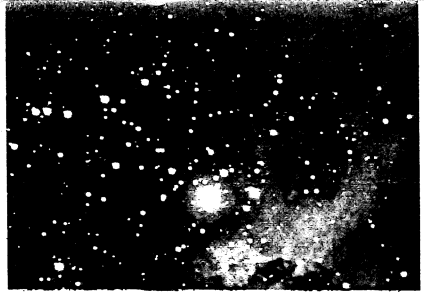

ASTRONOMY

ASTROPHYSICS SPECIAL

VIKING UPLINK...

by Sven Grenander
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In the frenzied months of the summer of '76 while the United States celebrated its 200-year experiment in Nationhood, an intent team of scientists and engineers held vigil beside their equipment monitoring the activities of two little spidery robots travelling towards, entering orbit and safely landing on the surface of our sun's fourth planet, Mars.

Viking I made touchdown on July 20, 1976 on the surface of Mars in a region located at 19.5N,34W called the Plain of Chryse. This event occurred seven years to the day from the first manned moon landing. Viking II landed on the Plain of Utopia, located 22.4N,225.8W on September 3, 1976.

Immediately upon landing both Viking crafts began transmitting data and photos to the JPL "Earth Base." At this time Viking II is in winter hibernation. This article describes the communication system between Viking I and the scientists. The programs published here are actual printouts of "conversations" with the lander during the evening of June 23, 1977.

This communication is effected through three modes: REC-recorded through the orbiter, RCE-relayed through the orbiter and DCS-direct to earth from the lander. A sol is a Martian day. A signal travels through space an average of 18 minutes.

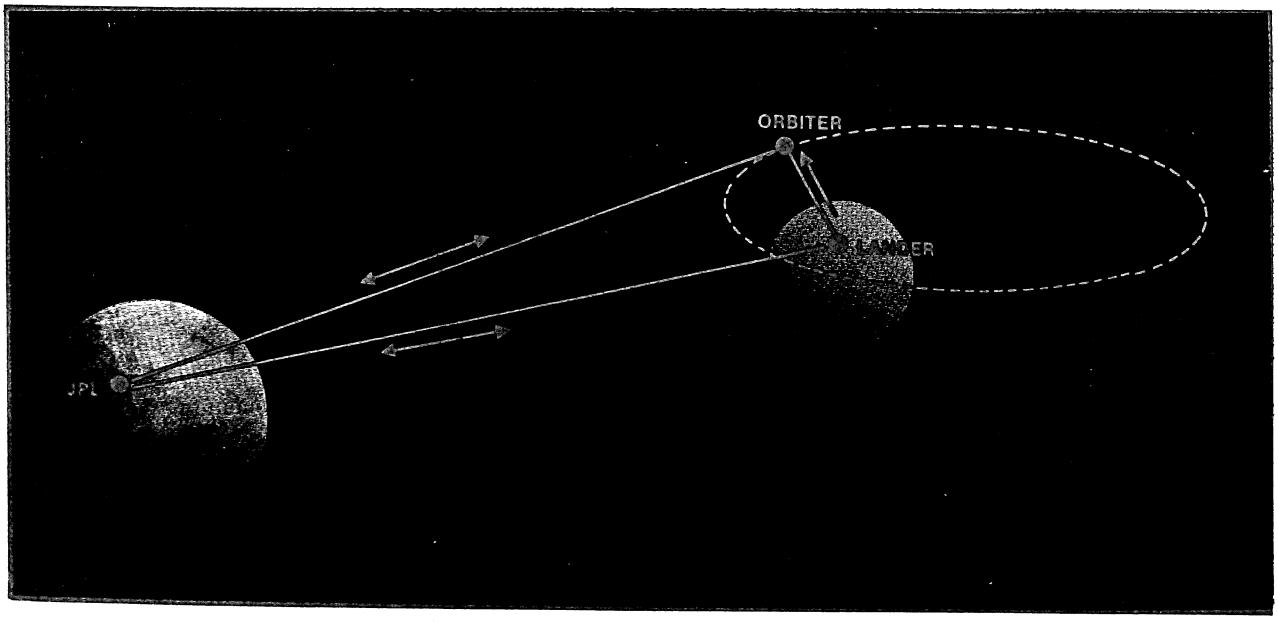
—editor

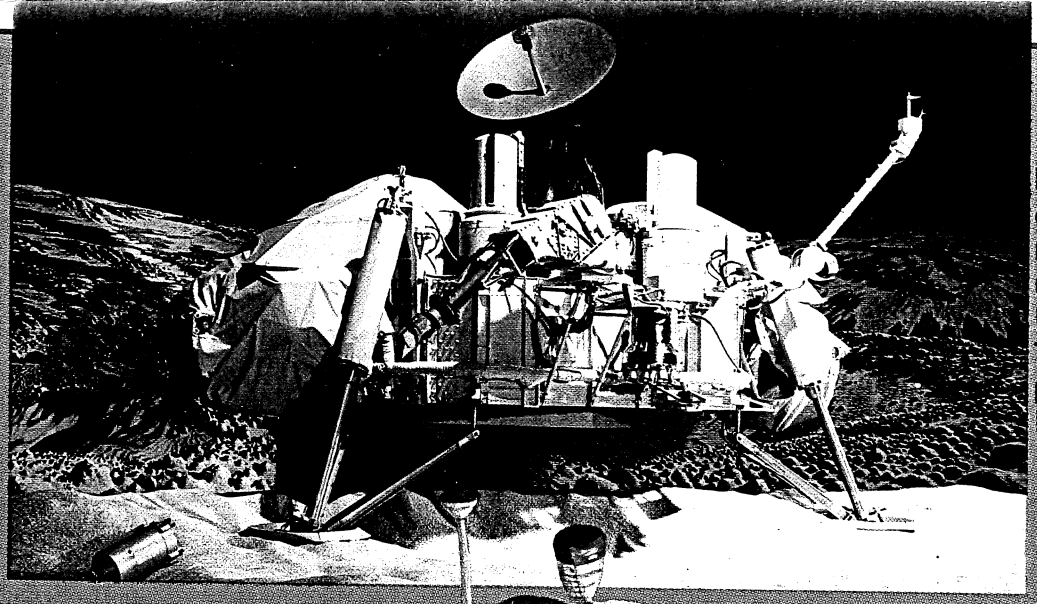
INTRODUCTION

The Viking Project provided the world with yet another couple of impressive displays of current space technology as two highly sophisticated spacecraft were softly and perfectly placed upon the Martian surface in the summer and early fall of 1976. The landing caught the attention of not only scientists around the world but also that of a public which had gradually become complacent about the exploration of our solar system. We were about to get our first close look at the surface of the planet which has traditionally been the home of our closest non-terrestrial neighbors, the Martians. Unfortunately no green aliens have yet been sighted and the Viking biology experiments have still to yield any conclusive evidence for or against the existence of Martian organisms.

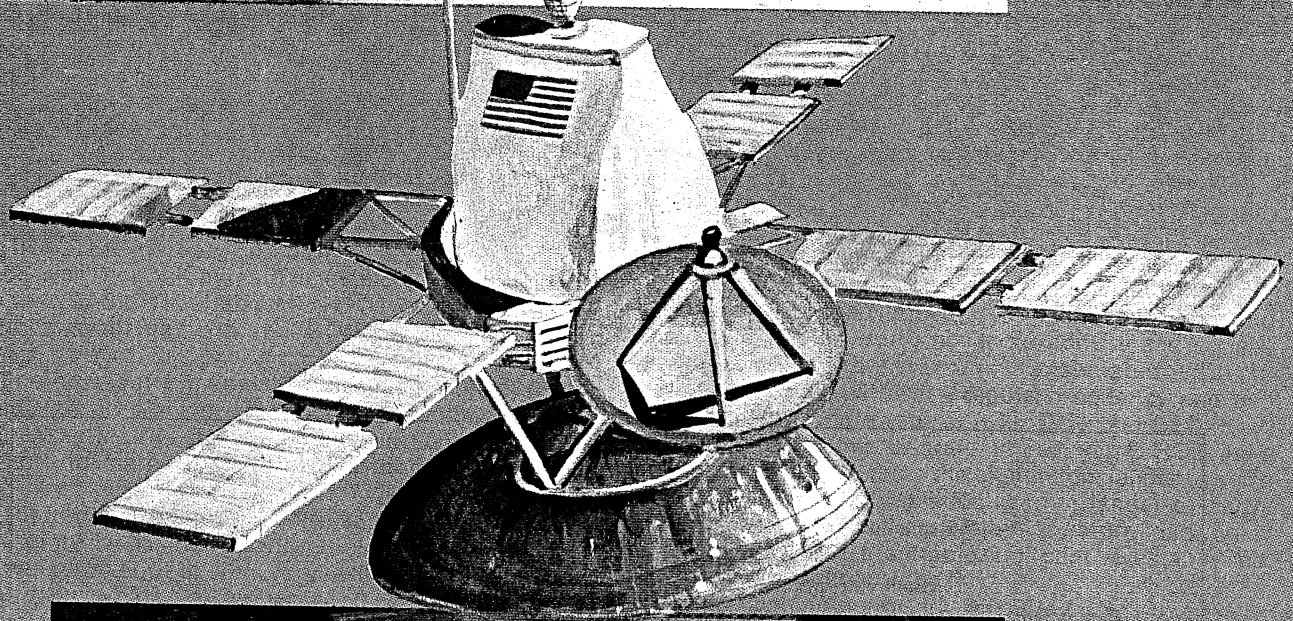
As the last of the biology experiments were exhausted, so was public interest and Viking started its inexorable drift into the shadows of history. None the less, on the Martian surface there are still two very active landers neither of which has shown any sign of wishing to fade into history quite yet. At the time of this writing, one lander (VL-2) is in a state of partial hibernation while weathering out the severe Martian winter. The other (VL-1) is still actively digging in the soil as evidenced by an ever-growing number of surface sampler trenches seen in the pictures taken by the lander cameras and returned to earth every few days.

