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USERS MANUAL


for

TSPOOND

15 December 1968

Prepared for

MOL Systems Office

Under Contract No. 

Prepared by

Mission Planning and Evaluation Project

TRW Systems

JAN 7 - 1969

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CONTROL SYSTEM ONLY

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TSPOOND GLOSSARY

AA Actual activity of target

ACQ Acquisition

ALTER Target addition, change, or deletion

ARRAY Programming term for vector

ASDT Actual scope dwell time

ATOF Actual acquisition telescope off time

ATON Actual acquisition telescope on time

ATS Acquisition and tracking scope

AV Actual visibility of target

B Boolean flag

BASIC Source target deck

BCD Binary coded decimal

BIT Binary interface tape

CNFLT Conflict flag

EGTXXX Reset File 8 location "XXX"

EOF End-of-file tape mark

EOT End-of-tape tape mark

F Floating point number

FST Flight support tape

GDT Group decision time

GO Computer GO or start control button

GN Group number

I Integer number

I/O Computer input and/or output operations

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TSPOOND GLOSSARY (Continued)

INTERRUPT Computer manual interruption control button

JOVIAL Procedure-oriented programming language

KBIT TSPOOND symbol for the binary interface tape

KOL Monte Carlo specific output tape

KOUT Listable output tape

KSPOUT TSPOOND BCD interface tape

LTAB Element on FST for on-line security control

MCD Mission correlation data

MO Main optics

MOL Manned orbiting laboratory

MPS Mission planning software

RA Reported activity of target

RESET Tape containing data base for TWONDER and ephemeris program control

REV Revolution, the interval in the orbit of a satellite from one ascending node to the next

REV END Last rev in a requested number of revs

REV START First rev in a requested number of revs

RV Reported visibility of target

SELT Target within group selected for photography

SEVXXX Reset File 7 location "XXX"

SMTC SCOPE master tape control program

SN Number of the scope that observes a target

SST System support tape

TGT Type of target, VIT, primary, alternate

VIT Visual intelligence target

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1. INTRODUCTION

1.1 BRIEF PROGRAM DESCRIPTION

The principal function of the computer program TSPOOND (Statistical Program of On-Board Decisions) is to simulate the actual conditions of target visibility and activity, crew voting and consequent main optics selections for the MOL/DORIAN missions. Two general types of results are generated for a specified rev span by TSPOOND: (1) typical sample detailed information describing crew performance and voting strategies, and (2) statistical summary data derived from a specified number of samples with means, variances, maximum and minimum values for specified output quantities.

TSPOOND accomplishes the simulation using a Monte Carlo technique sampling at random certain variables such as target visibility, activity, scope dwell times, crew recognition and false alarm. Using the path selection for the main optics and two acquisition telescopes from the TWONDER BIT, TSPOOND simulates the effects of different crew voting logics and other relevant factors on overall mission results.

The Monte Carlo cycle length for the program is one rev, i.e., all the samples are processed for one rev before beginning on the next. This choice of the cycle length, however, does not preclude getting statistics for quantities over several revs.

A basic flow diagram showing the hierarchy of operations is given in Figure 1-1.

1.2 INTRODUCTION TO MANUAL

This manual includes detailed operating instructions, input specifications, and a guide for interpreting the output of the TSPOOND computer program. Detailed information on program control to achieve study objectives is delineated for effective use of the program.

TSPOOND is designed to operate on the CDC 3600/3800 computer configuration and in the environment of the SCF System I software. Familiarity with the operation of the System I Scope Master Tape Control (SMTC) program is essential for effective use of TSPOOND.

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TSPOOND

TSPOOND

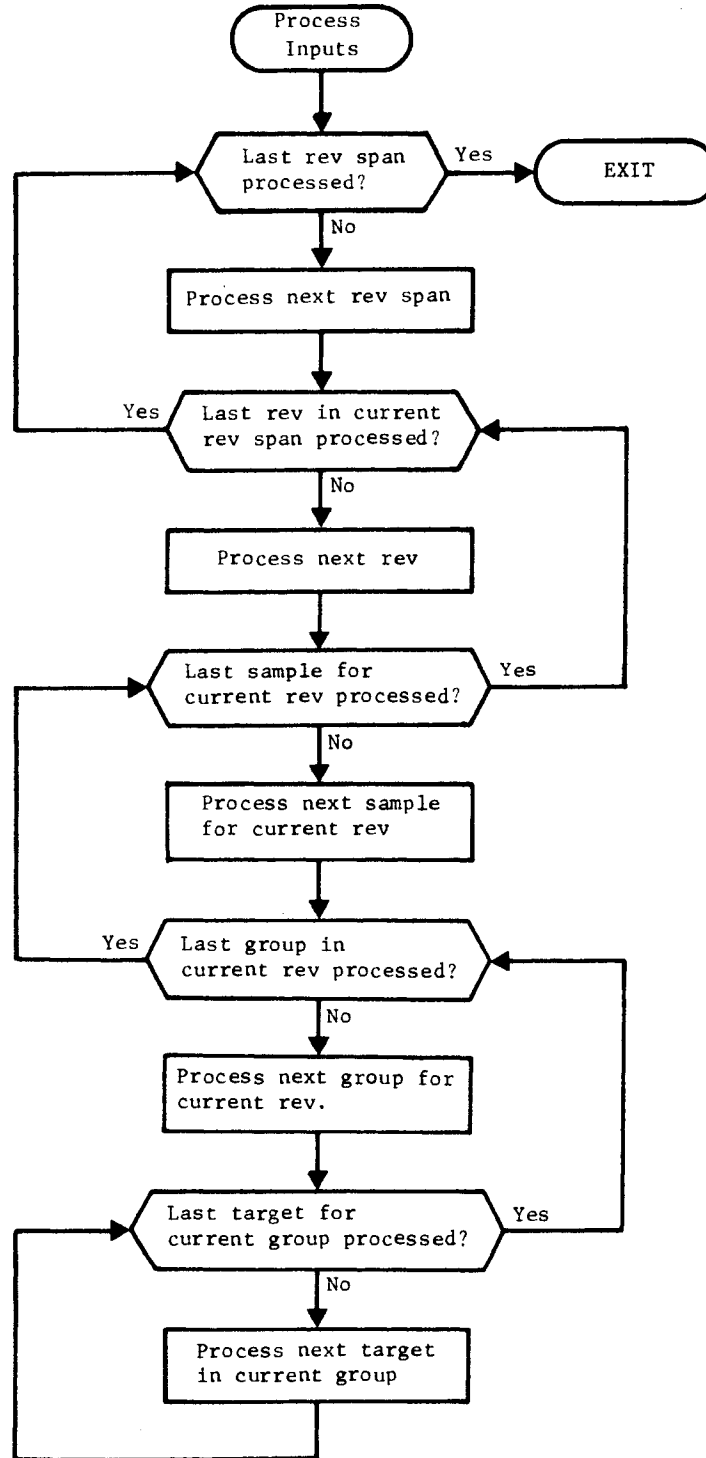


Figure 1-1. TSPOOND Basic Functional Flow

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2. INPUT

2.1 INPUT CHECK LIST

FUNCTION CARD PARAMETERS

Symbol	Program Item	Description	Item, Type and Units
	VEHNO	Vehicle number on reset tape used to generate the TWONDER Binary Interface Tape	INT*
P_R	PREC	Probability of crew recognition of activity when present	DEC** $0. \leq P_R \leq 1.0$
P_F	PFAL	Probability of false alarm (i.e., probability that a crew member reports a target active when it is inactive)	DEC** $0. \leq P_F \leq 1.0$
P_v	PVINP	Probability that a target is visible	DEC** $0. \leq P_v \leq 1.0$
x_1	XX1	Dwell time density for reject votes	DEC** seconds
x_2	XX2		
x_3	XX3		
r_1	RATIO1	Dwell time density ratios for clear votes	DEC**
r_2	RATIO2		
ρ	IGCC	Intra-group visibility correlation coefficient	DEC** $0. \leq \rho \leq 1.0$
t_{max}	TMAX	Maximum time to consider inter-group correlation	DEC** seconds
	IPVIS	Option flag for selection of probability of visibility (See Section 2.2.5)	INT* $0 \leq IPVIS \leq 4$

* INT indicates that item type is an integer number with no decimal point required.

** DEC indicates that the item can be expressed as a number containing a fraction (decimal point required).

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Symbol)	Program Item	Description	Item, Type and Units
	IVO	Decision strategy flag (only 0 at present)	INT*
	IRN	Initial random number generator seed	INT* $0 \leq \text{IRN} \leq 2^{36}$
	PROL	Output option flag (See Section 2.2.5)	INT* $-1 \leq \text{PROL} \leq 1$

DATA CARD INPUT

SUMMARY Card/s	(Required if no DETAIL cards follow, otherwise optional) - Input cards specifying (1) the rev span and (2) number of samples for which statistical summary data is derived.
DETAIL Card/s	(Required if no SUMMARY cards precede, otherwise optional) - Input data cards specifying the revs for which detailed typical sample information is desired.
EXTENDED Card/s	(Optional) - Input data cards specifying the item numbers for which means, variances, maximum and minimum values are desired over the range of samples. These item numbers are defined in Section 2.3.3 (Extended Statistics Card Input) and Section 3.2.2 (Extended Statistics on Requested Parameters).
END Card	(Required) - Indicates the end of all Data Card Input.

* INT indicates that item type is an integer number with no decimal point required.

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2.2 FUNCTION CARD INPUT PARAMETERS

2.2.1 Input Probabilities, Recognition, False Alarm, Visibility

P_R PREC Probability of crew recognition of activity when present. PREC is the 2nd item on the TSPOOND function card and is input as a decimal fraction between 0. and 1.0.

P_F PFAL Probability of false alarm (i.e., probability that a crew member reports a target active when it is inactive). PFAL is the 3rd input item on the TSPOOND function card and is input as a decimal fraction between 0. and 1.0. The zero-one random variable η for false alarm is sampled by the program and is defined as follows:

$$\Pr (\eta=1) = P_F ,$$

$$\Pr (\eta=0) = 1-P_F$$

P_v PVINP Probability of target visibility, PVINP is the 4th input item on the TSPOOND function card and is input as a decimal fraction between 0. and 1.0.

The zero-one random variable v for target visibility is sampled by the program and is defined as follows:

$$\Pr (v=1) = P_v$$

$$\Pr (v=0) = 1-P_v$$

2.2.2 Dwell Time Density Parameters

x_1 XX1 Dwell time density parameters for reject votes. These parameters are the 5th, 6th and 7th input items on the TSPOOND function card and are input in units of seconds. x_1, x_2, x_3 should be specified in ascending order of magnitude since they represent the three vertices of the dwell time triangular density function for reject votes.

[NOTE: The amount of time required to recognize cloud cover is less than that required to view a target and search for activity; therefore the TSPOOND user should specify different distribution functions for the sample dwell times to account for clear or clouded situations. (Figure 2-1 illustrates pictorially the usage of x_1, x_2, x_3).]

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r_1 RATIO1 Dwell time density ratios for clear votes. These two ratios must appear as the 8th and 9th input items on the TSPOOND function card and are input as unitless ratios. r_1 and r_2 are multiplied by the recommended dwell time, Q , to form the remaining vertices of the dwell time triangular density function for clear votes. (See Figure 2-1). Q is extracted by TSPOOND from the BIT.

r_2 RATIO2

2.2.3 Intra/Inter Group Correlation Parameters

ρ IGCC Intra-group visibility correlation coefficient. It is the 10th input item on the TSPOOND function card and should be specified as a decimal fraction between 0. and 1.0. The intra-group correlation logic of TSPOOND takes into account that the weather of two targets in the same group (and hence geographically close) is correlated to the extent specified by ρ .

t_{\max} TMAX Inter-group visibility correlation takes into account that the weather of two groups close to each other is correlated. t_{\max} represents the maximum time in which TSPOOND considers inter-group visibility correlation (i.e., if the time difference between the group decision times of group i and group $i + 1$ does not exceed t_{\max} , inter-group visibility correlation is considered). t_{\max} is the 11th input item on the TSPOOND function card specified in units of machine time seconds as a decimal item.

2.2.4 Random Number Generator Seed

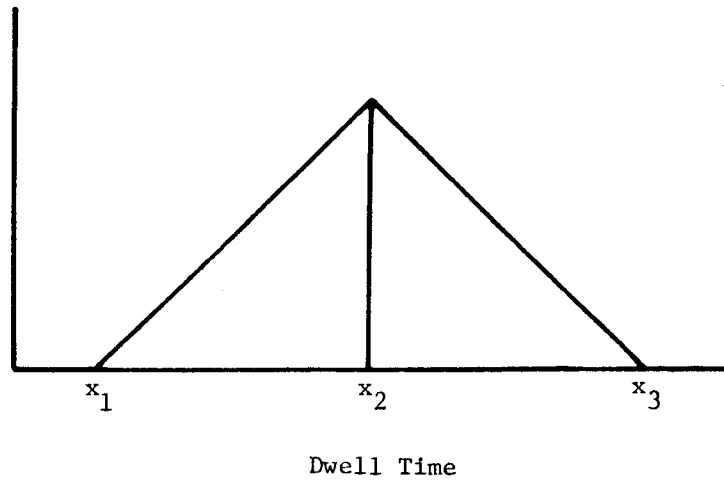
IRN Initial random number generator seed. IRN is the 14th input item on the TSPOOND function card and must be input as a positive integer between 0 and 2^{36} . In changing IRN from TSPOOND run to TSPOOND run, the sequence of (pseudo) random numbers, generated to compute the random quantities involved in the Monte Carlo sampling, is changed, thereby altering the program results for "identical" cases.

