)
TAUPW=FDS(13)
FLAMDA=FDS(9)
IF(FLAMDA.LT..025) IBAND =2
IF(FLAMDA.LT..0125) IBAND =3
XXXX=0.
DTX=FDT(1)*C2
DTY=FDT(2)*C2
GZER=FDS(2)
THETA=V=FDS(12)*CR
SL1=FDS(20)
SL2=FDS(21)
SL3=FDS(22)
PX=FDS(5)
TAUP1=FDS(14)

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```

TAUPP=FDS(15)
TSN=FDS(7)
PNR=FDS(3)
PRF=FDS(4)
PSI=FDT(11)*CR
RC=FDS(6)
Z=6367650.
AH=FDS(18)*CR
VG1=FD0(5)
H=FD0(2)*C2
NT=IDT(1)
RNJC=NT
TSPACE=FDT(10)*C2
Y=FD0(1)*C2
VS=FDS(23)*6076.*C2
G=FDEVT(6)
IF(Y.LT.(1.5*VS)) GO TO 20
GO TO 30
20 Y=1.5*VS
PRINT 25
25 FORMAT(* Y TOO SMALL, INCREASED TO BE 1.5 SWATH WIDTHS *)
30 GAMMA=Y/Z
222 SR=SQRT(P*Z*(Z+H)*(1-COS(GAMMA))+H*H)
GRA=SR*TAN(AH)
SR=SQRT(SR*SR+GRA*GRA)
HORIZ=SQRT((Z+H)**2-Z*Z)
PHIH=ASIN(HORIZ/(Z+H))
PHI=ACOS(((Z+H)**2-SR**2-Z*Z)/(-2*Z*SR))
PHI=PHI-CPI/2.
FLP=C*TAUPP*.5/RC
DCY=FLP/(COS(PHI)*COS(AH))
DCX=DX/COS(AH)
DCMIN=AMINI(DCX,DCY)
RNJC1=DCMIN/(NT*(TSPACE+DTX))
RATSIG=AMINI(RNJC,RNJC1)
SIGFAC=AMAX1(1.,RATSIG)
XTE=AMINI(DCX,DTX)
XTY=AMINI(DCY,DTY)
ATE=XTE*XTY
AG=DCX+DCY
ARE=AMAX1((AG-ATE),0.)
PHIM=PHI-THETA
IF(PHIM.LE.PHIH) PHIM=PHIH
COMP=CPI/2.-PHIM
IF(PHIM.LE.PHIH) GO TO 51
COMP=CPI-ASIN(SIN(CPI/2.-PHIM)+(Z+H)/Z)
51 GAMMA=CPI/2.+PHIM-COMP
YMAX=Z*PHIH
GAMAXY=ACOS((SR**2-(Z+H)**2-Z*Z)/(-2*Z*(Z+H)))
XY=Z*GAMAXY/C2

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PHIM1=PHI-(Y+.5*VS)/Z
GAMMAX=ACOS((CPA+*2-2*Z*Z)/(-2*Z*Z))
X=Z*GAMMAX/C2
GAF=GZFR*(SIN(PHIM1)/SIN(PHI))*2*SQRT
2(COS(PHI)/COS(PHIM1))/COS(AH)
WP=FDR(S)
AG1=AG
ABF1=0.
IF(ARF.F0.0.) GO TO 200
105 DXX=AMAX1(DGX,DGY)
DN=AMIN1(DGX,DGY)
IF(DXX.LE.WP) GO TO 200
IF(DN.LE.WP) GO TO 110
AP=WP*(DXX+DN)/2.
GO TO 120
110 AP=DN*(DXX+WP)/2.
120 AL=AMAX1((AG-AP),0.)
F1=1.
A1=AP+F1*AL
IF(ATE.GT.AP) GO TO 130
ABE1=ATF-AP
GO TO 140
130 ATFL=ATF-AP
APE1=A1-F1*ATEL-AP
140 AG1=F1*AG
200 AT=DTX*DTY
PHI=PHI/C8
N=15
I=6+IBAND
BAND=IBAND
SIGTF=FDI(1)*(C3/FLAMDA)**.3
TFMP5=ABS(PSI-AH)
SIGTE=10.*ALOG10(SIGTF)+PHI/15.-5/45.*TFMP5/C8
IF(TFMP5.GE..7854) SIGTE=SIGTE+5/45.*TFMP5/C8
5-5/45.*(90.-TFMP5/C8)
SIGTF=10.**((SIGTE/10.))
210 TFMP3=AG/AT
IF(TFMP3.GT.1.) GO TO 220
SIGTF=TFMP3*SIGTE
220 SIGTF=SIGFAC*SIGTE
SIGR1=0.
JJ=ICT(10)
NX=ICT(11)
NY=ICT(12)
IX=JJ
IY=IX+NX
IZ=IY+NY
CALL INTER2(PHI,FAND,FDIAR(IX),FDIAR(IY),FDIAR(IZ),
S NX,NY,SIGR1,XXXX,NX)
SIGR1=10.**((SIGR1/10.))