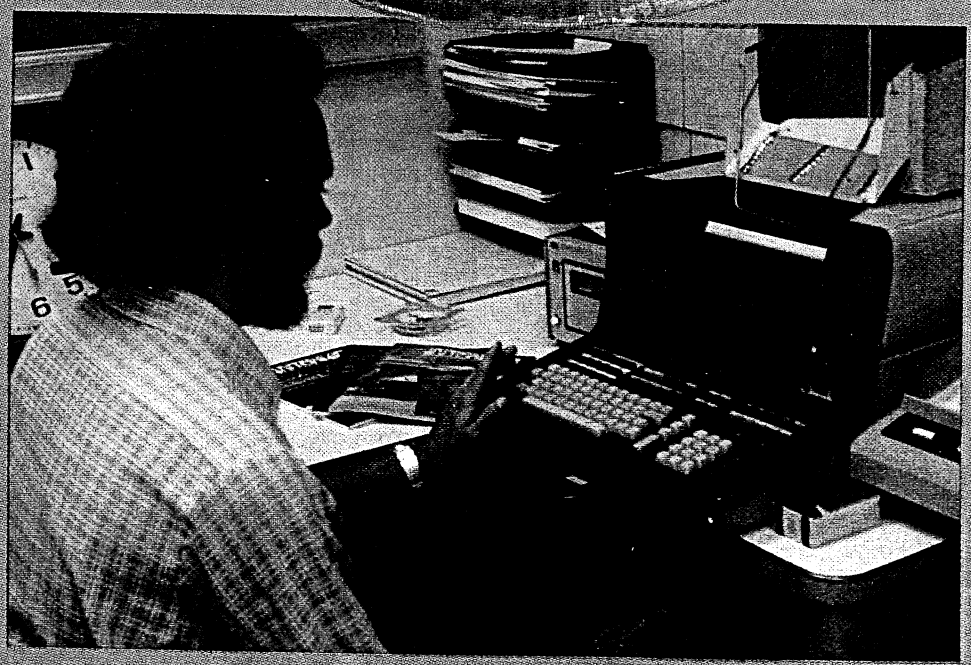
Three desktop computers are playing an integral part in this successful operation of the surface samplers and lander cameras. These computers are employed by the surface sampler and lander imaging teams in the generation and checking of all planned sequences





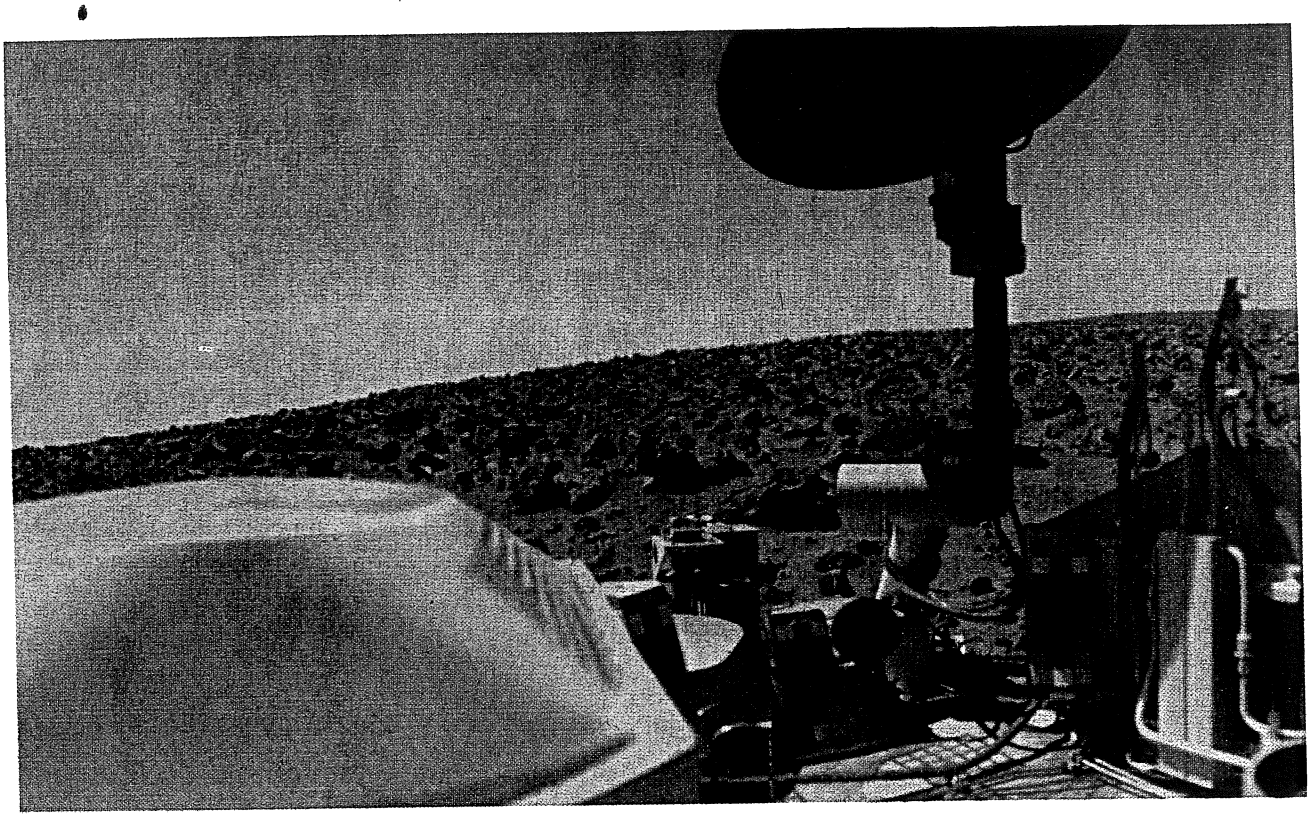
Lander portrayed here is the full-scale operating sandbox model in frequent use to test out UPLINK commands. This model is on public view at NASA-JPL.

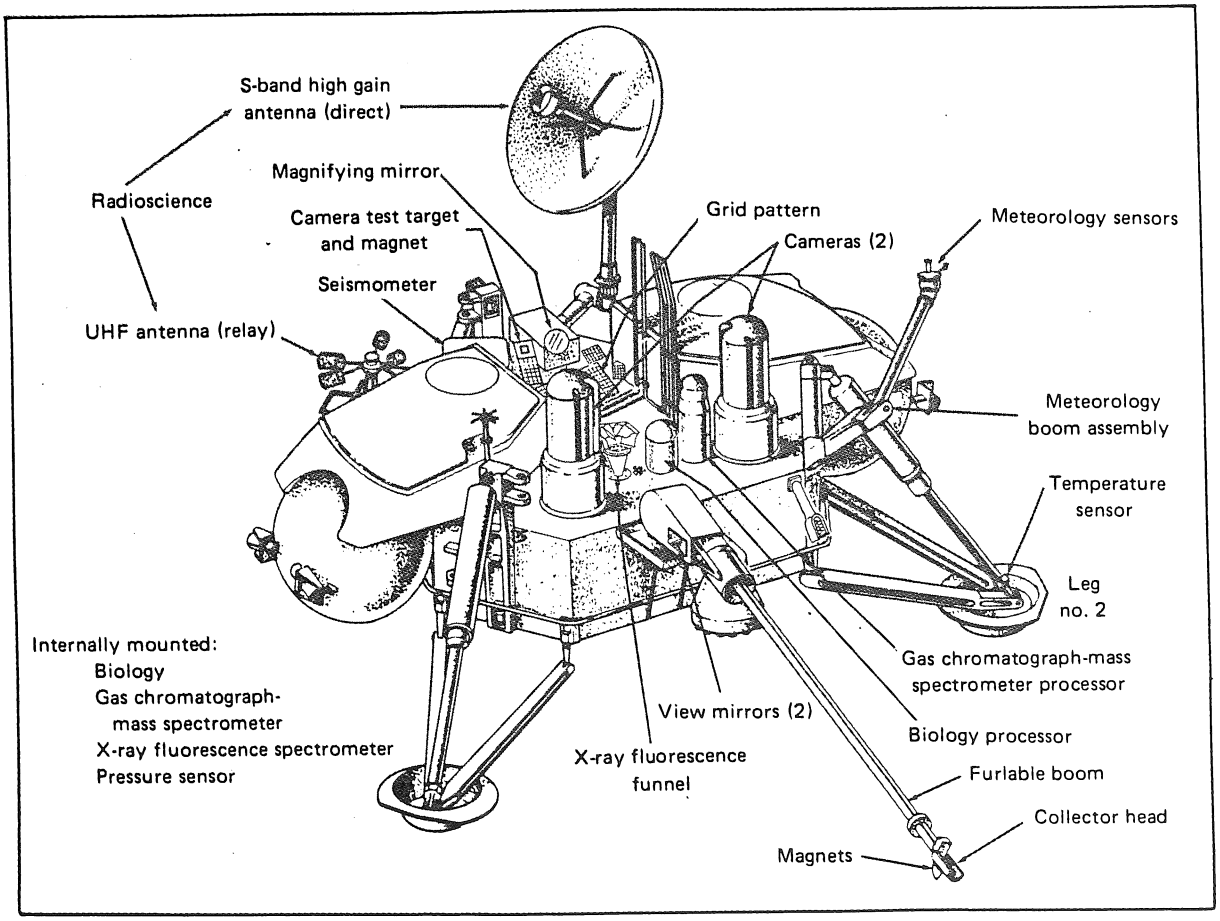




Author Sven Grenander at the keyboard of the Hewlett Packard Model 9830A.

