USER'S GUIDE TO OGO-6 CERENKOV TAPES

by

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CONTENTS:

I. Tape organization - physical.

Cerenkov tapes are labelled CERnnn. They are 9-track, 800 bpi, with one or more files. The physical records have a fixed length of 8192 bytes. Tapes produced by CERENKOV have a variable number of files, and should not be used by any processing program. Tapes produced by CTAPEDIT usually consist of a single file containing an entire calendar month of data. These tapes are similar in physical format to those produced by CERENKOV. The contents of each tape is listed on the attached label, as well as in the edit log in room 114 downs.

II. Tape organization - logical.

There are four types of logical records on CER tapes. These are designated L, A, C, and F, and are described below. The first level of organization is the "run". This usually corresponds to a single run of the CERENKOV program, which in turn usually corresponds to a single day of data. Each run has a unique name, except that there may be more than one run with the name nnnX, where nnn may be any set of three characters. Run names of this form are forced by CERENKOV when it encounters data checks on the input tapes (RMR,MR,FMR). Runs are subdivided into acquisitions, corresponding to those on the abstract tapes (RMR,etc). Acquisitions are then further subdivided into four types of logical records:

L records: 32 bytes long, one at the beginning and end of each acquisition, plus an extra one at the end of each run. These contain the name of the current run, the abstract tape which the acquisition was taken from, and the start time and end time of the acquisition or run. See Figure 1.

A records: 24 bytes long, one record for each acceptable attitude/orbit point (usually one per minute). These contain the current orbit number, year, day, universal time, latitude, longitude, altitude, and Invariant Latitude, plus the C2 and C3 command status bits, a bitrate code, and a temperature warning flag. See Figure 2.

C records: 6 bytes long, one record for each acceptable frame which contains an analyzed Cerenkov event. These contain the same information as F records (below) plus the pulse-height channels for D1',D2', and D3'. See Figure 3.

F records: 3 bytes long, one record for each acceptable frame which does not have a Cerenkov event but which does have XY=2 (cf. SRL Internal Report #19), so that MC114 represents the Cerenkov scaler. See Figure 4. These contain error flags, MC114, and a number which is one greater than $(A-B)/C$, where A is the time (UT) of the current frame (milliseconds), B is the time of the last A record, and C is 432 milliseconds (arithmetic done in integer mode). If the last quantity is zero, the time information is useless.

III. CERENKOV/F overview - producing the tapes.

Detailed specifications for CERENKOV are contained in the notebook "Cerenkov Tape Programs" and will not be discussed here. The purpose of this section is merely to explain enough of the features of the program so that its output can be used correctly.

CERENKOV has been used in two versions: E and F, including three modifications of the latter. The differences between these versions will not normally concern the user of the final tape output. Some slight differences in the printed output may be noticed. The major changes in tape output revolve around which version of INPUTF was used to process a given input tape, especially RMR and MR tapes. Table 1 contains a list of version combinations of CERENKOV/INPUTF together with the periods during which they were used. The processing date for any CERENKOV run can be found in the CERENKOV output binders. This information is summarized in Table 2.

CERENKOV produces three kinds of printed output in addition to the tape output. These are: 1) "CERENKOV Output" which is bound separately

and includes descriptions of errors encountered and statistical summaries
for each acquisition, 2) "CERENKOV Data Processing Log" which includes
start and end times for each acquisition, 3) "Ephemeris" which includes
data from each A record written, plus the number of input frames and out-
put records processed.

CERENKOV checks for error conditions and warning flags in the input
data, and may bypass input frames with serious errors or process those
with less serious errors and indicate this in the output. Some errors
got through all but the latest versions, so care should be exercised when
using earlier runs for critical applications. Most errors are rare, and
cause no significant problems in final results in cases examined so far.
In any case, all available error flags in the CER tape records should be
checked by any program using this data. SRL Internal Report #24 contains
descriptions of the input tape errors and the actions taken by INPUTF when
they occur.

IV. CTAPEDIT overview - editing the tapes.

The tapes initially produced by CERENKOV are not in the most con-
venient form for processing. They usually contain one run per file, often
contain redundant or defective acquisitions, and sometimes are not perfectly
time-ordered. The editing process performed by CTAPEDIT includes concate-
nation of input files in a time-ordered way, deletion of acquisitions which con-
tain redundant or poor-quality data, and recovery of unused space in the last
physical record of each run. The final tapes each contain one month of data.