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```

PHI=PHI*CR
SIGRF=ARF1*SICP1*SIN(PHI)
SIGG=AG1*SICR1*SIN(PHI)
CALL ATFN(JRANO,CAS,H,ISFAS,PHI,TAUAR)
TAUAR=1./(10.**((TAUAR/10.))
O=0.
TEMP3=0.
IF(SL1) 270,280,270
270 TFMP3=1./(10.**((SL1/10.))
280 IF(SL2) 290,300,290
290 TEMP3=TEMP3+1./(10.**((SL2/10.))
300 IF(SL3) 310,320,310
310 TEMP3=TEMP3+1./(10.**((SL3/10.))
320 O=?.*TFMP3
IF(O.FO.O.) O=.1
PDO=TAUP1*PX*GAF/(4.*CPI*SR*SR)*TAUAR
PRTT=TAUAR*SICTF*PDO
PRRT=TAUAR*SICRF*PDO
PRRR=TAUAR*SICG*PDO
TFMP4=TAUP2*TAUAR*GAF*FLAMDA**2/(4*CPI*SR)**
PATT=PRTT*TEMP4
PART=PRRT*TEMP4
PARB=PRRR*TEMP4
FL=.44*FLAMDA*SR/DCX
FN=FL*PF*(C2*C3+VG1)
PRT=FN*PART
PTT=FN*PATT
PRB=FN*PARB
PSL=O*PRB
SNRAT=(PTT+PRT)/(PRB+PSL+PNR)
SNRAT=10.*ALOG10(SNRAT)
Y=Y/C2
ANGL0=ATAN(Y/X)
SR=SR/C2
H=H/C2
SP=VG1*C3
ANGLT=PHI
P3D=0.
P3R=0.
IF(SNRAT.GF.TSN) P3D=1.0
IF(P3D.LE.0.) GO TO 400
XNR=AMINI(DGX,DCY)/SQRT(DGX*DCY)
TEMP1=(XNR-3.2)**2/11.
IF(TEMP1.LT.180.) GO TO 390
P3R=1.0
GO TO 400
390 P3R=1.-EXP(-TEMP1)
400 AT=DCX*DCY
AT=AT*(NT+(NT-1)*TSPACE/DCX)
ASPCT=FDS(17)

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```

WSM=VS
AS=VSM*WSM*ASPFCT
500 ARATIO=AT/AS
TVIFV=ASPFCT*WSM/(SP*C2)
TEMP1=(700./C)*ARATIO*TVIFV
IF(TEMP1.LT.130.) GO TO 510
P2=1.0
RETURN
510 P2=1.-EXP(-TEMP1)
RETURN
END
SUBROUTINE ATFN(IRAND,CAS,H,ISFAS,PHI,ATT)
COMMON/TARLFS/FTAB(725)
COMMON/TARSET/ICT(50)
JJ1=ICT(13)
JJ2=ICT(16)
JJ3=ICT(19)
JJ4=ICT(22)
JJ5=ICT(25)
JJ6=ICT(28)
NX1=ICT(14)
NY1=ICT(15)
NX2=ICT(17)
NY2=ICT(18)
NX3=ICT(20)
NY3=ICT(21)
NX4=ICT(23)
NY4=ICT(24)
NX5=ICT(26)
NY5=ICT(27)
NX6=ICT(29)
NY6=ICT(30)
IZ=JJ2+NX2+NY2
I1=IZ+NY2+ISFAS
I2=IZ+ISFAS
CPI=2.*ASIN(1.)
IF(H.LT.FTAB(I1)) GO TO 50
IF(H.LT.FTAB(I2)) GO TO 70
DELS=S1(FTAB(I1),H,PHI)-S1(FTAB(I2),H,PHI)
GO TO 100
50 DELS=0.
GO TO 100
70 DELS=S1(FTAB(I1),H,PHI)
100 SUM=0.
IZ=JJ4+NX4+NY4
DO 200 I=1,NY4
N=IZ+NY4*(ISFAS-1)+I
SUM=SUM+FTAB(N)
IF(SUM.GE.CAS) GO TO 250
200 CONTINUE

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```

250 C=.04
   IF(IRAND.FO.2) C=.2
   IF(IRAND.FO.3) C=.4
   II=JJ3+NY3+NX3+NY3*(ISEAS-1)+I
   ATT=C*FDTAR(II)+.001*DFLS+(I-1)/R
   IF(H.LT.FDTAR(I?)) GO TO 260
   DFLS=S1(O,H,PHI)-S1(FDTAR(II),H,PHI)
   GO TO 280
260 DFLS=S1(O,H,PHI)
280 SUM=0.
   MC=0
   IF(DFLS.LT.10000.) MC=1
   IZ=JJ5+NX5+NY5
   IF(MC.FO.1) IZ=JJ6+NX6+NY6
   IF(MC.FO.1) NY5=NY6
   IF(MC.FO.1) NX5=NX6
   DO 300 I=1,NYS
   N=IZ+NY5*(ISEAS-1)+I
   SUM=SUM+FDTAR(N)
   IF(SUM.GF.CAS) GO TO 350
300 CONTINUE
350 IZ=JJ1+NX1+NY1
   ILOC=IZ+NY1*(IRAND-1)+I
   ATR=FDTAR(ILOC)*DFLS
   ATT=ATT+ATR
   RETURN
END
FUNCTION S1(H1,H,PHI)
  CPI=P.*ASIN(1.)
  Z=6367650.
  S1=- (Z+H)*COS(CPI/2.-PHI)+SQRT(((Z+H)*COS(CPI/2.-PHI))**2
  + (Z+H)**2 - (Z+H)**2)
  RETURN
END

```

**DAT  
FILM**

**6-8**