...DOWNLINK





–External features of the Viking Lander.

which are to be sent to the landers. The process requires a great deal of precise bookkeeping and the equipment has to be available at any time without prior notice. Minicomputers were chosen for the task because of their stand-alone nature which in effect gives them a higher degree of reliability than larger systems which must be shared with other users and which would require a major effort to be brought back into operation in the event of a systems crash.

The computers used are Hewlett Packard 9830A's, two of which have INFOTEK memory boards while the third has a Hewlett Packard memory. The INFOTEK cores were chosen because INFOTEK could offer 16K words of memory, whereas Hewlett Packard could only provide 8K at the time of purchase. Even 16K is somewhat inadequate and has strongly influenced the structure of the programs used. The relative slowness of the machines has also caused problems at times, but even so, the wisdom of choosing minicomputers for the job can hardly be denied. Their ease of operation and almost trouble-free history has more than made up for their lack of size and speed.

EQUIPMENT DESCRIPTION

The computers are Hewlett Packard Model 9830A's which program in Hewlett Packard BASIC. The 9830 has an internal cassette drive which holds a tape with a capacity of about 32K words, twice the maximum memory available.

The INFOTEK memory boards are model EM-30 and hold 16K words or 32K bytes. The memory was supplied with a fast BASIC ROM also by INFOTEK. The special operations available with the ROM will be outlined below.

A remote cassette memory is also being used. It is another Hewlett Packard product, Model 9865A. The remote cassette drive has the unexpected advantage of being able to mark 10% more files than the internal drives.

The Plotter is a Hewlett Packard 9862A with a plotter surface of 10 by 15 inches and an electrostatic platen which has turned out to work very well. The plotter uses felt-tip pens which is probably all that is needed because of the accuracy available in the pen movements. Any finer writing instrument would tend to increase the visibility of the plotter steps.

A general design phone coupler is also used at times to interface the HP with the other machines. The interface has not been used as extensively as was expected because of the selfsufficiency of the HP and the low baud rate available.

The ROMS used were, the fast BASIC supplied by INFOTEK, a plotter control ROM by HP, an advanced programming I ROM by HP, an advanced programming II ROM by HP, a data communications I ROM by HP, a data communications III ROM by HP, an extended I/O ROM by HP, a string variables ROM and a matrix operations ROM.

The fast BASIC ROM supplied a *send* function which sends the contents of one array of matrix into another without requiring that a BASIC loop be set up—and at 200 times the speed of the equivalent loop. It also made it possible to program the choice of printall which determines if all displays are to be printed or not. And it also gives a Frac command which is the inverse of the INT or Integer command.

The plotter control ROM serves the obvious function of controlling the operation of the plotter.

The advanced programming I and II ROMS have overlapping features and the AP II ROM was discarded in favor of the more useful fast BASIC ROM. The functions provided are: *transfer* which puts string variables into numerical strings, *sort* which is used to sort numeric or string arrays, the *beep function* which allows a beep to be programmed so as to alert the operator of something which has to be done or to indicate that the program has reached a certain point in its execution.

The data communications ROM supplies the text option which allows text to be entered in to a program-type file. It also allows the other features necessary for telephone or hardwire communications with other computer installations.

The extended I/O ROM is intended for use with peripherals which were never acquired such as digitizers, card readers and the like.

The string variables ROM is needed to allow alphanumeric inputs and processing. Without it all inputs would have had to be numeric which would have proved very cumbersome.

The matrix operations ROM is used for all matrix operations which would otherwise have had to be ruled out.

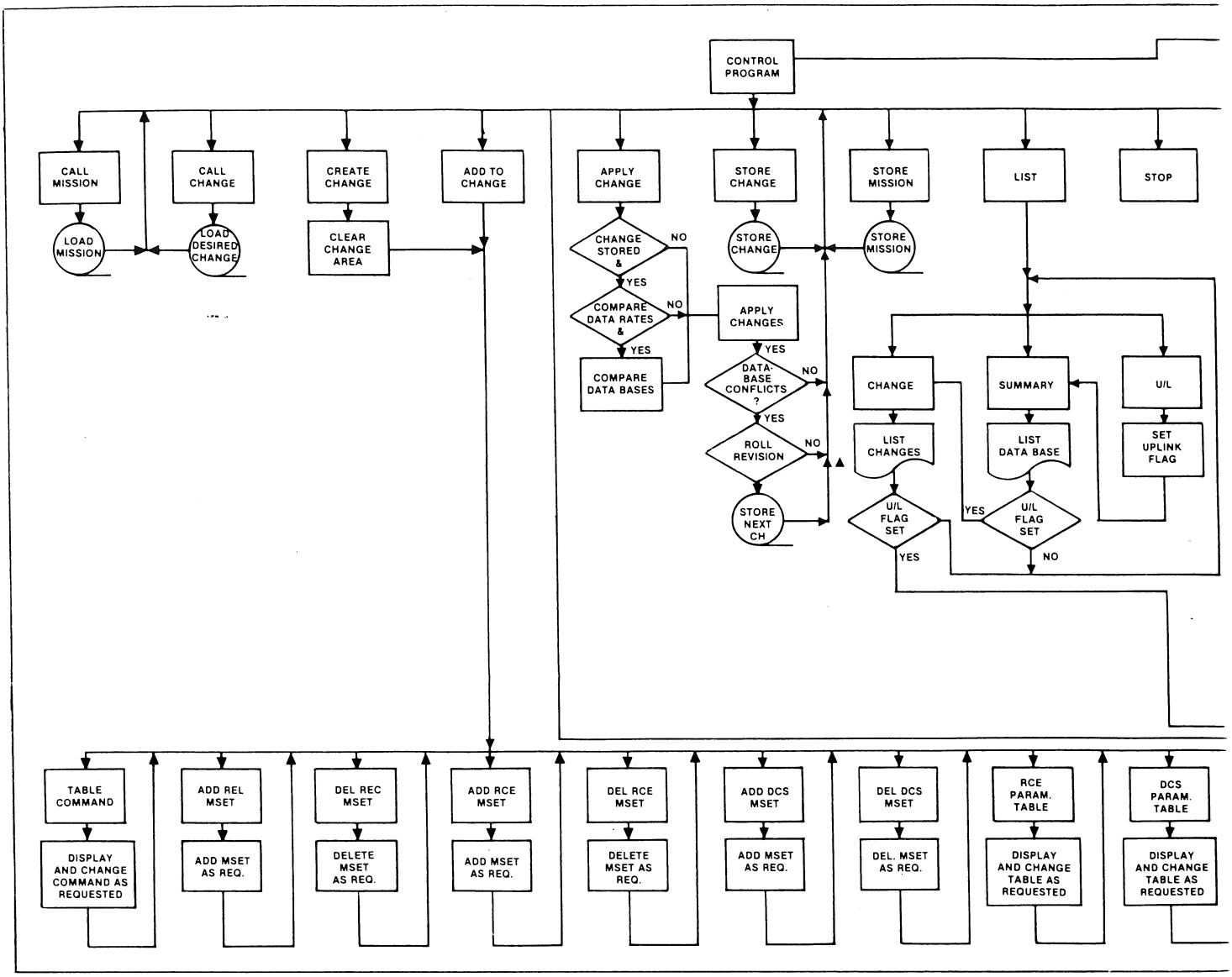
The machines are used mainly in the generation of SIPS, the medium through which the science teams communicate their instructions to the rest of the project and ultimately to the landers. The acronym SIP stands for *S*cience *I*nstrument *P*arameter listing and a description of its contents and generation requires that a brief introduction be given as to how the science teams control their instruments.

Communications with the spacecraft are divided into UPLINK and DOWNLINK where UPLINK is the use of a radio link to send commands up to a receiving spacecraft and DOWNLINK is the use of a link to return data to earth. UPLINKS are grouped into cycles, each cycle spanning about two weeks' worth of lander activity and usually having two to three UPLINKS associated with it. DOWNLINKS occur with less regular frequency and use three modes of data return; RCE, DCS and REC. Both RCE and DCS links operate in real time, RCE links employ an orbiter to relay the signal from lander to earth and DCS links transmit directly from lander to earth. REC DOWNLINKS use an orbiter to store and delay transmission until a suitable link can be established, REC is short for "recorded."