V. CREAD - using the tapes.

CREAD, and its associated entry points CSKIP, CSKIPL, and CRWIND, read
and control CER tapes, and unpack the data into FORTRAN-compatible form.
They all use the following COMMON blocks:

```
COMMON/LCOM/LFLAGS,ARUN,RMRID,STTIME,ENDTIM
COMMON/ACOM/C2C3,BITRAT,TEMPFL,REVNO,YEAR,DAY,UTMSEC,LAT,LON,ALT,LAM
COMMON/CCOM/IC114,ICSING,ICSHI,ICPRTY,ICSYNC,ICEVTL,ID1,ID2,ID3
COMMON/FCOM/IF114,IFSING,IFSHI,IFPRTY,IFSYNC,IFEVTL
COMMON/MESSG/MFLAG,BLKCNT,ALPH
```

The variable types are defaults, except:

```
REAL*8 ALPH(15),RMRID,STTIME,ENDTIM
REAL*4 LAT,LON,LAM
INTEGER*4 C2C3,BITRAT,TEMPFL,REVNO,YEAR,DAY,UTMSEC,BLKCNT
```

The DD card is of the form:

```
//CERIN DD UNIT=TPE800,DISP=OLD,LABEL=(1,BLP,,IN),VOL=SER=CERnnn,DSN=dsname
```

Where "dsname" is any valid dataset name (cf. IBM C28-6539-9 Job

Control Language).

Before calling any of these routines, BLKCNT should be set to zero.

Subsequently, BLKCNT will contain the number of the physical record currently

being processed. To read a logical record, use

   CALL CREAD

The result of the operation is indicated by MFLAG:

MFLAG	meaning
1	An L record has been returned in LCOM.
2	An A record has been returned in ACOM.
3	A C record has been returned in CCOM.
4	An F record has been returned in FCOM.
5	Unable to open CERIN. DD card is probably missing or in error.
6	Data check on CERIN. The physical record containing the error is ready to be processed. Proceed with caution.
7	End-of-file on CERIN. Tape is rewound and ready to read again from beginning.
(8)	(No longer used. Indicated a volume-switching attempt in early versions of CREAD.)

If MFLAG > 4, ALPH will contain a message which can be printed in FORMAT

(15A8). If MFLAG is 5, no attempt should be made to use CREAD, CSKIP or

CSKIPL again. The contents of the COMMON blocks after read operations can be inferred from Figures 1 - 4.

Sometimes it is desirable to skip certain types of logical records. The following forms are used for this purpose:

```
CALL CSKIP(ITYPE)
CALL CSKIPL(ITYPE)
```

These cause skipping of all records except those specified by ITYPE:

ITYPE	record type
0	L
4	A
8	C
12	F

At return from CSKIP or CSKIPL, the COMMON blocks are set as if CREAD had been used. The difference between CSKIP and CSKIPL is that CSKIPL always processes L records, regardless of ITYPE. Examples:

```
CALL CSKIP(4)  - process the next A record.
CALL CSKIPL(8) - process the next C record or L record, whichever comes
                 first.
CALL CSKIP(0)  - process the next L record.
CALL CSKIPL(0) - process the next L record.
```

Sometimes it is desirable to reread a CER tape. This is accomplished by:

```
CALL CRWIND
```

at any time. If an end-of-file (MFLAG=7) has been reached, this is not necessary.

Final note: a USER ABEND CODE=999 is issued if any of these routines tries to read beyond the end of an input buffer; i.e., if no "last record" flag is found. This is a warning of a defective tape or an internal program error.
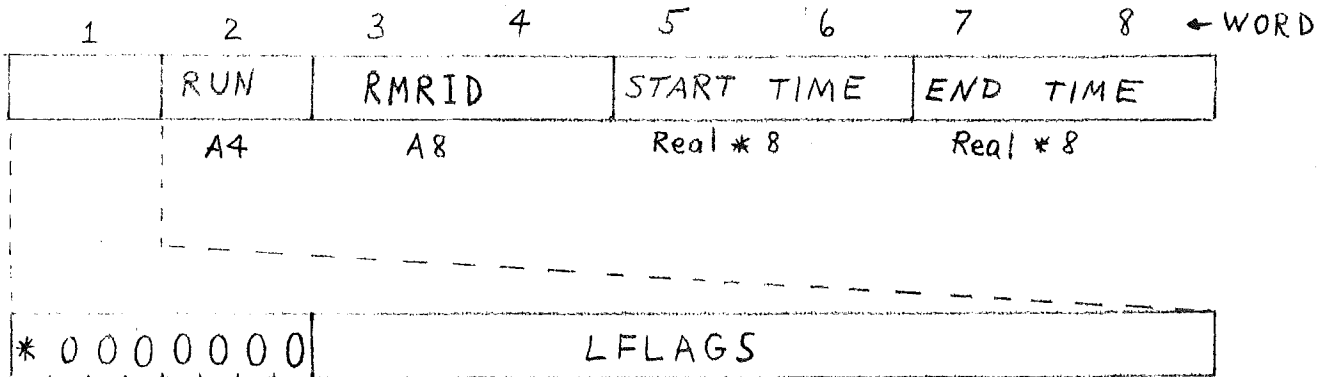
Figure 1.