2.2.5 Other Input Option Flags

IPVIS Option flag for selection of the probability of visibility. IPVIS is the 12th input item on the TSPOOND function card and must be input as an integer between 0 and 4.

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Dwell time Probability Density Function (Reject votes)



Dwell Time Cumulative Distribution Function (Reject Votes)

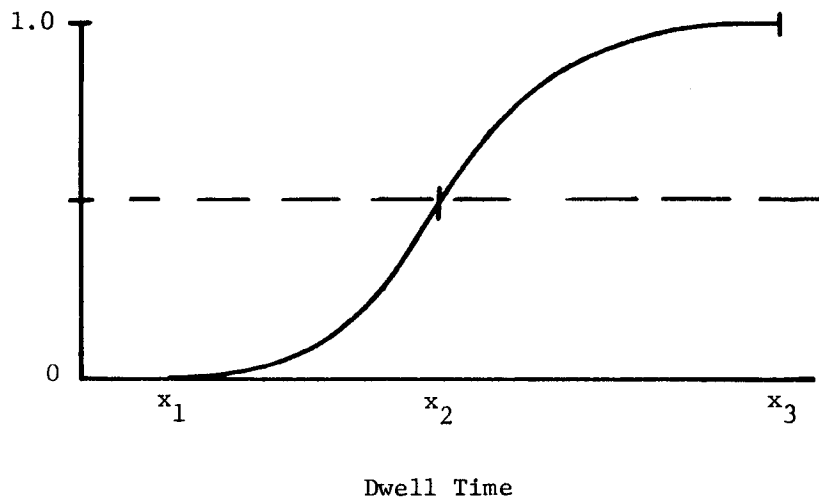
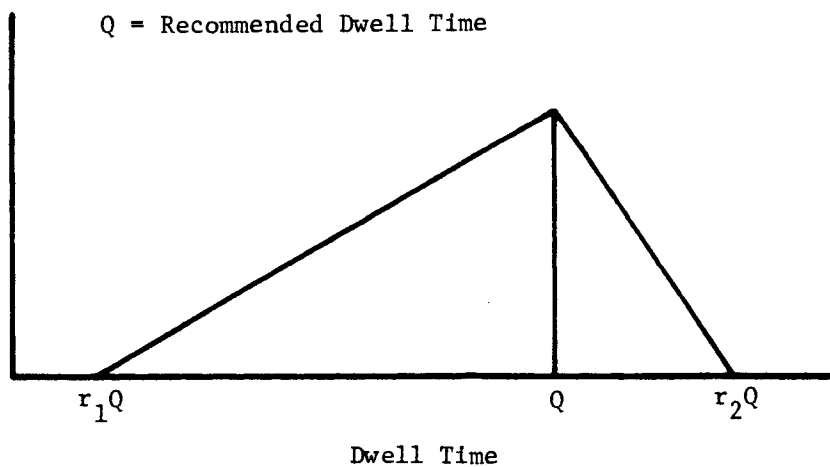


Figure 2-1. Dwell Time Density and Distribution Functions

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Dwell Time Probability Density Function (Clear Votes)



Dwell Time Cumulative Distribution Function (Clear Votes)

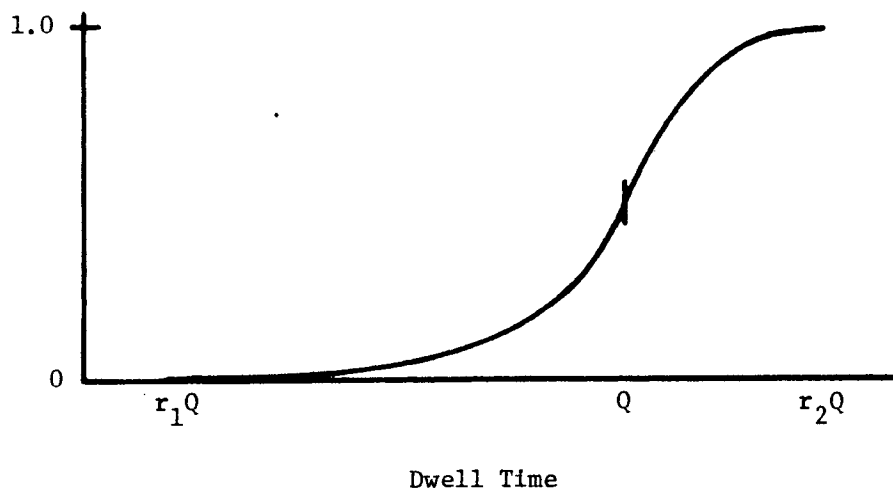


Figure 2-1. Dwell Time Density and Distribution Functions
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- IPVIS = 0 TSPOOND considers Intra/Inter group visibility correlation and processes with the probability of visibility from file 8 of the TWONDER BIT (EGT931).
- IPVIS = 1 TSPOOND considers Intra/Inter group visibility correlation and processes with the target specific probability of visibility from target specific selection file(s) of the TWONDER BIT.
- IPVIS = 2 TSPOOND considers Intra/Inter group visibility correlation and processes with the input probability of visibility (PVINP - 4th input item on the TSPOOND function card).
- IPVIS = 3 TSPOOND disregards any Intra/Inter group visibility correlation and processes with the probability of visibility from file 8 of the TWONDER BIT (EGT931).
- IPVIS = 4 TSPOOND disregards any Intra/Inter group visibility correlation and processes with the input probability of visibility (PVINP - 4th input item on the TSPOOND function card).

IVO Decision Strategy Flag. IVO is an integer item specified as the 13th input parameter on the TSPOOND function card. At present, there exists only one voting strategy for selecting the target for photography (IVO = 0). The weights for the voting are chosen by allowing the active and inactive columns of the voting table to be the expected weights of the targets given in the reported state, the reject column to be all zeros, and the unobserved weight to be a function of the probabilities of visibility, activity, and inactivity.

PROL Output option flag. The setting of the output option flag, PROL, determines which output tapes are written. PROL is an integer input specified as the 15th input item on the TSPOOND function card.

PROL = 1 No output of special Monte Carlo specific detail and summary information to appear on tape KOL.

PROL = -1 Special Monte Carlo specific detail and summary formatted information to appear on tape KOL.

Section 3.1.3 describes the expanded detailed output. Section 3.3 describes Monte Carlo specific output formats.

See Figure 2-2 for an example of a TSPOOND function card.

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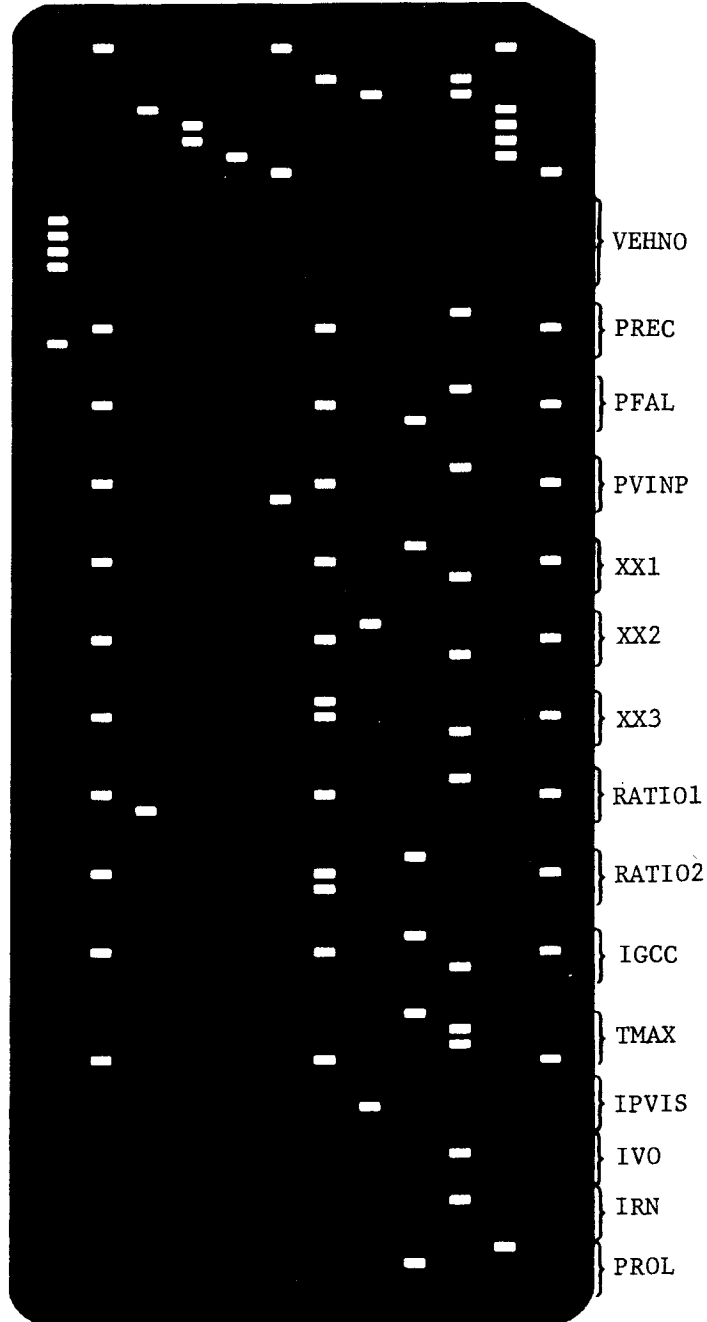


Figure 2-2. TSPOND Function Card Example

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2.3 DATA CARD INPUT

2.3.1 SUMMARY Data Card

SUMMARY Data Cards are input to indicate to TSPOOND the rev span(s) over which statistical summary data is desired. These data are derived from the total number of samples which is also specified on the SUMMARY Data Card. The format of the SUMMARY Data Card is free field and has the following form:

SUMMARY	REV START	REV END	NO. OF SAMPLES
---------	-----------	---------	----------------

where:	Rev Start	an integer rev number specifying the beginning rev over which statistical summary data is desired.
	Rev End	an integer rev number indicating the ending rev over which statistical summary data is desired.
	No. of Samples	an integer depicting the total number of samples from which the statistical summary data is derived.

$$1 \leq \text{no. of samples} \leq 5100$$

NOTE: The Rev Start and Rev End integer input specifications on the SUMMARY data cards must reflect revs which exist on the input TWONDER Binary Interface Tapes; otherwise, an error/action message is displayed on-line (see Section 4.5 Error/Action Messages and Recovery Procedures).

At least one SUMMARY card must appear in the data card deck if no DETAIL data cards are input. If at least one DETAIL card appears in the data deck, the SUMMARY card input is optional. A maximum of about 50 SUMMARY cards per TSPOOND run in any order is acceptable, this limit being dependent upon how many DETAIL data card rev inputs are specified outside the ranges of the SUMMARY card rev starts and rev ends (see Section 2.3.2, DETAIL card input).

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Following are some examples of input SUMMARY data cards:

Example 1 - SUMMARY

SUMMARY	6	10	1000
---------	---	----	------

The SUMMARY data card shown above signifies to TSPOOND that statistical summary data is desired over the rev span range of 5 revs, from rev 6 to rev 10 inclusive, to be derived from 1000 samples.

Example 2 - SUMMARY

SUMMARY	16	16	500
---------	----	----	-----

This SUMMARY data card directs TSPOOND to output statistical summary data for rev 16, derived from 500 samples.

Example 3 - SUMMARY Cards

SUMMARY	6	10	1000
---------	---	----	------

SUMMARY	16	16	500
---------	----	----	-----

These SUMMARY data cards would accomplish both output summaries of Example 1 and Example 2 in one TSPOOND case run. When multiple SUMMARY cards are input, the rev spans specified between SUMMARY cards may not overlap since TSPOOND cannot process separate overlapping rev span summaries. For example, the following cards indicating desired statistical summaries over revs 6 to 10, and revs 9 to 12, should not be input on the same TSPOOND case for the foregoing reason.

SUMMARY	6	10	1000
---------	---	----	------

SUMMARY	9	12	1000
---------	---	----	------

If separate overlapping rev span summaries are desired, the solution is to make separate TSPOOND cases.

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2.3.2 DETAIL Data Cards

DETAIL Data Cards input on a TSPOOND run indicate to the program, those rev(s) over which a typical sample giving detailed information about the actual status of the variables, voting, and decisions made, is desired for output. The format of the DETAIL data card is free field and should be input in the following form:

DETAIL	Rev no.	Rev no.	Rev no.
--------	---------	--------------	---------

where: Rev no. an integer rev number specifying the rev in which a typical sample detailed output is desired.

As many rev numbers as there is space on the DETAIL card may be specified. If SUMMARY cards are input, the input of DETAIL cards is optional. If no SUMMARY card appears in the input data deck, at least one DETAIL card must be inserted. The DETAIL cards must follow all SUMMARY cards in the input card deck order.

Note: As on the SUMMARY data card, the rev numbers specified on the DETAIL data cards must reflect revs which exist on the selection files of the TWONDER BIT; otherwise program execution is halted with an error/action message displayed on-line.

Following are some examples of input DETAIL data cards.

Example 1 - DETAIL

DETAIL	5	7	10	12	20	21	22	23	27
--------	---	---	----	----	----	----	----	----	----

The DETAIL data card shown above indicates to TSPOOND that typical sample detailed information is desired output for revs 5, 7, 10, 12, 20, 21, 22, 23, and 27.