At the beginning of the planning for a cycle the science teams are given the UPLINK and DOWNLINK schedule and are told how many UPLINK words are available for instrument control and how many megabits of data can be downlinked. It is then up to the teams to agree how these allocations are to be split up between the different experiments in order to maximize the return of useful data and to start laying out sequences which can be accommodated within the given allocations.

These sequences are put into SIP form by coding all instructions in a format which can be read by the project computers responsible for further encoding, testing and finally radio transmission. Depending upon the instrument concerned, the SIP will also contain other pertinent information which may be needed for an understanding of the contents and possible error searching.

The teams hand in their first SIP at what is called the preliminary SIP port and a number of computer simulations are run to determine if there are any problems. The problems which will turn up are usually scheduling conflicts or allocation overruns. Each science team is responsible for checking the output of a simulation called LSEQ (*L*ander *SEQ*uence of events) to determine for which if any problems they are responsible. If a team is involved in a conflict it will have to rewrite the SIP and resubmit it at the final SIP port after which all simulations are rerun and another LSEQ run is produced. If problems still remain in the final LSEQ run, then the team will once again have to rewrite and resubmit the SIP at



the adaptive SIP port and all simulations are rerun a third time. There is still one more chance to correct the SIP after the adaptive LSEQ run has been reviewed. That is at the late adaptive SIP port, but such corrections are avoided if at all possible because there is usually insufficient time to run the simulations between the late adaptive SIP port and the time of the actual UPLINK.

For each lander there are usually upwards of three SIPS in a state of flux at any one time. The process of sequence generation, checking and rechecking requires so much time that two consecutive cycles have to be in a state of planning and simultaneously giving rise to a situation which lends itself to momentary confusion and numerous mixups. However, it is to the credit of this cautious, if somewhat cumbersome system, that both landers are as operational today as they were upon the day of landing.

The bookkeeping task is further complicated by the cumulative nature of the UPLINKS. Each UPLINK changes the contents in the on-board computer into a configuration which will cause the planned sequence to be executed. Thus any change in any one UPLINK has to be rippled down through the bookkeeping of all successive UPLINKS so that the changes planned for later UPLINKS are indeed applicable to the on-board computer load at the time of the UPLINK.

THE PROGRAM

The lander imaging team uses the program which is flowcharted in Figure 1 and listed in Figure 2 (see page 78) to track the data base in the on-board computer and to generate the SIPS needed for future changes and sequences. The program was written in the spring of 1976 when prelanding exercises showed the impossibility of manual tracking. The principal author of the program is William R. Patterson of Brown University who managed to write the code in addition to his other responsibilities as a camera engineer. The program is still being tweaked on an almost weakly basis to further improve its performance. Most of these changes have to do with additional tasks which should be incorporated but others are made to speed up the running or simplify operation.

The program actually consists of two programs because of size limitations of the memory. The programs are loaded into memory as needed and are called control and plan. The control program contains all the bookkeeping operations and some listing routines; plan is only used to generate listing and plots. The programs are written in Hewlett Packard BASIC which is very similar to most other forms of BASIC or FORTRAN. A Hewlett Packard remote cassette memory is used to hold the programs during use and the internal cassette drive is reserved for the data tapes holding the UPLINKS. One data tape is used for each UPLINK, each tape holding a small bookkeeping file, a data base file (the data base as it should appear after the previous UPLINK), and twenty change files. The data base is referred to as the "Mission" in the program while the change files are called

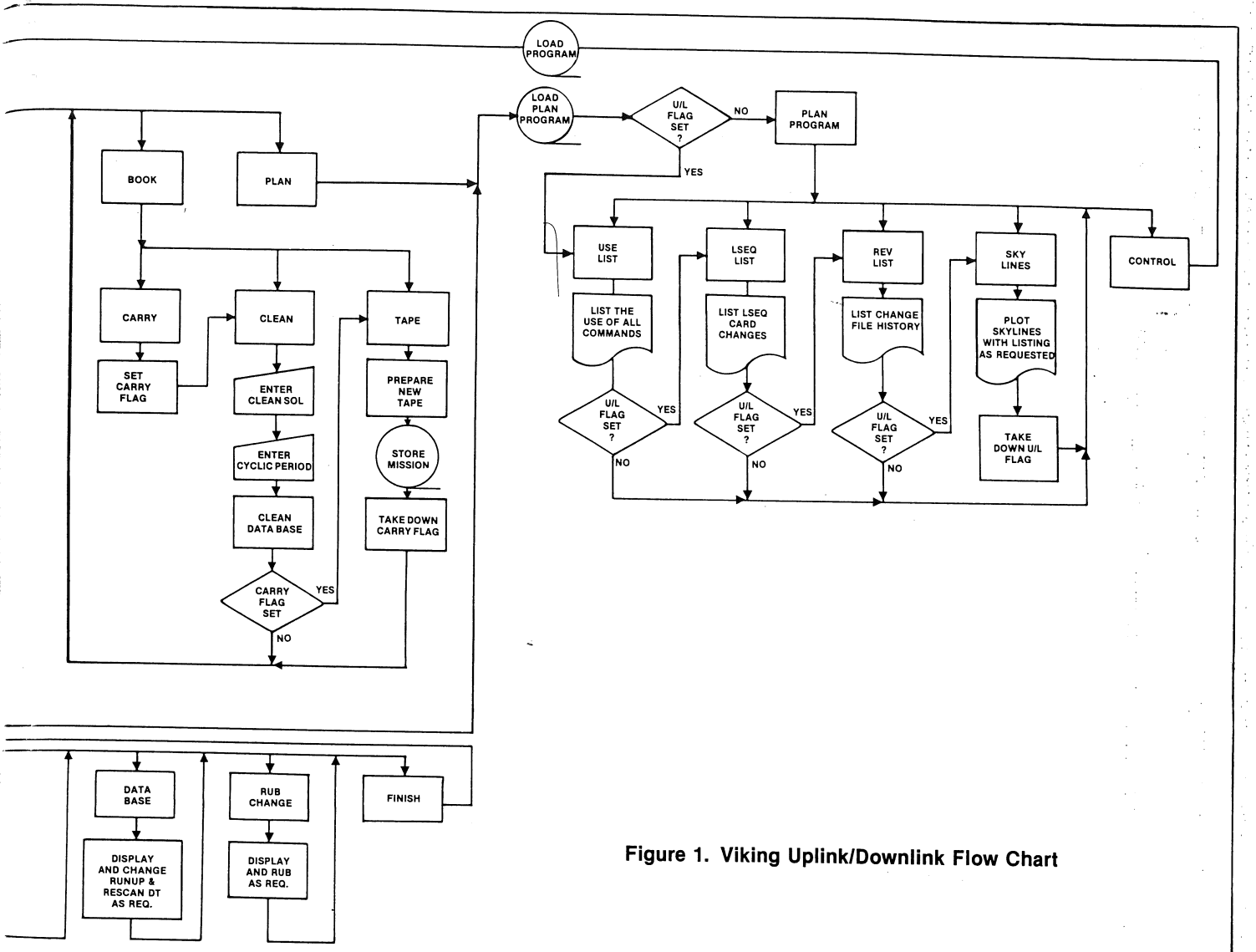


Figure 1. Viking Uplink/Downlink Flow Chart

"Change." Because of two-program interfacing it is necessary to hold the Mission file and current Change file in common memory, the Mission being array PI(186,10) and the Change being CI(101,11). The "I" in the array name designates that the arrays are of integer precision, once again because of storage space shortage. Figure 3 is a listing of a typical Mission file and shows how some data compression had to be used to fit the whole mission into a matrix of size 186 by 10. Figure 4 shows the corresponding Change file and how it is structured.

The structure of each tape is shown in Figure 5. Each Change file contains all the changes present in the previous Change file unless the change was created from scratch or previous changes have been selectively rubbed as described in a later section. A Mission file is generated by applying all the changes in a designated Change file to the data base which resides in the on-board computer before the UPLINK. This *apply* operation will also be discussed in greater detail further on.

GENERATION OF A SIP (Science Instrument Parameter)

PREPARING AN UPLINK TAPE: The generation of a SIP starts with the red-lining of a markup copy. The markup copy is a copy of the data base as it should appear after the previous UPLINK and red-lining it simply means that the copy is altered by marking the desired changes in red. This red-lined copy is given to the data base tracker who pulls out the program tape and loads the control program into memory and also into the special key functions which are used to speed up the entry of repetitious program commands. If this red-lined copy is the first of an UPLINK, the previous UPLINK tape will be put into the internal cassette drive and the command "Call MI" will be entered in response to the prompting by the computer: "Enter control level command." "Call MI" is short for "Call Mission" and causes the loading of the Mission file from the UPLINK tape in the tape drive. The program will ask for another control level command after the mission has been loaded and this time the entry will be "Call CH" which causes a Change file to be loaded. The program will come back to ask "Latest change?" to which the answer is usually "Y" or "Yes." If the answer is "No," the program will respond "Enter desired REV NO." and the number of the desired Change file has to be entered. To assure that the correct file is being pulled, the program prints the number of the Change file requested, who generated it and when, then asks if that is indeed the correct file. When the Change file has been pulled the operate will answer "apply CH" to the program prompting. The program will ask if a "Database Compare" is required to which the answer is almost invariably "Yes." The apply operation causes all the changes to be applied to the data base, giving the UPLINK as it would look after the UPLINK. The Database Compare option searches through the data base and Change file to make sure that no changes have been rolled into the

data base which would cause the changes to be invalid as they stand. The program will enquire if a "REV Roll" is desired in the case of a data base conflict. In the case of a REVROLL the computer can fix the Change file so that it will match the current data base, at other times the program will not know how to make the fixup and will simply list the problem areas, leaving it up to the operator to make the fix.