L Record Format

1	2	3	4	5	6	7	8	← WORD

	RUN	RMRID		START TIME		END TIME	
	A4	A8		Real * 8		Real * 8	

* 0 0 0 0 0 0 0	LFLAGS

* = 1 if this is the last logical record in
       the current block
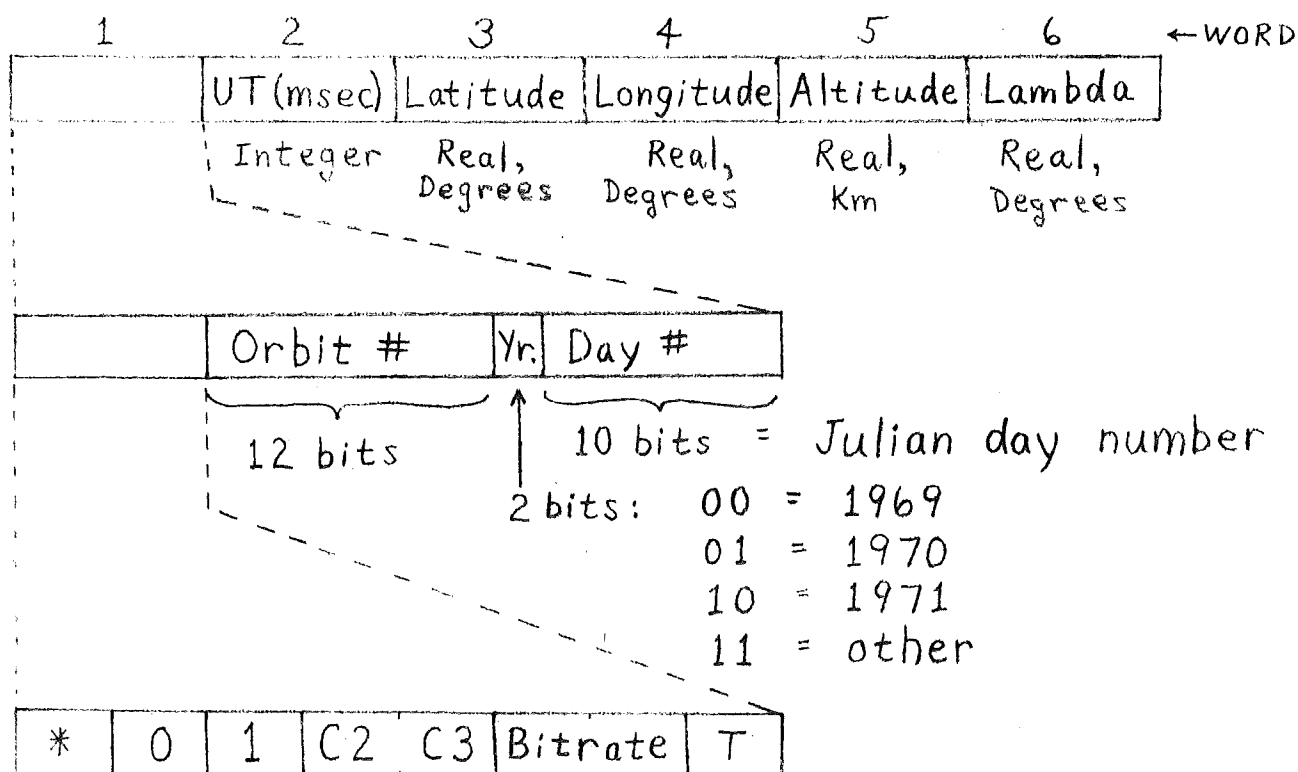 = 0 otherwise

LFLAGS:

bit on	means
1	First acquisition of current run.
2	This acquisition contains some data which overlaps a previous acquisition in the current run.
4	Last acquisition of current run, no A record at end-of-acq.
8	Last L record of run.
16	This is an end-of-acq. or an end-of-run label.