Example 2 - DETAIL

DETAIL	5	7	10	12	20	TO	23	27
--------	---	---	----	----	----	----	----	----

The DETAIL data card specified above would accomplish the same results as in Example 1. Typical sample detailed information would be output for revs 5, 7, 10, 12, 20 to 23 inclusive, and rev 27. The descriptor "TO" existing between any two rev numbers would result in typical sample output for all revs inclusive to the two bracketing rev numbers.

Section 3.1.3 (Detailed Output) describes the typical sample detailed output.

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2.3.3 EXTENDED Statistics Card Input

EXTENDED data cards are input to TSPOOND when extended statistics on specified output parameters are desired on a rev by rev basis. These extended statistics include means, standard deviations, maximum, and minimum values of a subset of the 30 output parameters taken over the number of samples specified on the SUMMARY data card for the corresponding rev number.

The maximum number of EXTENDED cards is 30 and may be input in any order as well as anywhere in the data card input deck behind the TSPOOND function card. In most instances, all output parameters designated for the extended statistics option may be so indicated with one or two EXTENDED input data cards.

The format of the EXTENDED data card is free field and should be input in the following format:

EXTENDED Output Parameter No. 1 Output Parameter No. 2 etc.

where the output parameter numbers are extended output parameter codes whose definitions are:

<u>Extended Number</u>	<u>Definition</u>
1	number of primary targets selected for photography that were reported active
2	number of primary targets selected for photography that were reported inactive
3	number of primary targets selected for photography that were reported reject
4	number of unobserved primary targets selected for photography
5	total number of primary targets selected for photography
6	number of active votes for primary targets
7	number of inactive votes for primary targets
8	number of reject votes for primary targets
9	number of unobserved primary targets

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<u>Extended Number</u>	<u>Definition</u>
10	total number of primary target votes
11	number of alternate targets selected for photography that were reported active
12	number of alternate targets selected for photography that were reported inactive
13	number of alternate targets selected for photography that were reported reject
14	number of unobserved alternate targets selected for photography
15	total number of alternate targets selected for photography
16	number of active votes for alternate targets
17	number of inactive votes for alternate targets
18	number of reject votes for alternate targets
19	number of unobserved alternate targets
20	total number of alternate target votes
21	number of false alarms involving primary targets
22	number of false alarms involving alternate targets
23	total number of false alarms
24	number of failures to recognize involving primary targets
25	number of failures to recognize involving alternate targets
26	total number of failures to recognize
27	weight with interdiction
28	weight without interdiction
29	number of clear targets photographed with interdiction
30	number of clear targets photographed without interdiction

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Example 1 - EXTENDED Data Card

SUMMARY	7	14	500						
EXTENDED	5	10	15	20	23	26	TO	30	

The EXTENDED data card shown above in conjunction with the SUMMARY card indicates to the program that extended statistics are desired on the following output parameters from revs 7 to 14 inclusive derived from 500 samples per rev.

Output Quantity Number

- 5 total number of primary targets selected
- 10 total number of primary target votes
- 15 total number of alternate targets selected
- 20 total number of alternate target votes
- 23 total number of false alarms
- 26 total number of failures to recognize
- 27 weight with interdiction
- 28 weight without interdiction
- 29 number of clear targets photographed with interdiction
- 30 number of clear targets photographed without interdiction

Notice that the TO descriptor between two output parameter numbers triggers an inclusive condition for output parameter numbers 26 to 30. This descriptor may be used for this purpose anywhere on the EXTENDED data card between two output parameter numbers.

Example 2 - EXTENDED Data Card

SUMMARY	6	12	100						
EXTENDED	1	TO	30						

The EXTENDED card shown above in conjunction with the SUMMARY card indicates extended statistics are desired for all of the summary output parameters from revs 6 to 12 inclusive derived from 100 samples.

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2.4 TWONDER OUTPUT BINARY INTERFACE TAPE (BIT)

The primary input to TSPOOND is the BIT (Binary Interface Tape) generated by the program TWONDER. The operating instructions required to load, execute, and control the TWONDER program for the generation of the BIT are given in Reference 1. Reference 2 describes the detailed content and format of the TWONDER BIT.

All the information contained on the TWONDER BIT is processed by TSPOOND, with only the indicated information on the revs of interest displayed as TSPOOND output. TSPOOND writes the information along with Monte Carlo specific information on BCD formatted magnetic tapes, which in turn may be used by other software programs operating on computer configurations other than the 3600 or 3800 computer systems.

2.4.1 TWONDER Function and Data Cards

The first file on the BIT contains general run identification information, with three or more constant size records. Record 1 is a run identification record consisting of the BIT label, rev span information, number of active acquisition telescopes, etc. Record 2 is a BCD card image of the target deck header card from the TWONDER target acquisition tape used on the TWONDER run. The BCD card image of the TWONDER function card appears as the 3rd record. If no TWONDER data cards were processed, the first file on the BIT will terminate with record 3. All TWONDER data cards processed appear as one record per card up to and including the "END" card.

2.4.2 Ephemeris Information and Critical Reset Parameters

The 2nd file of the BIT consists of three records each of 1000 words containing the data base input to the TWONDER computer run.

The 1st record contains 27 words of Vehicle Ephemeris Information, including parameters defining the nominal period, and initial conditions of the osculating ellipse at epoch.

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TSPOOND purges record 1 for the 27 words of Vehicle Ephemeris Information and writes this information on the TSPOOND BCD interface tape (see Section 3.1.2.2).

The 2nd record of file 2 constitutes the payload capabilities parameters contained on file 7 of the Reset Tape. Four hundred words of the file 7 record are written on the TSPOOND BCD interface tape along with the full 1000 word 3rd record containing the Reset Tape File 8 parameters. Sections 3.1.2.4 and 3.1.2.6 discuss the BCD formats of the TSPOOND BCD interface tapes with reference to the File 7 and File 8 reset parameters.

2.4.3 TWONDER Selection Information

Each additional file of the TWONDER BIT will contain the MO and ATS selections for one complete rev. Beginning from the 3rd file, the BIT will consist of a selection file for each rev in the TWONDER rev span blocked into equal size records of 1500 words/record. The number of records/rev will depend on the size of the selection for the rev.

In addition to reformatting all TWONDER selection entries from binary to BCD for output, TSPOOND will output, on option, a detailed account of specified rev spans. This output consists of parameters which are computed as functions of the parameters from the TWONDER selection entries. Included in this output will be:

1. The actual and reported states of every target entry.
2. The actual target chosen for photography in each group.
3. The actual scope on and off times.
4. The main optics on and off times for each target entry.
5. The group decision time, group number, rev number, scope number.
6. The mid-time stereo angles, slant range, obliquity and photo mode.
7. The active and inactive weights.
8. The visual intelligence target, alternate target, and primary target flags.

All of the above output items are generated from information transmitted to TSPOOND via the TWONDER BIT target selection file(s).

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3. PROGRAM OUTPUT

This section describes each of the three output tapes that TSPOOND can generate, namely, (1) the BCD Interface Tape (KSPOUT), (2) the list-able output tape (KOUT) and (3) the Monte Carlo Specific output tape (KOL). The function card parameter PROL specifies which tapes will be written as follows:

PROL > 0	KSPOUT, KOUT tapes will be written
PROL < 0	KSPOUT, KOUT, KOL tapes will be written

KSPOUT serves as the interface tape for anyone desiring to use TSPOOND results. KOUT and KOL display the program results with descriptive headers that define the various output parameters and are written to facilitate output interpretation when TSPOOND is being used for studies.

The following paragraphs describe the format and content of the three output tapes:

3.1 KSPOUT - BCD INTERFACE TAPE

The purpose of the TSPOOND BCD tape (KSPOUT) is to supply the important input parameters that describe crew performance and voting strategies generated by the TSPOOND and TWONDER programs to other software programs. The KSPOUT tape will be generated in BCD to facilitate usage by computer configurations other than the CDC 3600 or 3800.

The tape will contain the basic input used by TWONDER and the complete MO and ATS selections generated by TWONDER as well as TSPOOND generated outputs. The TSPOOND outputs include the actual conditions of target visibility and activity, crew voting and subsequent main optics selections.

The information will be written on tape as a sequence of records, 120 characters in length, within a sequence of files, so that the tape may be conveniently listed.

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3.1.1 File 1 - General Run Identification Information

The first file will consist of general run identification information pertinent to both the TSPOOND and TWONDER runs. Each record will contain an 80 character hollerith card image expressed in internal BCI code. Internal BCI code is described in Appendix E of Reference 5. The number of records is variable. Figure 3-1 and 3-2 are sample listings of the information contained in the first file of the KOL, KOUT and KSPOUT tapes, respectively.

The file will contain the following items:

- TSPOOND function card and data cards
- TWONDER BIT tape label
- Run identification word
- The Rev Span
- Number of active ATS
- Target tape ID
- TWONDER function card and data cards

The following paragraphs describe the above items in detail.

3.1.1.1 TSPOOND Function and Data Cards

The first record is the image of the TSPOOND function card, followed by records containing the images of the TSPOOND data cards. If more than one card is used to input the function card parameters, however, only the image of the last card will be written in the first record. The format of the function card is discussed in Sections 2.1 through 2.2 and that of the data cards in Sections 2.3.1 through 2.3.3.

3.1.1.2 BIT Run Identification File

Following the image of the TSPOOND END card will be the images of the first and each successive record on the Run Identification File found on the BIT input tape. The first record copied from the BIT is the Run Identification Record with a format as follows:

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<u>Card Column</u>	<u>Content or Symbol</u>	<u>Definition</u>
2 - 18	17H(**TWONDER BIT**)	BIT Identifier phrase
21 - 28	8H(RLV SPAN)	Descriptor
30 - 32	<u>RSTART</u>	Start of rev span (integer) from <u>TWONDER</u> function card
34 - 34	1h(-)	Separator
36 - 38	<u>REND</u>	End of rev span (integer) from <u>TWONDER</u> function card
45	<u>NUMSCOP</u>	Number of active scopes (integer) from file eight of reset tape
47 - 52	6H(SCOPES)	Descriptor
59 - 69	11H(RUN IDENT -)	Descriptor
71 - 78	IDBCD	Run identification word (BCI) from File 1 of reset tape

All columns not indicated are blank.

The next record will be the target deck header card from the Input BCI target tape or the Input target acquisition tape, whichever is used for the given run. The format of the target tape header card is:

<u>Columns</u>	<u>Content</u>	<u>Definition or Comment</u>
1 - 5	5H(BASIC)	Identifies card as target deck header card
7 - 80	----	Descriptive label or identification of target deck used

If target tape header card is not present, columns 6 through 80 will be blank.

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```

*13 TSPOUND 9999 .5 .4 1. 2. 3. .3333333333 1.666666666 .3 100. 2 0 0 -1
SUMMARY 2 6 100
DETAIL 2 10 6
EXTENDED 1 TO 30
END
CARD SPAN IS 2 TO 6 BIT SPAN IS 1 TO 16
***TWONDER BIT*** REV SPAN 1 - 16 2 SCOPES RUN IDENT - JACK25
BASIC HABIT 000
*13 TWONDER 9999 1 16 ACQ BIT

```

Figure 3-1. Function and Data Card Images on BCD Tapes (KOL and KOUT)