The above sequence "Call MI", "Call CH" and "Apply CH" will give the data base of the UPLINK which was handed over as the red-lined copy. To get a tape to operate on for this desired UPLINK the operator enters into the "Book" subsection of the control program by answering "Book" to the control level command prompting. The program will ask for a "Bookkeeping Command" to which the answer is "Tape." The tape command will cause the program to request that a blank (or old tape) be put in the internal drive in place of the one used to generate the data base. Once this tape has been put into place and the program has been instructed to "continue," the calculator will proceed with the marking of the tape into files of the size and number needed. The mission in the calculator will be stored in the Mission file and the operator will be asked who he is, what the data is and which UPLINK tape has just been prepared. All this additional bookkeeping information is also stored on the tape before the program returns to the control section.

CREATING A CHANGE FILE: After an UPLINK tape has been prepared as described above the operator can proceed with the creating of a Change file in accordance with the instructions on the red-lined copy. The program will still be in the control section after the completion of the "Tape" command issued in the previous section and the operator will input "Create CH" in response to the prompting by the calculator. "Create CH" causes the Change file in the calculator to be set to zero so that a

Figure 3. Viking Uplink Mission File

1	405	102	775	875	0	12109	3230	3901	1	0	94	10401	102	1975	2200	-30	0	0	0	0	0
2	305	102	975	1075	0	12111	930	6202	1	0	95	10403	102	1975	2200	-30	0	0	0	0	0
3	400	102	1050	1150	-40	12111	1120	5702	0	0	96	10402	102	1975	2200	-30	0	0	0	0	0
4	508	102	2350	2450	-50	12111	1645	5002	1	0	97	10301	101	550	1500	-30	0	0	0	0	0
5	10414	103	350	400	-10	12111	2230	6101	0	0	98	10408	102	1775	1950	-50	0	0	0	0	0
6	10309	101	350	400	-10	12111	2650	4701	0	0	99	10408	103	0	50	0	0	0	0	0	0
7	10301	101	350	400	-10	12111	2750	5801	0	0	100	1500	0	250	0	0	0	0	0	0	0
8	10414	103	3050	3100	-10	12111	3210	4701	1	0	101	0	0	0	0	0	0	0	0	0	0
9	10409	101	3050	3100	-10	12209	3255	3901	1	0	102	0	0	0	0	0	0	0	0	0	0
10	10401	101	3050	3100	-10	12309	3320	3901	1	0	103	12710	0	2	0	0	0	0	0	0	0
11	10401	101	2325	2500	10	12316	3820	3702	1	0	104	13110	0	2	0	0	0	0	0	0	0
12	10300	102	825	1125	-30	12408	3200	5902	0	0	105	0	0	0	0	0	0	0	0	0	0
13	10303	102	2225	3150	-20	12408	4100	6002	1	0	106	0	0	0	0	0	0	0	0	0	0
14	10401	101	425	600	-20	12408	5820	3801	1	0	107	0	0	0	0	0	0	0	0	0	0
15	10401	101	2850	3025	-20	12411	5200	8002	1	0	108	0	0	0	0	0	0	0	0	0	0
16	10403	102	1750	2450	0	12413	700	4202	1	0	109	0	0	0	0	0	0	0	0	0	0
17	10313	102	2750	2800	-20	12413	1855	4601	0	0	110	0	0	0	0	0	0	0	0	0	0
18	10313	102	825	875	-20	12413	2046	4301	1	0	111	0	0	0	0	0	0	0	0	0	0
19	10313	102	2075	2175	-30	12413	2247	4402	0	0	112	0	0	0	0	0	0	0	0	0	0
20	10313	102	225	325	-20	12413	2358	4502	1	0	113	0	0	0	0	0	0	0	0	0	0
21	10201	101	550	1375	-20	12416	3845	3702	1	0	114	0	0	0	0	0	0	0	0	0	0
22	10200	102	850	1675	-30	12509	3409	3901	1	0	115	0	0	0	0	0	0	0	0	0	0
23	10208	102	750	1575	-50	12607	0	9901	101	0	116	0	0	0	0	0	0	0	0	0	0
24	10201	101	1500	2325	-20	12609	3434	3901	1	0	117	0	0	0	0	0	0	0	0	0	0
25	10213	102	1500	2325	-10	12610	0	4801	1	0	118	0	0	0	0	0	0	0	0	0	0
26	10208	102	1825	2650	-50	12613	0	9902	101	0	119	0	0	0	0	0	0	0	0	0	0
27	401	101	1875	1875	10	12709	3459	3901	1	0	120	0	0	0	0	0	0	0	0	0	0
28	201	101	1900	1900	10	12808	700	6301	0	0	121	0	0	0	0	0	0	0	0	0	0
29	1	101	1925	1925	10	12808	800	6401	0	0	122	0	0	0	0	0	0	0	0	0	0
30	1	101	550	550	10	12808	900	6501	1	0	123	0	0	0	0	0	0	0	0	0	0
31	201	101	575	575	10	12808	5500	6601	0	0	124	0	0	0	0	0	0	0	0	0	0
32	401	101	600	600	10	12808	5700	6801	1	0	125	0	0	0	0	0	0	0	0	0	0
33	10104	102	1675	1700	30	12809	5000	6601	0	0	126	0	0	0	0	0	0	0	0	0	0
34	10104	102	750	775	30	12809	5100	6701	0	0	127	0	0	0	0	0	0	0	0	0	0
35	10004	102	2525	2550	30	12809	5200	6801	0	0	128	0	0	0	0	0	0	0	0	0	0
36	10004	102	1700	1725	20	12809	5524	5101	1	0	129	0	0	0	0	0	0	0	0	0	0
37	10104	102	1700	1725	20	12810	3524	5201	0	0	130	0	0	0	0	0	0	0	0	0	0
38	10004	102	2425	2450	10	12810	3700	6901	0	0	131	0	0	0	0	0	0	0	0	0	0
39	10004	102	2475	2500	20	12810	3900	6801	1	0	132	0	0	0	0	0	0	0	0	0	0
40	10104	102	2475	2500	20	12811	5524	5301	0	0	133	0	0	0	0	0	0	0	0	0	0
41	10204	102	1700	1725	20	12811	5700	6901	0	0	134	0	0	0	0	0	0	0	0	0	0
42	10408	102	175	225	-10	12811	5800	7001	0	0	135	0	0	0	0	0	0	0	0	0	0
43	10413	102	2675	2800	-20	12811	5900	6801	1	0	136	0	0	0	0	0	0	0	0	0	0
44	10413	102	875	925	-20	12815	24	5401	0	0	137	0	0	0	0	0	0	0	0	0	0
45	10413	102	775	850	-20	12815	200	6901	0	0	138	0	0	0	0	0	0	0	0	0	0
46	10400	102	2150	2275	-30	12815	300	7001	0	0	139	0	0	0	0	0	0	0	0	0	0
47	10104	103	2675	2725	10	12815	400	6801	1	0	140	0	0	0	0	0	0	0	0	0	0
48	10405	102	1600	1675	-10	12816	1024	5502	1	0	141	0	0	0	0	0	0	0	0	0	0
49	10400	102	1800	2600	-30	12816	1200	6601	0	0	142	0	0	0	0	0	0	0	0	0	0
50	10308	302	275	350	-10	12816	1300	6701	0	0	143	0	0	0	0	0	0	0	0	0	0
51	10104	103	2500	2525	10	12816	1400	6801	1	0	144	0	0	0	0	0	0	0	0	0	0
52	10104	103	2575	2600	10	12816	5024	5602	1	0	145	12310	1453	1	12	0	0	0	0	0	0
53	10204	103	2750	2775	10	12816	5200	6601	0	0	146	12409	848	1	0	45	0	0	0	0	0
54	10204	103	3275	3300	10	12816	5400	6801	1	0	147	12507	2120	1	1	0	0	0	0	0	0
55	10104	103	1650	1675	10	12817	4700	6301	0	0	148	12710	0	1	0	0	0	0	0	0	0
56	10004	103	1725	1750	10	12817	4800	6401	0	0	149	13002	0	1	0	0	0	0	0	0	0
57	10401	101	2850	2950	-10	12817	4900	6501	1	0	150	13110	0	1	0	0	0	0	0	0	0
58	10501	1601	2350	2750	10	12909	3548	3901	1	0	151	14008	600	2	1	4	0	0	0	0	0
59	10301	101	1550	2375	10	13009	3613	3901	1	0	152	14017	5800	2	1	4	0	0	0	0	0
60	10309	101	1550	2375	10	13014	0	7902	1	0	153	14508	600	2	2	5	0	0	0	0	0
61	10509	1601	2350	2750	10	13109	3638	3901	1	0	154	14517	5800	2	2	5	0	0	0	0	0
62	10409	101	2850	2950	-10	13909	1500	19001	1	0	155	15008	600	2	3	6	0	0	0	0	0
63	10201	101	2100	2125	0	13910	0	17201	1	0	156	15017	5800	2	3	6	0	0	0	0	0
64	10209	101	2100	2125	0	13910	2000	17902	1	0	157	15508	615	2	1	4	0	0	0	0	0
65	10214	103	2100	2125	0	13911	2000	18102	101	0	158	15517	5827	2	1	4	0	0	0	0	0
66	10301	101	2100	2125	0	14410	0	17101	1	0	159	0	0	0	0	0	0	0	0	0	0
67	10309	101	2100	2125	0	14410	2000	18201	0	0	160	0	0	0	0	0	0	0	0	0	0
68	10314	103	2100	2125	0	14410	2300	18301	0	0	161	0	0	0	0	0	0	0	0	0	0
69	10401	101	2100	2125	0	14410	2600	18401	101	0	162	0	0	0	0	0	0	1	2820	0	2	1
70	10409	101	2100	2125	0	14410	3000	17602	101	0	163	0	0	0	0	0	0	2	2820	0	2	1
71	10313	102	1500	2200	-10	14909	1500	19001	1	0	164	0	0	0	0	0	0	0	0	0	0	0
72	10300	102	1600	2500	-30	14910	0	17201	1	0	165	0	0	0	0	0	0	0	0	0	0	0
73	10308	102	1825	2700	-50	14910	2000	17902	1	0	166	0	0	0	0	0	0	0	0	0	0	0
74	10305	102	700	1150	0	14911	2000	18102	101	0	167	0	0	0	0	0	0	0	0	0	0	0
75	10301	101	550	1550	-30	15410	0	17101	1	0	168	0	0	0	0	0	0	3	3420	0	2	1
76	10400	102	950	1450	-30	15410	2000	18201	0	0	169	0	0	0	0	0	0	4	3420	0	1	1
77	10308	102	550	1175	-50	15410	2300	18301	0	0	170	0	0	0	0	0	0	0	0	0	0	0
78	10413	102	50	350	-10	15410	2600	18401	101	0	171	0	0	0	0	0	0	0	0	0	0	0
79	10300	102	125	350	-20	15410	3000	17602	101	0	172	0	0	0	0	0	0	0	0	0	0	0
80	10401	101	2800	3225	-20	0	0	0	0	0	173	0	0	0	0	0	0	0	0	0	0	0
81	10401	101	2800	3150	-20	0	0	0	0	0	174	0	0	0	0	0	0	11	96	0	2	1
82	10408	102	1825	1950	-50	0	0	0	0	0	175	0	0	0	0	0	0	12	170	0	2	1
83	10408	102	2050	2275	-50	0	0	0	0	0	176	0	0	0	0	0	0	13	494	4	1	1
84	10408	102	2350	2500	-50	0	0	0	0	0	177	0	0	0	0	0	0	14	100	0	1	1
85	10309	101	0	0	0	0	0	0	0	0	178	0	0	0	0	0	0	15	100	0	2	1
86	10201	102	0	0	0	0	0	0	0	0	179	0	0	0	0	0	0	16	373	0	2	1
87	10201	102	0	0	0	0	0	0	0	0	180	0	0	0	0	0	0	21	448	0	2	1
88	10101	102	0	0	0	0	0	0	0	0	181	0	0	0	0	0	0	22	448	0	2	1
89	10101	102	0	0	0	0	0	0	0	0	182	0	0	0	0	0	0	23	448	0	2	1
90	10304	103	2250	2650	10	0	0	0	0	0	183	0	0	0	0	0	0	24	438	0	1	1
91	10314	102	200	200	-10	0	0	0	0	0	184	0	0	0	0	0	0	25	438	0	1	1
92	10200	102	950	1050	-20	0	0	0	0	0	185	0	0	0	0	0	0	26	438	0	1	1
93	10100	102	950	1050	-20	0	0	0	0	0	186	0	0	0	0	0	0	323	9	79	1	1