Figure 2.

A Record Format

1	2	3	4	5	6	←WORD
	UT (msec)	Latitude	Longitude	Altitude	Lambda	
	Integer	Real, Degrees	Real, Degrees	Real, Km	Real, Degrees	

	Orbit #	Yr.	Day #	

12 bits   10 bits = Julian day number

2 bits: 00 = 1969
             01 = 1970
             10 = 1971
             11 = other

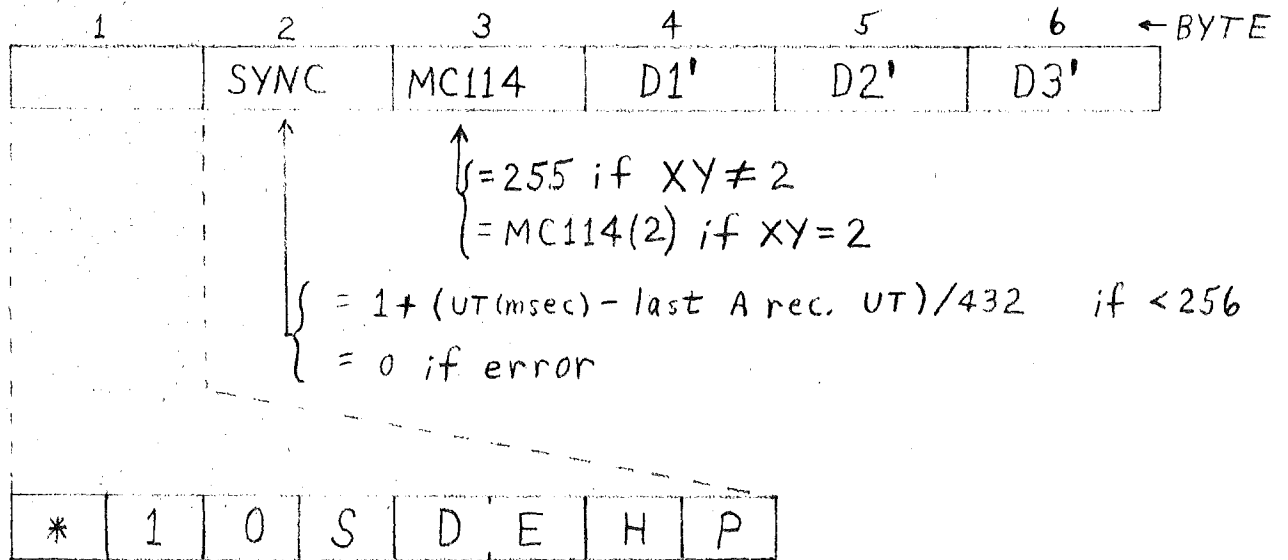| *	0	1	C2 C3	Bitrate	T

* see figure 1

$C2 C3$ = 00 ⇒ Čerenkov Telescope disable
      = 01 ⇒ D1'D3' Analysis enable
      = 10 ⇒ D2'D3' Analysis enable
      = 11 ⇒ Normal

Bitrate = 00 ⇒ undetermined
      = 01 ⇒ 8 kbps
      = 10 ⇒ 16 kbps
      = 11 ⇒ 64 kbps

T   = 0 ⇒ Čerenkov Telescope temperature
               is between $10°C$ and $35°C$.
      = 1 ⇒ temp. $< 10°C$ or temp. $> 35°C$.

Figure 3.

C Record Format

1	2	3	4	5	6	← BYTE
	SYNC	MC114	D1'	D2'	D3'	

$$\begin{cases} = 255 \text{ if } XY \neq 2 \\ = MC114(2) \text{ if } XY = 2 \end{cases}$$

$$\begin{cases} = 1 + (\text{UT(msec)} - \text{last A rec. UT})/432 \quad \text{if} < 256 \\ = 0 \text{ if error} \end{cases}$$

*	1	0	S	D	E	H	P

* see Figure 1

S = subcom sync flag = 1 if NC(11) or NC(12) was
returned 1 from INPUTF

= 0 otherwise

DE = detector: $00 \Rightarrow D1'$
$01 \Rightarrow D2'$ } currently unused
$10 \Rightarrow D3'$
$11 \Rightarrow D4'$

H = high rate flag = 1 if detector (DE) singles
rate was above a preselected
limit. (Now used only for D4'.)