```

*13 TSPOUND 9999 1. 0. .4 1. 2. 3. .8 1.2 .7 100. 2 0 0 -1
SUMMARY 1 8 50
SUMMARY 10 16 50
DETAIL 1 TO 8 10 TO 16
EXTENDED 1 TO 30
END
***TWONDER BIT*** REV SPAN 1 - 16 2 SCOPES RUN IDENT - JACK25
BASIC HABIT 000
*13 TWONDER 9999 1 16 ACQ BIT

```

Figure 3-2. Sample Output - Function and Data Card Images on KSPOUT Tape

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3.1.1.3 TWONDER Function and Data Cards

The next record will be the image of the TWONDER function card from the BIT. The format of the TWONDER function card is described in Section 3.1.1 of Reference 1.

Next, all the TWONDER data cards will be written, one record per card, up to and including the "END" card. If no data cards are read, the file will terminate with the TWONDER function card image. The format of the data cards is described in Section 3.1 of Reference 1.

3.1.2 File 2 - Data Base Information File

This file will consist of 286 records of five BCD words per record in addition to three records of title information.

3.1.2.1 Record 1 Ephemeris Title

Record one contains the descriptors "EPHEMERIS INFORMATION" beginning in the second character of the record.

3.1.2.2 Records 2 through 7 - Ephemeris Information

The 27 words of Ephemeris Information will be written in six records of five words per record, with the 6th record containing only two words. The five values of each record are displayed in the following characters of the record: 15 to 30, 35 to 50, 55 to 70, 75 to 90, 95 to 110.

A sample of the above card images is shown in Figure 3-3. Detailed descriptions of the 27 Ephemeris words are as follows:

<u>Record Number</u>	<u>Word Number</u>	<u>Jovial Definition</u>	<u>Definition</u>
1	0	I 48 S	Base Day
1	1	I 48 S	Base Month
1	2	I 48 S	Base Year
1	3	I 48 S	Ephemeris rev start
1	4	I 48 S	Ephemeris rev end
2	0	I 48 S	Epoch Day
2	1	I 48 S	Epoch Month
2	2	I 48 S	Epoch Year
2	3	F	Epoch System Time (sec)

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<u>Record Number</u>	<u>Word Number</u>	<u>Jovial Definition</u>	<u>Definition</u>
2	4	I 48 S	Epoch Rev
3	0	F	Epoch Time (minutes from base date)
3	1	F	Inclination (deg)
3	2	F	Drag (cu ft/lb - sec)
3	3	F	Nominal period (min)
3	4	F	Eccentricity
4	0	F	Argument of Perigee (deg)
4	1	F	Longitude of ascending node (deg)
4	2	F	True Anomaly (deg)
4	3	F	Argument of Latitude (deg)
4	4	F	Cartesian position (ft) - X
5	0	F	Cartesian position (ft) - Y
5	1	F	Cartesian position (ft) - Z
5	2	F	Cartesian position magnitude (ft) - R
5	3	F	Cartesian velocity (ft/sec) - XD
5	4	F	Cartesian velocity (ft/sec) - YD
6	0	F	Cartesian velocity (ft/sec) - ZD
6	1	F	Cartesian velocity magnitude (ft/sec)-V
6	2		Not Used - Blank
6	3		Not Used - Blank
6	4		Not Used - Blank

3.1.2.3 Record 8 - File Seven Title

This title begins in the second character of the record and contains the descriptors "FILE SEVEN".

3.1.2.4 Records 9 through 88 - Reset Tape File 7

The 400 words from file 7 of the reset tape will be written as 80 records in a format containing 5 words per record.

A location tag, SEVXXX, starting in the fifth character of each of the eighty records is displayed. The number appearing in the location tag indicates the sequence number within File Seven that corresponds to the

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first value of that record. Each of the eighty records displays five values of File Seven in the following characters of the records: 15 to 30, 35 to 50, 55 to 70, 75 to 90, 95 to 110.

A sample listing of the File Seven output is shown in Figure 3-4. Detailed definitions of File Seven words are described in Section 4.1.2 of Reference 1 and in Section 3, Table 1 of Reference 3. Definitions from the TWONDER users manual will override any conflict with the definitions from the Reset Parameter Descriptions.

3.1.2.5 Record 89 - File Eight Title

This title begins in the second character of the record and contains the descriptors "FILE EIGHT".

3.1.2.6 Records 90 through 289 - Reset Tape File 8

The 1000 words from file 8 of the reset tape will be written on the following 200 records in a format containing five words per record.

A location tag, EGTXXX, starting in the fifth character of each of the 200 records is displayed. The number appearing in the location tag indicates the sequence number within File Eight that corresponds to the first value of that record. Each of the 200 records displays five values of File Eight in the following characters of the records: 15 to 30, 35 to 50, 55 to 70, 75 to 90, 95 to 110.

A sample of the File Eight output is shown in Figure 3-5. Detailed definitions of File Eight words are described in Section 4.1.2 of Reference 1 and in Section 6 of Reference 3. Definitions from the TWONDER users manual will override any conflict with the definitions from the Reset Parameter Descriptions.

The following parameters from File 8 are used by TSPOOND:

- PROBA - Probability of activity (EGT922)
- PROBFA - Probability of falsely reporting a target active (EGT923)
- PROBREC - Probability of recognizing activity (EGT 924)
- PROBV - Probability that a target will be unclouded (EGT 931)

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3.1.3 File 3 (and Subsequent Files): Selection and Decision File(s)

One file containing detailed output is written for each rev. Each file will consist of the main optics (MO) and acquisition telescopes (ATS) selection, along with the detailed accounting of the actual visibility and activity states and the crew voting information on each target selected. Each target entry will be displayed in six 120 character BCD records, containing a variable number of items per record. The total number of records for each rev will depend on the number of targets for that rev. The target information will be written in group order for a given rev. A sample of the expanded detailed output display is shown in Figure 3-6.

Each selection entry will include target specific information, MO selection information, and ATS selection information from the TWONDER BIT. Included in this output will be the following typical sample TSPOOND output:

- a. The actual and reported states of every scheduled target along with the group number in which each resides.
- b. The target chosen for photography in each group.
- c. The scope on and off times.
- d. The actual scope dwell time.
- e. Conflict flag indicative of photography eliminated due to conflict.

If no selection is made for a rev in a span, one file of one 120 character record will be written. The record will consist of the following message displayed starting at the third character of the record:

REV. NO. XXX IS A NULL REV.

The typical sample expanded detailed output associated with each target will be output, six records per target, in the following format:

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<u>Name</u>	<u>Record Number</u>	<u>Characters</u>	<u>Item*** Type</u>	<u>Description</u>
TREV	1	2 - 5	I	Revolution number, orbit on particular mission starting with revolution 1 at first passage of ascending node (0-999)
TTIME	1	8 - 20	F13.6	Time of vertical acquisition (when the vehicle is closest to the target) in minutes from base date. (0-262143)
TESS	1	23 - 24	-	Not used
TIDA	1	27 - 34	A	First 8 characters of target's alphanumeric identifier
TIDB	1	35 - 36	A	Final 2 characters of target's alphanumeric identifier
TWX	1	41 - 43	I	Weather factor (0-99)
TTLV	1	46 - 47	I	Target location validity code (0-9)
TLONG	1	49 - 59	F11.6	Target longitude in radians ($\pm \pi$)
TLAT	1	61 - 70	F10.6	Target latitude in radians ($\pm \pi/2$)
TALT	1	73 - 76	I	Target altitude in $f \times 10^{-2}$ (0-999)
TPRIA	1	79 - 81	I	Active priority of target (0-99)
TPRII	1	84 - 86	I	Inactive priority of target (0-99)
TBENCHF	1	89	I	Flag indicating that target is a bench mark target (1 - yes, 0 - no)
TBABL3	1	92 - 98	F7.4	Time in seconds between forward and vertical acquisition. (0-16)

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<u>Name</u>	<u>Record Number</u>	<u>Characters</u>	<u>Item*** Type</u>	<u>Description</u>
TBAMS	1	101 - 105	I	Mission number (N.D.)(0-9999)
TMODE	1	108 - 109	I	Requested photographic mode (0-9)
TNSF	1	112	I	Direction of vehicle pass over target 0:NS 1:SN
TBAVY	1	115	I	Azimuth flag 0: descending 1: ascending
TMPF	1	118	I	Mandatory primary flag. If set target is to be taken by main optics and is assigned a priority of 0. (1=yes, 0=no)
TBACD	2	2	I	Specifies alter option used. (0-none, 1-add, 2-change, 3-delete)
TBARV	2	4 - 7	I	Revolution of acquisition requested on target card (0-999)
TBA16	2	9 - 13	F5.3	Obliquity of vertical acquisition (at time TTIME) (radians)
TBAPR	2	15 - 17	I	Probability factor (%) (0-99)
TBA23	2	20 - 22	I	Specified obliquity deletion angle in degrees. A limit for obliquity beyond which targets are deleted from consideration (0-90°)
TSCC	2	25 - 28	I	Special category code, a three character numeric code which, when present on the target card, designates a target which falls in a special category (000-999)
TDDD	2	31 - 33	I	Target diameter in ft x 10 (0-128)
TRR	2	36 - 38	I	Resolution requirement in inches (0-99)
TBASA	2	41 - 46	F6.4	Sun elevation angle (radians) ($\pm\pi/2$)
TBACH	2	49 - 54	-	Not used
TBASR	2	57 - 61	F5.2	Slant range in nautical miles at time of vertical acquisition (0-256)

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<u>Name</u>	<u>Record Number</u>	<u>Characters</u>	<u>Item*** Type</u>	<u>Description</u>
TBAHT	2	64 - 68	F5.2	Vehicle altitude in nautical miles at time of vertical acquisition (0-256)
TBAVF	2	71 - 76	-	Not used
TSHADE	2	79 - 81	-	Not used
TSHAPE	2	84 - 85	I	Pitch weighting function, non-dimensional (0-9) (See File 8 Description, Reference 1.
TSIGMAD	2	88 - 90	I	Desired pitch angle, in degrees (+90)
TPROBA	2	93 - 95	I	Probability of activity at a given target in % (0-99)
TDWELL	2	98 - 100	I	Nominal ATS dwell time in seconds (0-99)
TMATSF	2	103	I	Mandatory ATS flag, non-dimensional indicates target must be viewed with ATS (1=yes, 0=no)
TVIF	2	106	I	Visual intelligence target flag. Non-dimensional, designates target to be viewed by ATS only, non-photographable. (1=yes, 0=no)
TSC	2	109	I	Scan target flag, non-dimensional (1=yes, 0=no)
TVELI	2	112 - 117	I	Inertial velocity vector magnitude of vehicle at time of vertical acquisition in ft/sec (0-65500)
TT1	3	2 - 17	E16.10	Forward acquisition time in seconds, machine time*
TT2	3	20 - 35	E16.10	Vertical acquisition time in seconds, machine time*
TT3	3	38 - 53	E16.10	Aft acquisition time in seconds machine time*

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<u>Name</u>	<u>Record Number</u>	<u>Characters</u>	<u>Item*** Type</u>	<u>Description</u>
TOMEGA1	3	56 - 71	E16.10	Obliquity at time TT1 in radians ($\pm\pi/2$)
TOMEGA2	3	74 - 89	E16.10	Obliquity at time TT2 in radians ($\pm\pi/2$)
TOMEGA3	3	92 - 107	E16.10	Obliquity at time TT3 in radians ($\pm\pi/2$)
TEEE	3	110 - 115	F6.4	Sun elevation angle in radians at time TT2 ($\pm\pi/2$)
TATSMO2	4	2 - 17	E16.10	Time off for main optics photography of TWASCON alternate targets in seconds, machine time*
TWI	4	20 - 35	E16.10	Inactive target weight, non-dimensional ($0-28 \times 10^{13}$)
TWA	4	38 - 53	E16.10	Active target weight, non-dimensional ($0-28 \times 10^{13}$)
TTON	4	56 - 71	E16.10	Main optics on time in seconds, machine time*
TTOFF	4	74 - 89	E16.10	Main optics off time in seconds machine time*
TWEIGHT	4	92 - 107	E16.10	Main optics relative weight (non-dimensional), of selected target, a measure of target worth ($0-28 \times 10^{13}$)
TMSIG	5	2 - 17	E16.10	Mid stereo angle in degrees, the stereo angle at the average time between TT1 and TT3 (not necessarily at TT2).

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<u>Name</u>	<u>Record Number</u>	<u>Characters</u>	<u>Item*** Type</u>	<u>Description</u>
TFLICT	5	20 - 27	0	**
TSMODE	5	30 - 31	I	Main optics selected photographic mode, non-dimensional (0-9). See File 8 Description, Reference 1.
TVAP	5	34	I	Target type flag, non-dimensional 0-VIT, 1-primary, 2-alternate
TASSNO	5	37	I	Scope number used, non-dimensional 0 - not viewed by ATS, 1 - scope 1 used, 2 - scope 2 used. Set in File 8
TGRNO	5	40 - 44	I	Target Group Number, non-dimensional
TSHW22	5	47		Spare

** Conflict matrix (or word), N.D. - for each photographable target a word is set as follows: A bit is set to 1 for each photographable target in the following group which the target conflicts with. Bits are time ordered starting at the left of the word. With a following group of n targets:

<u>BIT NO.</u>	<u>VALUE</u>	<u>MEANING</u>
0	1,0	Conflict, no conflict
1	1,0	Conflict, no conflict
2	1,0	Conflict, no conflict
.	.	
.	.	
.	.	
N	1,0	Conflict, no conflict

Any remaining bits in the word are set to 0. Conflict words of VIT's and conflict bits of photographable targets compared to VIT's have no meaning and are set to 0.

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<u>Name</u>	<u>Record Number</u>	<u>Characters</u>	<u>Item*** Type</u>	<u>Description</u>
TAON	5	50 - 65	E16.10	ATS time on, seconds, machine time
TTDWELL	5	68 - 83	E16.10	ATS dwell time in seconds from File 8 (0-99)
TDECIS	5	86 - 101	E16.10	Latest time at which decision can be made to take the primary target of a group or substitute an alternate, seconds
TAWGT	5	104 - 119	E16.10	ATS relative target weight; non-dimensional, a measure of worth (0-28x10 ¹³)
TNASSTE	6	2 - 5	I	Number of ATS entries for rev (first entry of rev only) (0-300)
TNMOSTE	6	8 - 11	I	Number of MO entries for rev (first entry of rev only) (0-150)
TNBITE	6	14 - 17	I	Number of entries on the BIT for rev (first entry of rev only) (0-300)
TAV	6	20	I	Actual visibility 0 - not actually visible 1 - actually visible
TAA	6	23	I	Actual activity 0 - not actually active 1 - actually active
TRV	6	26	I	Reported visibility 0 - reported not visible 1 - reported visible 2 - not reported
TRA	6	29	I	Reported activity 0 - reported not active 1 - reported active 2 - not reported
TAVOT	6	32	I	Vote on reported and active status 1 - voted active 2 - voted inactive 3 - voted reject 4 - not voted upon (unobserved)

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<u>Name</u>	<u>Record Number</u>	<u>Characters</u>	<u>Item*** Type</u>	<u>Description</u>
TASDT	6	35 - 50	E16.10	Actual ATS dwell time (sec)
TON	6	53 - 68	E16.10	Actual ATS on time (machine time*)
TOFF	6	71 - 86	E16.10	Actual ATS off time (machine time*)
TCNFLT	6	89	I	Conflict flag 0 - photography of target not in conflict 1 - target photography eliminated due to conflict
TTSEL	6	92 - 93	I	Target number selected within group
TGN	6	96 - 97	I	Group number of present target

A sample of the expanded detail output within the selection and decision files of the KSPOUT is shown on Figure 3-6.

* Machine time is measured in seconds from 0000 base day, month, year. (See Section 3.1.2.2). System time is measured in seconds from 0000 GMT and cycles to zero every day.

***Item type descriptions A, O, I, Fw.d, and Ew.d define the forms of BCD conversion of the numerical data. These types of conversion are specified as follows:

A Alpha-numeric item
O Octal integer item
I Decimal integer item
Fw.d Fixed point decimal item
Ew.d Floating point decimal item

The unsigned fixed point constants w and d shown in the F- and E-type conversions indicate the width (w) of the field, and the number of positions (d) of the field which appear to the right of the decimal point.

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```

END OF FILE
1 1334104400 0 44633114 " " .M4130 1.414007 " 90 40 0 3.9385 4302 1 0 1 0
0 -.046 0 0 -0.005 -0.017 124.13 94.44 5.113 0 0 0 0 0 0 60 0 0 0 25724
.M026432334 45 .M026432334 45 .M0311466740 45 -0.445746974 0 -0.681691009 0 0 -0.0605
0000000000002 5.565651906 43 .M026432334 45 .M027632939 45 .M027632939 45 .6389651906 43
.234927967 47 00000000 1 1 0 .M026432334 45 .M026432334 45 .M026432334 45 .M026432334 45 .6389651906 43
4 1 0 1 0 2 .M026432334 45 .M026432334 45 .M026432334 45 .M026432334 45 .M026432334 45 .M026432334 45
1 1334104400 0 44633114 " " .M4130 1.414007 " 90 40 0 3.9385 4302 1 0 1 0
0 -.046 0 0 -0.005 -0.017 124.13 94.44 5.113 0 0 0 0 0 0 60 0 0 0 25724
.M026432334 45 .M026432334 45 .M0311466740 45 -0.445746974 0 -0.681691009 0 0 -0.0605
00000000000004 5.565651906 43 .M026432334 45 .M027632939 45 .M027632939 45 .M027632939 45 .M027632939 45
.5044131754 41 00000000 1 1 0 .M026432334 45 .M026432334 45 .M026432334 45 .M026432334 45 .M026432334 45 .M026432334 45
0 0 0 0 0 3 .M026432334 45 .M026432334 45 .M026432334 45 .M026432334 45 .M026432334 45 .M026432334 45
1 1334104400 0 44633114 " " .M4130 1.414007 " 90 40 0 3.9385 4302 1 0 1 0
0 -.046 0 0 -0.005 -0.017 124.13 94.44 5.113 0 0 0 0 0 0 60 0 0 0 25724
.M026432334 45 .M026432334 45 .M0311466740 45 -0.445746974 0 -0.681691009 0 0 -0.0605
00000000000004 5.565651906 43 .M026432334 45 .M027632939 45 .M027632939 45 .M027632939 45 .M027632939 45
-.134001445 47 00000000 1 1 0 .M026432334 45 .M026432334 45 .M026432334 45 .M026432334 45 .M026432334 45 .M026432334 45
0 0 0 0 0 3 .M026432334 45 .M026432334 45 .M026432334 45 .M026432334 45 .M026432334 45 .M026432334 45
1 1334104400 0 44633114 " " .M4130 1.414007 " 90 40 0 3.9385 4302 1 0 1 0
0 -.046 0 0 -0.005 -0.017 124.13 94.44 5.113 0 0 0 0 0 0 60 0 0 0 25724
.M026432334 45 .M026432334 45 .M0311466740 45 -0.445746974 0 -0.681691009 0 0 -0.0605
00000000000001 5.565651906 43 .M026432334 45 .M027632939 45 .M027632939 45 .M027632939 45 .M027632939 45
-3191232617 42 00000000 1 1 1 .M026432334 45 .M026432334 45 .M026432334 45 .M026432334 45 .M026432334 45 .M026432334 45
0 0 0 0 0 3 .M026432334 45 .M026432334 45 .M026432334 45 .M026432334 45 .M026432334 45 .M026432334 45