new set of changes can be entered. Figures 6a and 6b show how the data base is listed in the data base summary and this is the listing which has been red-lined. The operator goes through the listing and performs the changes required.

COMMAND TABLE CHANGES: Command table changes are made by keying in "Table C" in response to the prompting by the calculator: "Enter Change Command". "Table C" and most of the other Change commands have been stored on immediately executing special keys so that the operator does not have to spell it out every time. The calculator will respond to the Change command by asking what is the "Command Number." The answer will be any number from 1 to 99 which will cause the display of the data base gain of the command in question. If the gain is correct the operator hits the space bar *execute*; if not, the correct gain is keyed in. The DR (*D*ata *R*ate), CH (photosensitive diode #), MD (mode of sampling), OFFSET, DCI (*D*ark *C*urrent *I*nhibit), "Start Azimuth," "End Azimuth" and elevation pointing angle of the camera are all gone through using the same technique. Space bar for "No change" and corrected value if there is a change.

RECORDED MSET CHANGES: The recorded MSETs control the execution of the commands listed in the command table and are structured as shown in the recorded MSET listing shown in Figure 7. Unlike the command changes, the changes to the recorded MSETs have to be in the form of a "Delete MSET" or "Add MSET". Once again the special function keys are used, "Add MSET" being used to add and "Del MSET" being used to delete. A new MSET is entered by giving the sol (Martian day since landing), hour, minute and second of the MSET upon request. Next the cyclic status of the MSET is entered as is the command number and camera. If cyclic is given as 1 that will cause the MSET to be automatically repeated every 20 days, otherwise it would only be used once. The command number called is the same as that listed in the command table and the choice of camera 1 or 2 depends for which the command was designed. The last inputs are "Pre-Cal," "Post-Cal," "Stow," "Rescan," and "Dust." PRE-CAL and POST-CAL will cause the camera to perform a calibration before or after the picture is taken. The Stow option causes the camera to stow behind the protective post after the execution of the command so as to avoid unnecessary exposure to the atmosphere and dust. Rescan is an option which will cause the camera to scan one azimuth line repeatedly at the end of the picture. The duration of the Rescan is determined by the RESCAN DT given at the end of the data base summary. The Rescan option is used to detect any motion in or across the line which is imaged. The Dust option controls the dusting of the camera window, an operation which is performed by a small nozzle placed above the window which blows CO_2 across the window to clear it of dust if needed. Recorded MSETs are deleted in the same manner as they are added but only requiring that the time and camera be specified.

ADDING AND DELETING DCS AND RCE MSETS: DCS and RCE MSETs are different from REC MSETs in that they do not explicitly cause a command to be executed but refer to an RCE or DCS parameter table to get the command number to be used. The duration of the image, the camera number and the "Stow" or "No-Stow." The MSETs are entered and deleted by using the appropriate special function key; ADD RCE, DEL RCE, ADD DCS and DEL DCS. Whatever the operation, the input will be the sol, hour, minute and second of the MSET and the parameters and options to be used.

RCE AND DCS PARAMETER CHANGES: The parameter changes are made by executing the appropriate special function key, then specifying the parameter and option to be changed. The program is written the same way for parameter changes as for command changes in that it displays the current value of the command, duration, camera and *stow* and expects a space bar *execute* in the case of "no change" and a corrected value if there is to be a change.

DATA BASE CHANGES: This change of the data base refers only to the portion containing the RESCAN DT and "Runup.Rescan" listed at the end of the data base. Executing the special function key "Data Base" will cause the current value of the RSCN.DT to be displayed as for command changes, then the "Runup.Rescan" will be displayed expecting the same kind of action, space bar or correct value.

THE RUB FUNCTION: "Rub" is used when a change is to be deleted as opposed to something already contained