P = parity error flag = 1 if there was a parity
error in MC10, MC11, MC12,
or MC114(2).

Figure 4.

F Record Format


```
        1           2        3      ← BYTE
 ┌──────────┬────────┬────────┐
 │          │ SYNC   │ MC114  │
 └──────────┴────────┴────────┘
```
see Figure 3

```
 ┌───┬───┬───┬───┬───┬───┬───┬───┐
 │ * │ 1 │ 1 │ S │ D │ E │ H │ P │
 └───┴───┴───┴───┴───┴───┴───┴───┘
```
see Figure 3
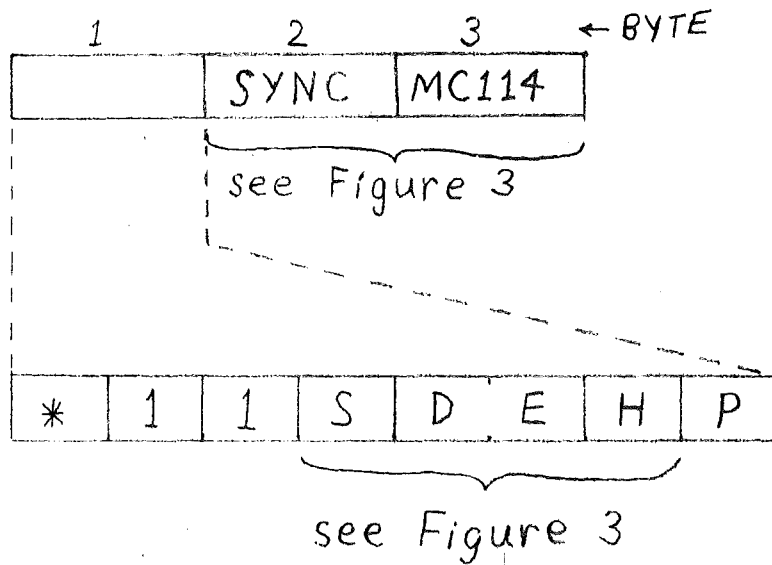
* see Figure 1

P = 1 if there was a parity error in MC114.

Table 1. Processing libraries corresponding to various versions of CERENKOV/INPUTF.

ID	Library Name	Disk Volume	Creation Date	CERENKOV Version	INPUTF Version	Comments
1.	WJB.CERLIB	CITSC5	4/5/71	E	5	See writeup for INPUTF V5.
2.	WJB.CERLIB	CITSC2	6/24/71	F	6	Data check handling. NEOF returns fixed in INPUTF.
3.	WJB.CERLIB	CITSC2	6/28/71	F1	6.1	Modification of above. Data check restart improved.
4.	WJB.CERLIB	CITSC4	7/1/71	F1.1	6.2	Record skip option. Sync error counter. Minor fixups in INPUTF.
5.	WJB.CERLIBF2	CITSC4	7/15/71	F2	7.0	Input checking in INPUTF.
6.	WJB.CERLIB	CITSC2	7/19/71	F2	7.1	Fixup for duplicate AREC at EOA due to fill. INPUTF CSECT name fixed.
7.	WJB.CERLIBF3	CITSC3	8/25/71	F3	7.2.1	Error-check suppression option. Telemetry lock flags checked. Record count/skip fixed to account for SYNAD.

Table 2. Processing libraries for each run.

Runs	Lib. ID*	Runs	Lib. ID*
1-5A	1	55-59	4
5B	4	60-89	6
6-9	1	90	7
10B	4	91-112	6
11-18	1	113-130	7
0E(19)	1	(131-151)	**
20-22	2	309-329	7
22A	4	(330-338)	**
23-23A	2	339-360	6
23B-23D	4	361-369	7
24	3	370-374	6
25-28	4	375	decks
29-37	1	376-391	6
38	4	392-414	7
39-40	1	(415-430)	**
41	4	431-441	7
42-44	1	(442-458)	**
45A	4		
46	1		
46A	4		
47-51	1		
52	4		
53	2		
54	3		

* See Table 1.
** Not yet done. Probably will use library 7.