```

END OF FILE
REV. NO. 2 IS A NULL REV.

```

END OF FILE
3 1523131127 0 947487C " " .M4130 1.414007 " 90 40 0 3.9385 4302 1 0 1 0
0 -.046 0 0 -0.005 -0.017 124.13 94.44 5.113 0 0 0 0 0 0 60 0 0 0 25724
.M026432334 45 .M026432334 45 .M0311466740 45 -0.445746974 0 -0.681691009 0 0 -0.0605
00000000000001 .863846308 44 .M026432334 45 .M027632939 45 .M027632939 45 .M027632939 45 .M027632939 45 .M027632939 45
.183274733 42 00000000 1 1 0 .M026432334 45 .M026432334 45 .M026432334 45 .M026432334 45 .M026432334 45 .M026432334 45
5 4 5 0 0 2 3 .M026432334 45 .M026432334 45 .M026432334 45 .M026432334 45 .M026432334 45 .M026432334 45
1 1523131127 0 947487C " " .M4130 1.414007 " 90 40 0 3.9385 4302 1 0 1 0
0 -.046 0 0 -0.005 -0.017 124.13 94.44 5.113 0 0 0 0 0 0 60 0 0 0 25724
.M026432334 45 .M026432334 45 .M0311466740 45 -0.445746974 0 -0.681691009 0 0 -0.0605
00000000000003 .6219890792 47 .M026432334 45 .M027632939 45 .M027632939 45 .M027632939 45 .M027632939 45 .M027632939 45
-.4756977154 41 00000000 1 1 1 .M026432334 45 .M026432334 45 .M026432334 45 .M026432334 45 .M026432334 45 .M026432334 45
0 0 0 1 0 1 0 2 .M026432334 45 .M026432334 45 .M026432334 45 .M026432334 45 .M026432334 45 .M026432334 45
3 1523131127 0 947487D " " .M4130 1.414007 " 90 40 0 3.9385 4302 1 0 1 0
0 -.046 0 0 -0.005 -0.017 124.13 94.44 5.113 0 0 0 0 0 0 60 0 0 0 25724
.M026432334 45 .M026432334 45 .M0311466740 45 -0.445746974 0 -0.681691009 0 0 -0.0605
00000000000004 5.565651906 43 .M026432334 45 .M027632939 45 .M027632939 45 .M027632939 45 .M027632939 45 .M027632939 45
-.323611730 42 00000000 1 1 1 .M026432334 45 .M026432334 45 .M026432334 45 .M026432334 45 .M026432334 45 .M026432334 45
0 0 0 0 1 0 1 0 2 .M026432334 45 .M026432334 45 .M026432334 45 .M026432334 45 .M026432334 45 .M026432334 45
3 1524240067 0 947487D " " .M4130 1.414007 " 90 40 0 3.9385 4302 1 0 1 0
0 -.046 0 0 -0.005 -0.017 124.13 94.44 5.113 0 0 0 0 0 0 60 0 0 0 25724
.M026432334 45 .M026432334 45 .M0311466740 45 -0.445746974 0 -0.681691009 0 0 -0.0605
00000000000005 5.565651906 43 .M026432334 45 .M027632939 45 .M027632939 45 .M027632939 45 .M027632939 45 .M027632939 45
-.181469947 42 00000000 1 1 1 .M026432334 45 .M026432334 45 .M026432334 45 .M026432334 45 .M026432334 45 .M026432334 45
0 0 0 1 0 2 2 4 .M026432334 45 .M026432334 45 .M026432334 45 .M026432334 45 .M026432334 45 .M026432334 45

```

Figure 3-6. Sample Output - Expanded Detailed Output on Tape KSPOUT

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3.2 KOUT - Listable Output Tape

The KOUT output tape is produced for statistical studies using the TSPOOND output. One complete case of TSPOOND output constitutes one file of the KOUT tape. The KOUT tape contains the following information:

- 1) TSPOOND function and data card images
- 2) REV span information message
- 3) BIT run identification file
- 4) TWONDER function and data card images
- 5) Ephemeris information
- 6) File seven
- 7) File eight
- 8) Expanded detailed output
- 9) Extended statistics on requested parameters
- 10) Rev span summary output

Items 1, 3, 4, 5, 6, and 7 have the same format and content as on KSPOUT, but are not separated by end of file marks.

Item 2 is an information message that follows the image of the TSPOOND end card in the following format:

CARD SPAN IS XXX TO XXX BIT SPAN IS XXX TO XXX

Item 8 in KOUT differs in format from KSPOUT only in that it may contain information messages. The information messages and Items 9 and 10 do not occur on KSPOUT and are described in the following paragraphs. A sample of Items 1, 2, 3, and 4 is shown in Figures 3-1 and 3-2.

3.2.1 Expanded Detailed Output

KOUT displays the expanded detailed output in the same format as the KSPOUT tape except that during the generation and printing of the expanded detailed output one of the two following messages may appear. If a group contains only VIT's or conflicts the following message will be written:

GROUP XXX OF REV XXX CONTAINS ALL VISUAL INTELLIGENCE TARGETS
OR CONFLICTS

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Or if a rev is a null rev:

REV. NO. XXX IS A NULL REV.

A sample of the expanded detailed output for KOUT is shown in Figure 3-7.

3.2.2 Extended Statistics on Requested Parameters

KOUT will also contain extended statistics on requested parameters for each rev. This block of data contains the mean, standard deviation, maximum, and the minimum over the samples for each requested parameter for each rev. Each time this block of data is displayed it will be headed by the following message: THE FOLLOWING DATA ARE EXTENDED STATISTICS OF REQUESTED PARAMETERS FOR REV XXX. A sample of the EXTENDED STATISTICS records is shown in Figure 3-8. The parameters included are those requested on the EXTENDED data card as described in Section 2.3.3. The thirty parameters with their labels are described below:

<u>REQUEST CODE</u>	<u>LABEL</u>	<u>DESCRIPTIONS</u>
1	ACTIVE PRIM	Number of primary targets selected for photography that were reported active
2	INACT PRIM	Number of primary targets selected for photography that were reported inactive
3	REJECT PRIM	Number of primary targets selected for photography that were reported reject
4	UNOBS PRIM	Number of unobserved primary targets selected for photography
5	TOTAL PRIM	Total number of primary targets selected for photography
6	V ACT PRIM	Number of active votes for primary targets
7	V INACT PRIM	Number of inactive votes for primary targets
8	V REJ PRIM	Number of reject votes for primary targets
9	V UNOBS PRIM	Number of unobserved primary targets
10	V TOTAL PRIM	Total number of primary target votes
11	ACTIVE ALTN	Number of alternate targets selected for photography that were reported active
12	INACT ALTN	Number of alternate targets selected for photography that were reported inactive
13	REJECT ALTN	Number of alternate targets selected for photography that were reported reject
14	UNOBS ALTN	Number of unobserved alternate targets selected for photography
15	TOTAL ALTN	Total number of alternate targets selected for photography
16	V ACTIVE ALTN	Number of active votes for alternate targets
17	V INACT ALTN	Number of inactive votes for alternate targets

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<u>REQUEST CODE</u>	<u>LABEL</u>	<u>DESCRIPTIONS</u>
18	V REJECT ALTN	Number of reject votes for alternate targets
19	V UNOBS ALTN	Number of unobserved alternate targets
20	V TOTAL ALTN	Total number of alternate target votes
21	FLS ALRM PRIM	Number of false alarms involving primary targets
22	FLS ALRM ALTN	Number of false alarms involving alternate targets
23	TOTL FLS ALRM	Total number of false alarms
24	FAIL REC PRIM	Number of failures to recognize involving primary targets
25	FAIL REC ALTN	Number of failures to recognize involving alternate targets
26	TOTL FAIL REC	Total number of failures to recognize
27	WGT W/ INTRN	Weight with interdiction
28	WGT W/O INTRN	Weight without interdiction
29	CL TGT W/ IN	Number of clear targets photographed with interdiction
30	CL TGT W/O IN	Number of clear targets photographed without interdiction.

3.2.3 Rev Span Summary Output

KOUT will also contain the statistical summary data. At the end of each requested rev span the statistical data from the samples is summarized and displayed. This block of data is rev span specific. A sample of the rev span output is shown in Figure 3-9. The following information is reported: Rev Span; number of groups, targets, primaries, alternates, and visual intelligence targets; number of samples; average number of groups eliminated due to conflict; average number of active, inactive, rejected, unobserved, and total primaries and alternates selected and voted for; average number of false alarms on primaries and alternates; average number of failures to recognize on primaries and alternates; average weight with and without interdiction; and the average number of clear targets with and without interdiction.

Even though a rev span is not requested on the SUMMARY data card this block of data will be displayed for each rev that is requested on the DETAIL data card. When this occurs the summary output will be for the first sample only.