13309	4227	4001	1	0	7000	0	0	0	0	0
13709	4406	4001	1	0	7000	0	0	0	0	0
13909	4456	4001	1	0	7000	0	0	0	0	0
14009	4521	4001	1	0	7000	0	0	0	0	0
13812	2400	4802	1	0	7000	0	0	0	0	0
13912	0	8102	1	0	7000	0	0	0	0	0
13809	4431	4001	1	0	7000	0	0	0	0	0
13909	1500	19001	1	0	8000	1	0	0	0	0
13910	0	17201	1	0	8000	1	0	0	0	0
13910	2000	17902	1	0	8000	1	0	0	0	0
13911	2000	18102	101	0	8000	1	0	0	0	0
14410	0	17101	1	0	8000	1	0	0	0	0
14410	2000	18201	0	0	8000	1	0	0	0	0
14410	2300	18301	0	0	8000	1	0	0	0	0
14410	2600	18401	101	0	8000	1	0	0	0	0
14410	3000	17602	101	0	8000	1	0	0	0	0
15909	1500	19001	1	0	7000	0	0	0	0	0
15910	0	17201	1	0	7000	0	0	0	0	0
15910	2000	17902	1	0	7000	0	0	0	0	0
15911	2000	18102	101	0	7000	0	0	0	0	0
16410	0	17101	1	0	7000	0	0	0	0	0
16410	2000	18201	0	0	7000	0	0	0	0	0
16410	2300	18301	0	0	7000	0	0	0	0	0
16410	2600	18401	101	0	7000	0	0	0	0	0
16410	3000	17602	101	0	7000	0	0	0	0	0
10104	102	1725	1750	20	1041	10204	102	1700	1725	20
10408	102	275	350	-10	1049	10400	102	1800	2600	-30
10201	103	1850	1875	10	1054	10204	103	3275	3300	10
10202	103	1850	1875	10	1055	10104	103	1650	1675	10
10101	103	1850	1875	10	1056	10004	103	1725	1750	10
10102	103	1850	1875	10	1057	10401	101	2850	2950	-10
10001	103	1850	1875	10	1058	10501	1601	2350	2750	10
10102	103	1850	1875	10	1059	10301	101	1550	2375	10
13816	3000	2	0	0	5000	0	0	0	0	0
13916	0	2	0	0	5000	0	0	0	0	0
13412	3000	2	0	0	5000	0	0	0	0	0
14512	0	2	0	0	5000	0	0	0	0	0
14008	600	2	1	4	6500	0	0	0	0	0
14017	5800	2	1	4	6500	0	0	0	0	0
14508	600	2	2	5	6500	0	0	0	0	0
14517	5800	2	2	5	6500	0	0	0	0	0
16008	600	2	1	4	6000	0	0	0	0	0
16017	5800	2	1	4	6000	0	0	0	0	0
16508	600	2	2	5	6000	0	0	0	0	0
16517	5800	2	2	5	6000	0	0	0	0	0
13620	4000	1	0	0	6000	0	0	0	0	0
13816	3000	1	0	0	6000	0	0	0	0	0
13916	0	1	0	0	6000	0	0	0	0	0
14114	0	1	0	0	6000	0	0	0	0	0
14308	0	1	123	456	6000	0	0	0	0	0
14412	3000	1	0	0	6000	0	0	0	0	0
14512	0	1	0	0	6000	0	0	0	0	0
14722	3000	1	1	0	6000	0	0	0	0	0
13718	4136	5402	0	0	7000	0	0	0	0	0
13718	4300	5502	0	0	7000	0	0	0	0	0
13718	4500	5602	0	0	7000	0	0	0	0	0
13718	4700	5702	1	0	7000	0	0	0	0	0
13719	1800	5802	0	0	7000	0	0	0	0	0
13719	2000	5902	1	0	7000	0	0	0	0	0
13812	5340	4902	1	0	7000	0	0	0	0	0
10308	102	1500	1550	0	1048	10405	102	1600	1675	-10
14413	0	2	1	0	5000	0	0	0	0	0
14611	3000	2	0	0	5000	0	0	0	0	0
14114	0	1	0	0	6500	0	0	0	0	0
15008	600	2	3	6	6500	0	0	0	0	0
15017	5800	2	3	6	6500	0	0	0	0	0
17008	600	2	3	6	6000	0	0	0	0	0
17017	5800	2	3	6	6000	0	0	0	0	0
14909	1500	19001	1	0	8000	1	0	0	0	0
14910	0	17201	1	0	8000	1	0	0	0	0
14910	2000	17902	1	0	8000	1	0	0	0	0
14911	2000	18102	101	0	8000	1	0	0	0	0
16909	1500	19001	1	0	7000	0	0	0	0	0
16910	0	17201	1	0	7000	0	0	0	0	0
16910	2000	17902	1	0	7000	0	0	0	0	0
16911	2000	18102	101	0	7000	0	0	0	0	0
13813	500	1702	1	0	7000	0	0	0	0	0
10414	103	1525	1625	-30	1017	10313	102	2750	2800	-20
1500	0	120	0	0	4100	1500	0	250	0	0
3	1620	0	2	1	2168	3	3420	0	2	1
10004	102	2475	2500	20	1040	10104	102	2475	2500	20
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
1	0	0	8	330	81	1	0	0	0	0

Figure 4. Viking Uplink Change File — 330 Dated June 23, 1977.

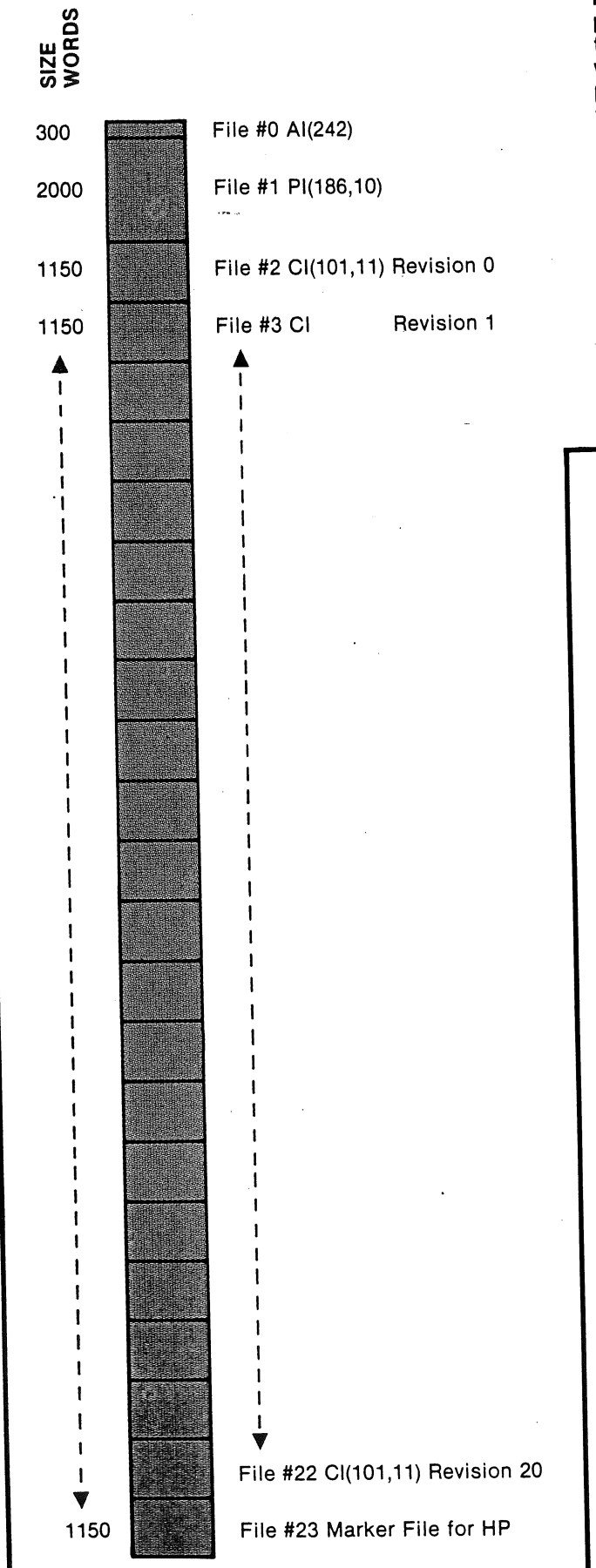


Figure 5. The UPLINK tapes contain a total of 24 files. The first file holds the array AI(242) which is used for tape bookkeeping. It includes the most recent revision of the previous UPLINK and the sol of said UPLINK, the number of the operator who created the tape, the date on which it was created and the same information for each of 21 possible Change files which may have been stored on the tape.

The second file holds the mission, i.e. the result of the previous UPLINK as it currently stands or as it was when the mission was most recently rolled forward. The file size is 2000 out of which 1860 are used by the 186 by 10 integer precision P matrix.

The next 21 files are used to store the Change files. Each file having a size of 1150 out of which 1111 is used for the 101 by 11 C matrix. The HP refers to the first file as file 0 so that AI is stored in 0, PI is stored in 1 and the changes are stored in 2 through 22. There is also one empty file at the end of each tape with the same size as the previous file. This is only a marker file used by the HP to find the end of the tape for further markings.

in the data base before the UPLINK. If an MSET has been entered incorrectly the special function key used to enter the MSET is once again used but this time in upper case. The program will display the added MSETs as they are stored in the Change file and ask if the change currently displayed is the one to be rubbed. The answer is either "Y" for "Yes" or space bar for "No." Table command changes are rubbed by first executing the "Rub" special function key, then entering the number of the command change to be rubbed plus 1000. (Figure 2: See lines 1220 through 1310).