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THE FOLLOWING DATA ARE EXTENDED STATISTICS OF REQUESTED PARAMETERS FOR REV 3

	MEAN	SIGMA	MAX	MIN
1-ACTIVE PRIM	0	0	0	0
2-INACT PRIM	.1800000000	.6928203230	.3000000000	0
3-REJECT PRIM	.1880000000	.5878775383	.3000000000	.1
4-UNOBS PRIM	.2600000000	.4386342440	.1000000000	0
5-TOTAL PRIM	.3940000000	.2374868420	.4000000000	.1
6-V ACT PRIM	0	0	0	0
7-V INACT PRIM	.1800000000	.6928203230	.3000000000	0
8-V REJ PRIM	.1940000000	.6135144660	.3000000000	.1
9-V UNOBS PRIM	.2600000000	.4386342440	.1000000000	0
10-V TOTAL PRIM	.4000000000	0	.4000000000	.1
11-ACTIVE ALTN	.2000000000	.1400000000	.1000000000	0
12-INACT ALTN	.4000000000	.1959591794	.1000000000	0
13-REJECT ALTN	0	0	0	0
14-UNOBS ALTN	0	0	0	0
15-TOTAL ALTN	.6000000000	.2374868417	.1000000000	0
16-V ACTIVE ALTN	.4000000000	.1959591794	.1000000000	0
17-V INACT ALTN	.6800000000	.4664761516	.1000000000	0
18-V REJECT ALTN	.2800000000	.4489988864	.1000000000	0
19-V UNOBS ALTN	0	0	0	0
20-V TOTAL ALTN	.1000000000	0	.1000000000	.1
21-FLS ALRM PRIM	0	0	0	0
22-FLS ALRM ALTN	0	0	0	0
23-TOIL FLS ALRM	0	0	0	0
24-FAIL REC PRIM	0	0	0	0
25-FAIL REC ALTN	0	0	0	0
26-TOIL FAIL REC	0	0	0	0
27-WGT #/ INTRN	.3244577839	.3103189985	.6234772642	.7
28-WGT #/O INTRN	.3244204646	.3102831644	.6234772642	.7
29-CL TGT #/ IN	.2120000000	.5878775383	.3000000000	.1
30-CL TGT #/O IN	.2060000000	.6135144661	.3000000000	.1

Figure 3-8. Sample Output - Extended Statistics

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=====
REV SPAN 2 TO 6
NUMBER OF GROUPS = 63
NUMBER OF TARGETS = 140
NUMBER OF PRIMARIES = 55
NUMBER OF ALTERNATES = 24
NUMBER OF VIS. INT. TARGETS = 57

THE FOLLOWING DATA ARE AVERAGES OVER THE REV SPAN FOR 100 SAMPLES

NUMBER OF GROUPS ELIMINATED DUE TO CONFLICT = 0

NUMBER OF PRIMARIES SELECTED = .4772000000 +2 NUMBER OF PRIMARIES VOTED ON = .5500000000 +2
ACTIVE = .1179000000 +2 ACTIVE = .1301000000 +2
INACTIVE = .1040000000 +2 INACTIVE = .1291000000 +2
REJECTED = .2370000000 +2 REJECTED = .2632000000 +2
UNOBSERVED = .1830000000 +1 UNOBSERVED = .2760000000 +1

NUMBER OF ALTERNATES SELECTED = .7200000000 +1 NUMBER OF ALTERNATES VOTED ON = .2800000000 +2
ACTIVE = .5350000000 +1 ACTIVE = .7350000000 +1
INACTIVE = .1450000000 +1 INACTIVE = .7420000000 +1
REJECTED = 0 REJECTED = .1244000000 +2
UNOBSERVED = .2800000000 +0 UNOBSERVED = .7900000000 +0

NUMBER OF FALSE ALARMS = .1852000000 +2 NUMBER OF FAILS TO RECOGNIZE = .1210000000 +1
PRIMARIES = .1192000000 +2 PRIMARIES = .1200000000 +1
ALTERNATES = .6600000000 +1 ALTERNATES = .7100000000 +0

WEIGHT WITH INTERDICTION = .3605612397 +11 NUMBER OF CLEAR TARGETS W/ INT. = .3190000000 +2
WEIGHT WITHOUT INTERDICTION = .2481152483 +11 NUMBER OF CLEAR TARGETS W/O INT. = .2846000000 +2
=====

```

Figure 3-9. Sample Output - Rev Span Summary

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3.3 KOL - MONTE CARLO SPECIFIC OUTPUT TAPE

The tape KOL is available if the user is interested primarily in Monte Carlo specific data. KOL is written if the input parameter PROL is less than zero. One file of the KOL tape contains the output from one complete case. The KOL tape contains the following information:

- 1) TSPOOND function and data card images
- 2) Rev span information message
- 3) BIT run identification file
- 4) TWONDER function and data card images
- 5) Ephemeris information
- 6) File seven
- 7) File eight
- 8) Special detailed Monte Carlo specific output
- 9) Extended statistics on requested parameters
- 10) Rev span summary output

Items 1, 2, 3, 4, 5, 6, 7, 9, and 10 have the same format as on KOUT.

Item 8 appears only on the KOL tape and is described below.

The detailed Monte Carlo specific output contains only that information which is used or generated by TSPOOND. The Monte Carlo specific information consists of 15 variables plus a header record which, when listed, displays the variables in fifteen columns with a descriptive header at the top of each column. There is one record (line) per target. A sample listing of this portion of the KOL tape is given in Figure 3-10.

The fifteen variables are described below:

<u>HEADER LABEL</u>	<u>DESCRIPTION OF VARIABLE</u>
GN	GROUP number for the REV.
SELT	The target within that group selected for photography.
TCNFLT	An eight digit octal number display of the conflict matrix. Each bit corresponds to a target in the next group in ascending order from left to right. Non-zero bits indicate those photographable targets within the following group a conflict with the present target.

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<u>HEADER LABEL</u>	<u>DESCRIPTION OF VARIABLE</u>
TGT	Target type; 0 = V.I.T., 1 = Primary, 2 = Alternate.
SN	The number of the scope used to observe that target. 0 = not viewed by ATS, 1 - scope 1 used, 2 - scope 2 used.
AV	Actual visibility of that target; 1 = Visible, 0 = Not Visible
AA	Actual activity of that target; 1 = Active, 0 = Not Active.
RV	Reported visibility of that target; 2 = Not Reported, 1 = Reported Visible, 0 = Reported Not Visible.
RA	Reported activity of that target; 2 = Not Reported, 1 = Reported Active, 0 = Reported Not Active.
VT	Vote on reported and active status; 1 = Voted Active, 2 = Voted Inactive, 3 = Voted Reject, 4 = Not Voted Upon (Unobserved).
ASDT	Actual scope dwell time (sec).
ATON	Actual ATS on time (machine time).
ATOF	Actual ATS off time (machine time).
GDT	Group decision time (machine time).
CNFLT	Conflict flag: = 1 if target is in conflict with the target selected for photography in the previous group. = 0 if target not in conflict.

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DETAILED OUTPUT FOR REV NO. 6

GN	SELT	1CNFLT	101	SN	LA	AA	RV	RA	VA	ASPT	ATON	ATOP	GDY	CMFLT		
1	1	0000000	1	1	0	0	0	2	3	.276661927	+1	.1020552900	+6	.1020713451	+6	0
2	1	0000000	1	1	0	1	0	2	2	.7561683154	+1	.1020678688	+6	.1020671406	+6	0
		0000000	0	2	1	0	1	0	2	.6180350317	+1	.1020688390	+6	.1020681406	+6	0
		0000000	0	1	1	0	1	1	1	.3820505014	+1	.1020729344	+6	.1020729344	+6	0
		0000000	0	1	1	0	1	1	1	GROUP 3 OF REV 6 CONTAINS ALL VISUAL INTELLIGENCE TARGETS OR CONFLICTS						
3	0	0000000	0	2	0	0	0	2	3	.3565470601	+1	.1021759227	+6	.1021774682	+6	0
4	2	0000000	0	2	0	0	0	2	3	.2362725530	+1	.10233479955	+6	.1023503583	+6	0
		0000000	1	1	0	0	2	2	4	.5654640805	+1	.1023504360	+6	.1023560926	+6	0
5	2	0000000	0	1	0	0	0	2	3	.1702072265	+1	.1023629008	+6	.1023646040	+6	0
		0000000	1	1	1	0	1	1	3	.5675171278	+1	.1023534076	+6	.1023590857	+6	0
6	3	0000000	0	2	1	1	1	0	2	.5043559564	+1	.1023545572	+6	.1023596000	+6	0
		0000000	0	2	1	0	2	2	4	.4645402163	+1	.1023729770	+6	.1023776224	+6	0
		0000000	1	1	0	1	1	1	1	.6670738434	+1	.1023577145	+6	.1023663852	+6	0
		0000000	0	2	1	0	1	1	1	.4225749778	+1	.1023612933	+6	.1023655170	+6	0
		0000000	2	1	0	0	0	2	3	.165097541	+1	.1023511766	+6	.1023522307	+6	0
		0000000	2	2	1	0	1	0	2	.3932617730	+1	.1023666165	+6	.1023705311	+6	0
7	4	0000000	0	1	0	0	0	2	3	.1782882235	+1	.1023667908	+6	.1023685736	+6	0
		0000000	0	2	0	1	0	2	3	.226464024	+1	.1023538021	+6	.1023560670	+6	0
		0000000	0	1	0	0	0	2	3	.1987225742	+1	.1023701303	+6	.1023721175	+6	0
		0000000	1	1	0	0	0	2	3	.1604274433	+1	.1023736832	+6	.1023752875	+6	0
8	2	0000000	0	1	0	0	0	2	3	.1555659455	+1	.1024290698	+6	.1024300255	+6	0
		0000000	1	1	0	0	0	2	3	.1631048724	+1	.1024402193	+6	.1024420503	+6	0
		0000000	2	1	0	0	0	2	3	.1577957507	+1	.1024325031	+6	.1024344810	+6	0
9	4	0000000	0	2	1	0	1	1	3	.8335689218	+1	.1024383313	+6	.1024464670	+6	0
		0000000	0	2	0	0	0	2	3	.2504407894	+1	.1024475356	+6	.1024500401	+6	0
		0000000	0	1	1	0	1	1	3	.5648149741	+1	.1024522946	+6	.1024579348	+6	0
		0000000	2	2	1	0	1	0	2	.2218850401	+1	.1024511893	+6	.1024534082	+6	0
		0000000	1	1	1	0	1	0	2	.3401111561	+1	.1024609588	+6	.1024643599	+6	0
10	3	0000000	0	2	0	0	0	2	3	.2677053074	+1	.1024611840	+6	.1024638611	+6	0
		0000000	1	1	0	1	0	2	2	.6310242044	+1	.1024623711	+6	.1024746814	+6	0
		0000000	2	2	1	0	1	1	3	.1044043504	+2	.1024649035	+6	.1024753440	+6	0
		0000000	0	2	0	0	0	2	3	.2331332749	+1	.1024766895	+6	.1024788207	+6	0
		0000000	0	1	0	1	0	2	3	.2298043841	+1	.1024769467	+6	.1024792427	+6	0
		0000000	2	2	1	0	2	3	.1932633327	+1	.1024800432	+6	.1024819758	+6	0	

Figure 3-10. Sample Output - Detailed Monte Carlo Specific

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4. OPERATING INSTRUCTIONS

This section contains all the information required to load, execute, and control the TSPOOND program.

4.1 IDENTIFICATION

Program Name:	TSPOOND
Program Working ID and Mod number:	X40BH
Producing Office:	Sunnyvale Field Office, TRW Systems Group, TRW, Inc.

4.2 PREREQUISITE PROGRAMS

TSPOOND operates as a stand-alone program given a TWONDER Binary Interface Tape (BIT) as input. In order to generate this BIT, the study program, TWONDER, must be run to generate the optimum target acquisition strategy for the main optics and the two acquisition telescopes. The details of the operation of TWONDER appears in Reference 1, USERS MANUAL FOR TWONDER. Basically, TWONDER determines its acquisition strategy through the use of the following computational processes:

- Reduces the master target list into a set of targets visible over a specified rev span
- Generates the pointing information describing acquisition possibilities of individual targets
- Determines best tracking mirror/telescope strategy.

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4.3 DECK SET-UP AND OPERATING PROCEDURES

Operation of TSPOOND is initiated by input of a function card to the SMTC executive control program. The TSPOOND function card must be followed by input data cards, some of which are optional. The order of input is as follows:

- TSPOOND function card (including function card input parameters)
- Free-field data cards (SUMMARY, DETAIL, EXTENDED)
There must exist at least one SUMMARY or one DETAIL card within the input data card deck. All DETAIL and/or EXTENDED data cards must follow the SUMMARY data cards in the input data card deck setup, and may be in any order. If a SUMMARY card is input, the DETAIL and EXTENDED cards become optional; conversely, if a DETAIL card is input, the SUMMARY and EXTENDED cards become optional input (See Section 2.3, Data Card Input)
- END card signifying termination of free-field data cards.

Figure 4-1 illustrates a sample input deck setup.

4.4 OPERATING PROCEDURES AND LOGICAL UNIT ASSIGNMENTS

The following procedures must be followed to operate the TSPOOND program.

The appropriate versions of the System Support Tape (SST) and Flight Support Tape (FST) must be loaded and activated using standard operating procedures (Reference 4). If program correctors are present, they must be read into the SMTC corrector table or onto the SST and/or FST on the disk file.

A system output (list) tape must be mounted on Tape 3 and secure list tapes must be mounted on Tape 2 (KOL), Tape 4 (KSPOUT), and Tape 8 (KOUT).

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*REMT TEST CASE Q3

*CLOK ON

*13 TSP00ND 9999 1. 0. .4 1. 2. 3. .8 1.2 .7 100. 2 0 0 -1
SUMMARY 1 8 50
SUMMARY 10 16 50
DETAIL 1 TO 8 10 TO 16
EXTENDED 1 TO 30
END

*CLOK OFF

*EOT NI2

*EOT NI10

*EOT NI8

*STTP U2

*STTP U10 A

*STTP U8 A

Figure 4-1. Sample Input Listing

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TABLE 4-1. Tape Assignments

Logical Tape	Normal Unit	Use
1	Disk 1	System support tape (SST)
2	Tape 2	Secure List Tape (KOL) Monte Carlo Specific Information
3	Tape 3	System Output (list) tape
7	Tape 7	BIT from TWONDER
8	Tape 0 (8)	Secure list tape (KOUT) Output (list) tape
10	Tape 4	Secure list tape (KSPOUT) BCD interface tape
12	Disk 5	Flight support tape (FST)
13		On-line printer

TSPOOND program execution is initiated by inputting the TSPOOND function card (followed by data cards) to the SMTC executive control program.

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4.5 ERROR/ACTION MESSAGES AND RECOVERY PROCEDURES

This section deals with information messages, error messages, halts, operator intervention, and recovery procedures required for TSPOOND program operation.

TSPOOND normally does not communicate with the operator via on-line information messages except in the case of errors detected by the program. Most of these errors involve unacceptable input parameters and other I/O violations. Requests for operator decisions usually follow computer halts, and in most cases, operation is resumed by pressing the GO button. Normally, the run may be aborted by pressing the interrupt button.

Other information notes by TSPOOND do not appear on-line but on secure tape output. These notes along with the error messages are printed below in CAPITALS, followed by explanations and recovery procedures.

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MESSAGE	RECOVERY PROCEDURE
SYSTEM DETECTED ERROR ON LAST CARD READ, INSERT CARD AND TRY AGAIN	The last data card read into the card reader has an incorrect format. Correct the card, insert into card reader and push GO.
NO SUMMARY OR DETAIL CARDS PROCESSED, PROGRAM CANNOT CONTINUE	The input deck setup did not contain any SUMMARY or DETAIL cards - correct input deck and restart.
REV NUMBER GREATER THAN 720, INSERT CARD AND TRY AGAIN	Either a SUMMARY or a DETAIL data card is requesting a rev greater than 720. Correct that data card, insert into card reader and push GO.
WRONG REV SPAN ON BIT OR INPUT CARD-RESTART AFTER CORRECTION	The requested rev span on the input data cards is outside the rev span range available on the BIT. Either the wrong BIT has been mounted or the data cards are incorrect. Correct and restart.
NO RECORDS ON 1ST FILE-RELOAD BIT - PUSH GO	An end of file was encountered on the first read operation of the BIT - Remount the proper tape and push GO.
REV XXX NOT FOUND ON BIT	A requested rev was not found on the BIT. Push GO to continue processing next requested rev.
TWONDER FUNCTION CARD NOT FOUND-HIT GO	The word TWONDER was not found on the function card while searching the image of the third record of the first file of the BIT. Push GO to ignore.
VEHICLE NO. NOT ON FUNCTION CARD-HIT GO	The vehicle number was not found on the TWONDER function card image (3rd record of 1st file of BIT).
BIT VEHICLE NO. TOO LARGE - HIT GO	While searching the image of the third record of the first file of the BIT, no blanks were found following the vehicle number. No vehicle number matchup can be performed. Push GO to continue.
VEHICLE NO. IS XXX DOES NOT MATCH INPUT CARD, CORRECT, RESTART-OR HIT GO TO CONTINUE	The vehicle numbers on the TSPOOND and the TWONDER function cards do not match. If the correct BIT is mounted push GO to continue. Otherwise mount the proper BIT and restart.

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MESSAGE	RECOVERY PROCEDURE
SYSTEM FOUND ERROR ON LAST READ ON UNIT XX PUSH START, TRY AGAIN	An unexpected error was encountered during the last read operation on unit XX. Push GO to continue.
IPVIS INCORRECTLY INPUT. PUSH GO TO USE FILE 8 CORRELATED	The option flag IPVIS for selection of the probability of visibility was not input correctly. You may use the File 8 correlated probability of visibility by pushing GO to continue. Otherwise correct the input function card and restart.
NO OTHER DECISION STRATEGY FOR IVO NQ O	This message will be displayed if the input parameter IVO is input other than zero. No other decision strategies exist at present. When other decision strategies are programmed this flag will dictate the flow of the computations.

The following are information messages which appear only on the secure output tapes:

MESSAGES	EXPLANATIONS
REV. NO. XXX IS A NULL REV	During the selection of any given rev span this message will appear if a null rev is found.
GROUP XXX OF REV XXX CONTAINS ALL VISUAL INTELLIGENCE TARGETS OR CONFLICTS	If a group is found to contain only VIT's or conflicting targets with the previous target selected for photography, this message will appear on the KOUT and KOL tapes.
CARD SPAN IS XXX TO XXX BIT SPAN IS XXX TO XXX	During the processing of the TWONDER function card the rev span of the BIT is compared with the requested rev spans on input cards. If the requests fall within the BIT rev span this message will appear on the KOUT and KOL tapes.

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4.6 POST EXECUTION PROCEDURES

During the TSPOOND execution, "black" information in listable form is generated not only on Tape 8 (KOUT), but on Tape 4 (KSPOUT), and Tape 2 (KOL). To preserve this information, the user should write "logical end-of-tapes" on Tapes 2, 4, and 8, using EOT (Reference 4) before rewinding and unloading the tapes. After the "end-of-tapes" have been written, TWLIST (Appendix B) may be run to list Tapes 2, 4, 8 on the on-line printer. TWLIST prints the appropriate security headers ("TOP SECRET SPECIAL HANDLING" or "SECRET SPECIAL HANDLING") at the top and bottom of each page along with the BCD output contained on the listable tapes. STTP (Reference 4) may be used to list Tapes 2, 4, and 8 as well, if appropriate security headers are not desired.

4.7 LISTABLE OUTPUTS

All "black" information containing the results of TSPOOND operation will be written on secure list tapes (Tapes 2, 4 and 8). No "black" TSPOOND information will be written on the on-line printer since TSPOOND output is not controlled by LTAB secure key match. On-line listings, therefore, are not enabled by the LTAB, reset File 7 match.

Detailed descriptions of TSPOOND listable outputs are given in Section 3.0, Program Output. The following is a summary of outputs:

<u>Output on Tapes</u>	<u>Listing</u>
KOL, KSPOUT, KOUT	TSPOOND function card and data card images
KOL, KSPOUT, KOUT	TWONDER function card and data card images
KOL, KSPOUT, KOUT	Ephemeris information
KOL, KSPOUT, KOUT	Reset tape File 7
KOL, KSPOUT, KOUT	Reset tape File 8
KSPOUT, KOUT	Expanded "typical sample" detailed output
KOL	Monte Carlo specific "typical sample" detailed output
KOL, KOUT	Extended statistics on requested output parameters
KOL, KOUT	Rev span summary output.

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5. BIBLIOGRAPHY

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APPENDIX A
SAMPLE OPERATING DECK

This appendix contains a sample operating deck for a typical TSPOOND computer run in which the following information is requested:

- Statistical summary output of 500 samples compiled over 5 revs of target acquisitions (rev 1 through rev 5 inclusive).
- Statistical summary output over 500 samples compiled over 11 revs of target acquisitions (rev 6 through rev 16 inclusive).
- A typical sample of detailed information on each target for each rev of the rev span 1-16.
- Means, standard deviations, maxima, and minima over the 500 samples on all 30 summary output parameters on a rev by rev basis.

The sample deck (Figure A-1) indicates that all TSPOOND output appears in a listable format on 3 BCD output tapes, Tape 2 (KOL), Tape 4 (KSPOUT), and Tape 8 (KOUT). If the user desires, the program TWLIST can be used to list these tapes with appropriate security headers.

The program CLOK (Reference 4) shown on the reference run set-up deck below initiates the routine which determines the time required to operate the specific TSPOOND case.

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A.1 RUN SET-UP DECK

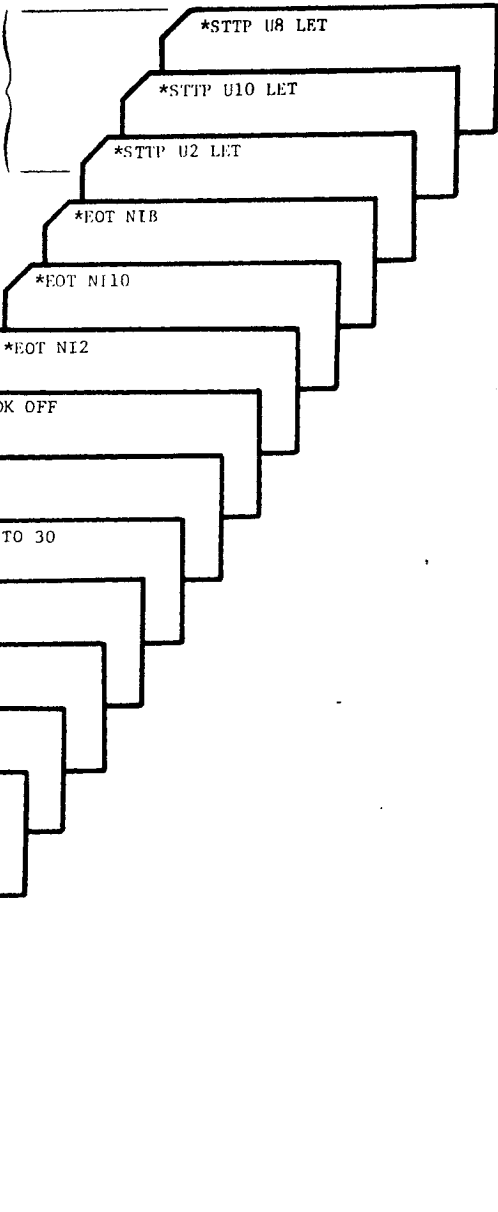
*REM SCRATCH TAPES ON LOGICAL UNITS 2,3,8, 10
*REM SST ON UNIT 1
*REM FST ON UNIT 12
*REM TWONDER BIT ON UNIT 7, WRITE RING OUT
*REM TWONDER BIT CONTAINING REVS 1 - 16
*HALT CHECK TAPE SETUP
*MO F
*CLOK ON
*TSPOOND 9999 0.9 0.1 0.4 1.0 2.0 3.0 0.8 1.2 0.7 100.2 0 0 -1
SUMMARY 1 5 500
SUMMARY 6 16 500
DETAIL 1 TO 16
EXTENDED 1 TO 30
END
*CLOK OFF
*EOT NI2
*EOT NI8
*EOT NI10
*STTP U2 LET
*STTP U8 LET
*STTP U10 LET

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For appropriate security headers on
on-line listing run program TWLIST
instead of STTP.

*TWLIST 9999



TSPOOND INPUT DATA CARDS

- Summary statistics on rev 1 thru 5 over 500 samples
- Summary statistics on rev 6 thru 16 over 500 samples
- Typical sample expanded detail output for rev 1 to rev 16 inclusive
- Extended statistics on all 30 output parameters

Figure A-1. Sample Input Deck Set-up

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APPENDIX B

TWLIST OPERATING INSTRUCTIONS

TSPOOND does not write security headers ("TOP SECRET SPECIAL HANDLING" or "SECRET SPECIAL HANDLING") on its secure list tapes (Tape 2, Tape 4, Tape 8). TWLIST has been provided to allow the user to obtain tape listings with security headers supplied.

B.1 PURPOSE

TWLIST will produce an on-line printer listing or off-line list tape containing security headers from an unblocked list tape, card-image tape, or card deck.

B.2 INITIATION OF PROGRAM OPERATION

B.2.1 Tape Assignments

The following tapes are required for TWLIST operation:

<u>Logical Tape</u>	<u>Nominal Location</u>	<u>Description</u>
1	Disk 1	System support tape (SST)
2	Tape 2	Reset tape (optional)
3	Tape 3	System output tape
9	Disk 2	Duplicate reset tape (optional)
12	Disk 5	Flight support tape (FST)

The reset tapes are required only if listing is to be output on the on-line printer.

A listable tape or a card deck in the on-line card reader is required for input. Legal logical tape units for input are zero (card reader input), 3 through 12 and 16 through 19. Nominal input unit is 8 (5 if "CARD" option is exercised).

If the on-line printer is not used for output, an output tape must be provided. Legal logical tape units for output are 4 through 13 and 16 through 19. Nominal output unit is 13 (on-line printer).

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B.2.2 On-line Security Control

If TWLIST output is to appear on the on-line printer, there must be a match of reset File 7 location SEV012 with the first cell of the element LTAB on the flight support tape (FST). The contents of these two cells must be identical, bit for bit, and must be non-zero.

SEV012 may be set using SWNRT (Reference 4). LTAB may be set using a corrector card (CORRECT option of *CARDS pseudo, Reference 4).

B.2.3 Prepositioning of Tapes

TWLIST rewinds the input tape before reading; however, it does not rewind the output tape. Therefore, any necessary output tape positioning should be performed before TWLIST is called.

B.2.4 Function Card Format

Operation of TWLIST is initiated by input of a function card to SMTC

*TWLIST (vehno Ixx Oyy CARD)

where

vehno (integer) is vehicle number corresponding to the reset tape and is required if output unit is "13" (on-line).

Ixx (where xx is an integer) specifies input unit to be xx and is optional. If "Ixx" is not present, input unit will be 8 (or t if "CARD" is present).

Oyy (where yy is an integer) specifies output unit to be yy and is optional. If "Oyy" is not present, output unit will be 13 (on-line printer).

CARD (BCD) means that the input unit will contain a card-image tape or card deck. If "IO" (input unit zero) is present, "CARD" option is assumed, whether "CARD" is present or not.

B.2.5 Format of Input Tape or Card Deck

If CARD option is exercised, the input must consist of a single file of BCD cards or card images. TWLIST will exit upon reading the first end of-file mark or card.

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If list tape option is exercised, the input must consist of a single logical tape in listable format and terminated by a double end-of-file. TWLIST will start a new page whenever an end-of-file mark is read and will exit upon reading two consecutive end-of-file marks.

B.3 MAINTENANCE OF PROGRAM OPERATION

If there is an error on the function card, one of the following messages will be printed out:

<u>Message</u>	<u>Recovery Procedure</u>
ILLEGAL INPUT TAPE NUMBER	Input tape number specified on function card is outside the legal range of values. $xx=0$, $3 \leq xx \leq 12$, and $16 \leq xx \leq 19$ are legal values for "Ixx." Correct function card, reload card reader, and push GO to restart TWLIST.
ILLEGAL OUTPUT TAPE NUMBER	Output tape number specified on function card is outside the legal range of values. $4 \leq yy \leq 13$ and $16 \leq yy \leq 19$ are legal values for "Oyy." Correct function card, reload card reader, and push GO to restart TWLIST.
ILLEGAL FUNCTION CARD PARAMETER	One of the parameters is other than "CARD," "Ixx," "Oyy," or vehicle number. Vehicle number must fall in the range $0 < \text{VEHNO} < 32,768$. (A four-digit decimal integer is customary.) Push GO to ignore illegal parameter, or correct function card, reload card reader, and push INTERRUPT to restart TWLIST.

If on-line printing is requested and secure match is not obtained, the following message will be printed out:

<u>Message</u>	<u>Recovery Procedure</u>
CONDITION NOT MET--TWLIST TERMINATED	Push GO to abort TWLIST. See Section 2.2 for secure on-line printing prerequisites.

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If a tape handling error occurs, one of the following messages will be printed out:

<u>Message</u>	<u>Recovery Procedure</u>
***** PARITY ERROR *****	Parity error was encountered while reading input tape.
REACHED END OF OUTPUT TAPE -- MOUNT NEW TAPE TO CONTINUE	Encountered physical end-of-tape marker while writing output tape. Mount new output tape and push GO to continue.
PARITY ERROR ON OUTPUT TAPE -- PUSH GO TO CONTINUE WITHOUT PARITY CHECKS	Parity error occurred while writing output tape. Push GO to continue without further parity checks, or, mount new output tape, reload function card in card reader, and push INTERRUPT to restart.

Error or status messages will be printed out by the RESET subroutine at the beginning of the TWLIST run. See Section 9, Critical Subroutines, of Reference 4 for list of messages and recovery procedures.

B.4 DESCRIPTION OF OUTPUT LISTINGS

The output of TWLIST will be on-line printer listing or a listable tape. Security headers will appear at the top and bottom of each page. If the "CARD" option is exercised, a card count will appear to the right of the contents of each card listed.

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Copy 13 of 30
Total Pages: 10

13 10

USERS MANUAL
FOR TSPOOND
(CHANGE A)

Original Publication: 15 December 1968
Change A: 17 February 1969

Prepared for
MOL Systems Office
Under Contract [REDACTED]

Prepared by
Mission Planning and Evaluation Project
TRW Systems

FEB 26 1969

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NOTE TO THIS CHANGE DOCUMENT

This document is Change A of the "Users Manual for TSPOOND," BIF-4-B30009-68, dated 15 December 1968. It consists of the following changed pages of the original document:

Title page
iv (Note to This Change Document)
10
30
31
32
33
36
44
47

Additions, deletions, and/or changes are indicated by change bars in the margin.

This document and the unaffected pages of the original document constitute a complete updated version of the "Users Manual for TSPOOND."

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<u>Name</u>	<u>Record Number</u>	<u>Characters</u>	<u>Item*** Type</u>	<u>Description</u>
TREV	1	2 - 5	I	Revolution number, orbit on particular mission starting with revolution 1 at first passage of ascending node (0-999)
TTIME	1	8 - 20	F13.6	Time of vertical acquisition (when the vehicle is closest to the target) in minutes from base date. (0-262143)
TESS	1	23 - 24	-	Not used
TIDA	1	27 - 34	A	First 8 characters of target's alphanumeric identifier
TIDB	1	35 - 36	A	Final 2 characters of target's alphanumeric identifier
TWX	1	41 - 43	I	Weather factor (0-99)
TTLV	1	46 - 47	I	Target location validity code (0-9)
TLONG	1	49 - 59	F11.6	Target longitude in radians ($\pm \pi$)
TLAT	1	61 - 70	F10.6	Target latitude in radians ($\pm \pi/2$)
TALT	1	73 - 76	I	Target altitude in $f \times 10^{-2}$ (0-999)
TPRIA	1	79 - 81	I	Active priority of target (0-99)
TPRII	1	84 - 86	I	Inactive priority of target (0-99)
TBENCHF	1	89	I	Flag indicating that target is a bench mark target (1 - yes, 0 - no)
TBAB13	1	92 - 98	F7.4	Time in seconds between forward and vertical acquisition. (0-16) Approximation based on file 7 and file 8 parameters (desired forward stereo angle (Σ) assuming a constant stereo rate ($\dot{\Sigma}$) from file 7).

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<u>Name</u>	<u>Record Number</u>	<u>Characters</u>	<u>Item*** Type</u>	<u>Description</u>
TBAMS	1	101 - 105	I	Mission number (N.D.)(0-9999)
TMODE	1	108 - 109	I	Requested photographic mode (0-9)
TNSF	1	112	I	Direction of vehicle pass over target 0:NS 1:SN
TBAVY	1	115	I	Azimuth flag 0: descending 1: ascending
TMPF	1	118	I	Mandatory primary flag. If set target is to be taken by main optics and is assigned a priority of 0. (1=yes, 0=no)
TBACD	2	2	I	Specifies alter option used. (0-none, 1-add, 2-change, 3-delete)
TBARV	2	4 - 7	I	Revolution of acquisition requested on target card (0-999)
TBA16	2	9 - 14	F6.3	Obliquity of vertical acquisition (at time TTIME) (radians)
TBAPR	2	16 - 18	I	Probability factor (%) (0-99)
TBA23	2	20 - 22	I	Specified obliquity deletion angle in degrees. A limit for obliquity beyond which targets are deleted from consideration (0-90°)
TSCC	2	25 - 28	I	Special category code, a three character numeric code which, when present on the target card, designates a target which falls in a special category (000-999)
TDDD	2	31 - 33	I	Target diameter in ft x 10 (0-128)
TRR	2	36 - 38	I	Resolution requirement in inches (0-99)
TBASA	2	41 - 47	F7.4	Sun elevation angle (radians) ($+\pi/2$)
TBACH	2	49 - 54	-	Not used
TBASR	2	56 - 61	F6.2	Slant range in nautical miles at time of vertical acquisition (0-256)

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<u>Name</u>	<u>Record Number</u>	<u>Characters</u>	<u>Item*** Type</u>	<u>Description</u>
TBAHT	2	63 - 68	F6.2	Vehicle altitude in nautical miles at time of vertical acquisition (0-256)
TBAVF	2	71 - 76	-	Not used
TSHADE	2	79 - 81	-	Not used
TSHAPE	2	84 - 85	I	Pitch weighting function, non-dimensional (0-9) (See File 8 Description, Reference 1.
TSIGMAD	2	88 - 90	I	Desired pitch angle, in degrees (<u>+</u> 90)
TPROBA	2	93 - 95	I	Probability of activity at a given target in % (0-99)
TDWELL	2	98 - 100	I	Nominal ATS dwell time in seconds (0-99)
TMATSF	2	103	I	Mandatory ATS flag, non-dimensional indicates target must be viewed with ATS (1=yes, 0=no)
TVIF	2	106	I	Visual intelligence target flag. Non-dimensional, designates target to be viewed by ATS only, non-photographable. (1=yes, 0=no)
TSC	2	109	I	Scan target flag, non-dimensional (1=yes, 0=no)
TVELI	2	112 - 117	I	Inertial velocity vector magnitude of vehicle at time of vertical acquisition in ft/sec (0-65500)
TT1	3	2 - 17	E16.10	Forward acquisition time in seconds, machine time*
TT2	3	20 - 35	E16.10	Vertical acquisition time in seconds, machine time*
TT3	3	38 - 53	E16.10	Aft acquisition time in seconds machine time*

TT1, TT2, TT3 computed on the basis of using TBAB13 as initial time interval for iterative algorithm.

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<u>Name</u>	<u>Record Number</u>	<u>Characters</u>	<u>Item*** Type</u>	<u>Description</u>
TOMEGA1	3	56 - 71	E16.10	Obliquity at time TT1 in radians ($\pm\pi/2$)
TOMEGA2	3	74 - 89	E16.10	Obliquity at time TT2 in radians ($\pm\pi/2$)
TOMEGA3	3	92 - 107	E16.10	Obliquity at time TT3 in radians ($\pm\pi/2$)
TEEE	3	110 - 116	F7.4	Sun elevation angle in radians at time TT2 ($\pm\pi/2$)
TATSMO2	4	2 - 17	E16.10	Time off for main optics photography of TWASCON alternate targets in seconds, machine time*
TWI	4	20 - 35	E16.10	Inactive target weight, non-dimensional ($0-28 \times 10^{13}$)
TWA	4	38 - 53	E16.10	Active target weight, non-dimensional ($0-28 \times 10^{13}$)
TTON	4	56 - 71	E16.10	Main optics on time in seconds, machine time*
TTOFF	4	74 - 89	E16.10	Main optics off time in seconds machine time*
TWEIGHT	4	92 - 107	E16.10	Main optics relative weight (non-dimensional), of selected target, a measure of target worth ($0-28 \times 10^{13}$)
TMSIG	5	2 - 17	E16.10	Mid stereo angle in degrees, the stereo angle at the average time between TTON and TTOFF (not necessarily at TT2).

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<u>Name</u>	<u>Record Number</u>	<u>Characters</u>	<u>Item*** Type</u>	<u>Description</u>
TASDT	6	35 - 50	E16.10	Actual ATS dwell time (sec)
TON	6	53 - 68	E16.10	Actual ATS on time (machine time*)
TOFF	6	71 - 86	E16.10	Actual ATS off time (machine time*)
TCNFLT	6	89	I	Conflict flag 0 - photography of target not in conflict 1 - target photography eliminated due to conflict
TTSEL	6	92 - 93	I	Target number selected within group
TGN	6	96 - 97	I	Target number within group

A sample of the expanded detail output within the selection and decision files of the KSPOUT is shown on Figure 3-6.

* Machine time is measured in seconds from 0000 base day, month, year. (See Section 3.1.2.2). System time is measured in seconds from 0000 GMT and cycles to zero every day.

***Item type descriptions A, O, I, Fw.d, and Ew.d define the forms of BCD conversion of the numerical data. These types of conversion are specified as follows:

- A Alpha-numeric item
- O Octal integer item
- I Decimal integer item
- Fw.d Fixed point decimal item
- Ew.d Floating point decimal item

The unsigned fixed point constants w and d shown in the F- and E-type conversions indicate the width (w) of the field, and the number of positions (d) of the field which appear to the right of the decimal point.

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3.3 KOL - MONTE CARLO SPECIFIC OUTPUT TAPE

The tape KOL is available if the user is interested primarily in Monte Carlo specific data. KOL is written if the input parameter PROL is less than zero. One file of the KOL tape contains the output from one complete case. The KOL tape contains the following information:

- 1) TSPOOND function and data card images
- 2) Rev span information message
- 3) BIT run identification file
- 4) TWONDER function and data card images
- 5) Ephemeris information
- 6) File seven
- 7) File eight
- 8) Special detailed Monte Carlo specific output
- 9) Extended statistics on requested parameters
- 10) Rev span summary output

Items 1, 2, 3, 4, 5, 6, 7, 9, and 10 have the same format as on KOUT.

Item 8 appears only on the KOL tape and is described below.

The detailed Monte Carlo specific output contains only that information which is used or generated by TSPOOND. The Monte Carlo specific information consists of 15 variables plus a header record which, when listed, displays the variables in fifteen columns with a descriptive header at the top of each column. There is one record (line) per target. A sample listing of this portion of the KOL tape is given in Figure 3-10.

The fifteen variables are described below:

<u>HEADER LABEL</u>	<u>DESCRIPTION OF VARIABLE</u>
GN	GROUP number for the REV.
SELT	The target within that group selected for photography.
TCNFLT	An eight digit octal number display of the conflict matrix. Each bit corresponds to a target in the next group in ascending order from left to right. Non-zero bits indicate those photographable targets within the following group in conflict with the present target.

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4. OPERATING INSTRUCTIONS

This section contains all the information required to load, execute, and control the TSPOOND program.

4.1 IDENTIFICATION

Program Name:	TSPOOND
Program Working ID and Mod number:	X4OBJ
Producing Office:	Sunnyvale Field Office, TRW Systems Group, TRW, Inc.

4.2 PREREQUISITE PROGRAMS

TSPOOND operates as a stand-alone program given a TWONDER Binary Interface Tape (BIT) as input. In order to generate this BIT, the study program, TWONDER, must be run to generate the optimum target acquisition strategy for the main optics and the two acquisition telescopes. The details of the operation of TWONDER appears in Reference 1, USERS MANUAL FOR TWONDER. Basically, TWONDER determines its acquisition strategy through the use of the following computational processes:

- Reduces the master target list into a set of targets visible over a specified rev span
- Generates the pointing information describing acquisition possibilities of individual targets
- Determines best tracking mirror/telescope strategy.

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