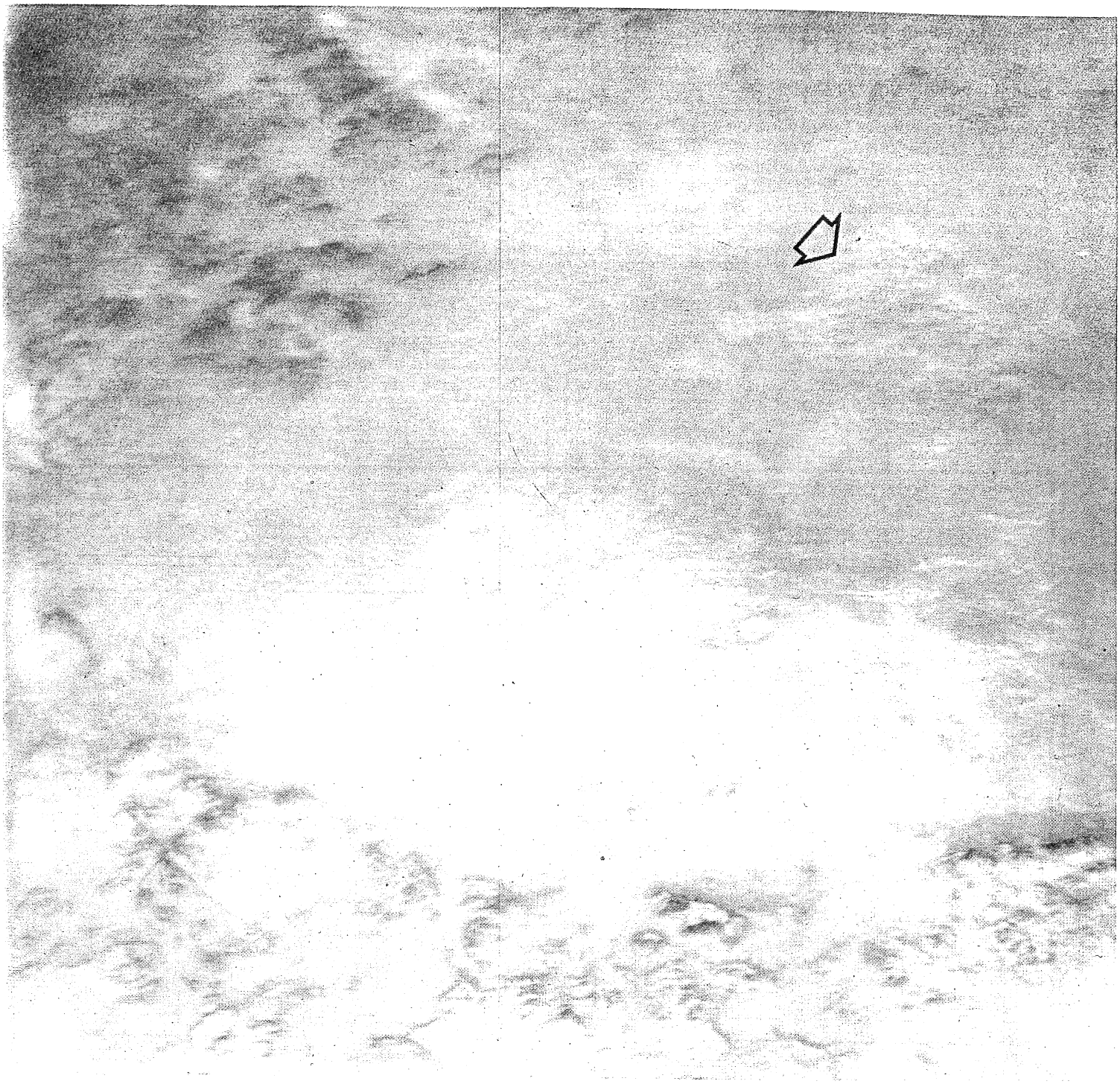
RCE parameter changes, DCS parameter changes and Data Base changes are most easily rubbed by rechanging the values back to what they were originally and then letting the data base compare in the Apply program find the null change and erase it with a REV roll as outlined earlier. These changes can be rubbed using the rub function directly but it involves entering a calculated value which is usually impractical.

FIN OR FINISH: The FIN operation is used after all changes have been entered and the change section of the program is to be exited. The operation causes the changes to be sorted and rubs to be executed.

ADDITIONAL COMMANDS — CONTROL

ADD TO CHANGE: "Add to" is used if a Change file is to be added to, as opposed to being created from scratch. Since the SIP generation is iterative it usually takes between 5 and 15 revisions to get a product which is acceptable. When a Change file is added to it will contain all its initial changes in addition to any that are added with the exception of changes which have for some reason been rubbed in the adding to process. All operations are the same when making changes after the "Add to" command as they were after the "Create CH" command given above.

APPLY CHANGE: The Apply option is used to apply all changes in the current Change file to the data base in the current Mission file. This operation is quite time consuming. It usually took between 5 and 45 minutes during the primary mission and still takes up to five minutes today with the use of the *send* command supplied by the fast BASIC ONE ROM from INFOTEK. The send command shifts the contents of arrays at a speed which is up to 200 times faster than the equivalent BASIC loop and is one of the commands which is not usually available to the BASIC user. The use of the "Apply CH" was outlined in the section describing how UPLINK tapes are prepared but one feature was not mentioned. The apply change will not allow a data base com-



Viking photographs a Martian dust storm. In this picture from Viking Orbiter 2, a turbulent, bright dust cloud (arrow) more than 300 kilometers (186 miles) across can be seen inside the great Argyre Basin. It is apparently moving eastward under the influence of strong winds that also create condensate lee-wave clouds to the west of the basin. This is the first color picture of a dust storm taken from a spacecraft orbiting the planet. Large depressions like Argyre and Hellas seem to be favored locations for the formation of dust storms. The great Argyre Basin in the southern hemisphere of Mars is one of several enormous depressions created by the impact of large asteroids early in the planet's history.

pare if the Change file being applied has not been stored first. The reason for this is that confusion would arise if database conflicts were found and corrections stored before the initial Change file had been stored.

STORED MISSION: Store MI is used to store the result of an *apply* on the UPLINK tape following the one in which the *apply* was performed. The *apply* will have produced a Mission file which will look like the one on the on-board computer after the UPLINK and that is therefore the data base of the subsequent UPLINK. The number of the operator, the data and UPLINK number will also be stored along with the rest of the mission. (Figure 7)

STORE CH: Store CH is used to store the change currently residing in the computer and as with the "Store Mission" command the operator number, data and UPLINK sol are also stored. The number of the revision is internally tracked and stored along with the rest of the information.

LIST: There are three list options in the control program: Change, Summary and U/L (for UPLINK). "Change" causes the listing of the current change file to be listed as shown in Figure 8. Summary gives a listing of the data base or mission currently in memory as shown in Figure 7. U/L is used when a whole UPLINK package or SIP is to be produced. It will generate both the Change listing and the Summary listing while being in the control program, then call in the plan program and list the LSEQ summary, Use List REV record and Skyline listings and plots as described in the plan section below. The operator is asked to give the date and time of the listing so that the different listings can be identified. A problem which occurred with some frequency before this addition was made was that two listings existed with the same revision number but with different missions as the base and it was not always apparent which was the most current one.

BOOK: The tape option in the book subsection was described above. There are two more options: "Clean" and "Carry." The Clean operation is used to clean out all MSETs out of the data base which are no longer of any use because they have already been executed. It is easy to see that MSETs would keep adding up in numbers forever if the "clean" operation were not available. The Carry option simply performs the "clean" and "tape"

```
--------------------------------------------------------------------------

JUNE 23, 21:20
TRANS. MODE?REC
PICT. CLASS?ALL
PLOT??Y
PLOTTER
CONT
--------------------------------------------------------------------------

JUNE 23, 21:20



LIST OF ALL IMAGES BY REC MODE OF
TRANSMISSION FROM RCE ON SOL 336
TO RCE SOL 338 PER VL 1 U/L- 330 REV.  8


RECORDED IMAGING

 LIST   TYPE  CAM. START    END    EPA      TIME      CMD.  BITS   DUR.
  NO.   PIC.         AZ.     AZ.           HR.:MIN        X10↑6
IMAGES ON SOL 337

   1    SUN     1  247.5  250.0   14.4     9:44     40    0.23   14.53
        GAIN: 0             REASON:  DAILY AM SUN DIODE
   2    BLU     2  185.0  187.5   10.0     18: 41    54    0.09    5.64
        GAIN: 2             REASON:  SKY COLOR, OZONE STUDY
   3    GRN     2  185.0  187.5   10.0     18: 43    55    0.09    5.64
        GAIN: 2             REASON:  SKY COLOR, OZONE STUDY
   4    BLU     2  185.0  187.5   10.0     18: 45    56    0.09    5.64
        GAIN: 1             REASON:  SKY COLOR, OZONE STUDY
   5    GRN     2  185.0  187.5   10.0     18: 47    57    0.09    5.64
        GAIN: 1             REASON:  SKY COLOR, OZONE STUDY
   6    BLU     2  185.0  187.5   10.0     19: 18    58    0.09    5.64
        GAIN: 0             REASON:  SKY COLOR, OZONE STUDY
   7    GRN     2  185.0  187.5   10.0     19: 20    59    0.09    5.64
        GAIN: 1             REASON:  SKY COLOR, OZONE STUDY
                              TOTAL BITS THIS MODE/SOL:   0.77

IMAGES ON SOL 338

   8    SUN     1  247.5  250.0   14.4     9: 44     40    0.23   14.53
        GAIN: 0             REASON:  DAILY AM SUN DIODE
   9    BB1     2  150.0  155.0    0.0     12: 24    48    0.45   27.86
        GAIN: 3             REASON:  SURFACE SAMPLER MAGNETS
  10    BB1     2   27.5   35.0  -10.0     12: 53    49    0.66   41.20
        GAIN: 4             REASON:  FUNNEL THROUGH MIRROR
  11    SUR     2  152.5  162.5  -30.0     13:  5    17    0.30   18.98
        GAIN: 4             REASON:  SURFACE SAMPLER TRENCH

                                      TOTAL BITS THIS MODE:   2.42
```

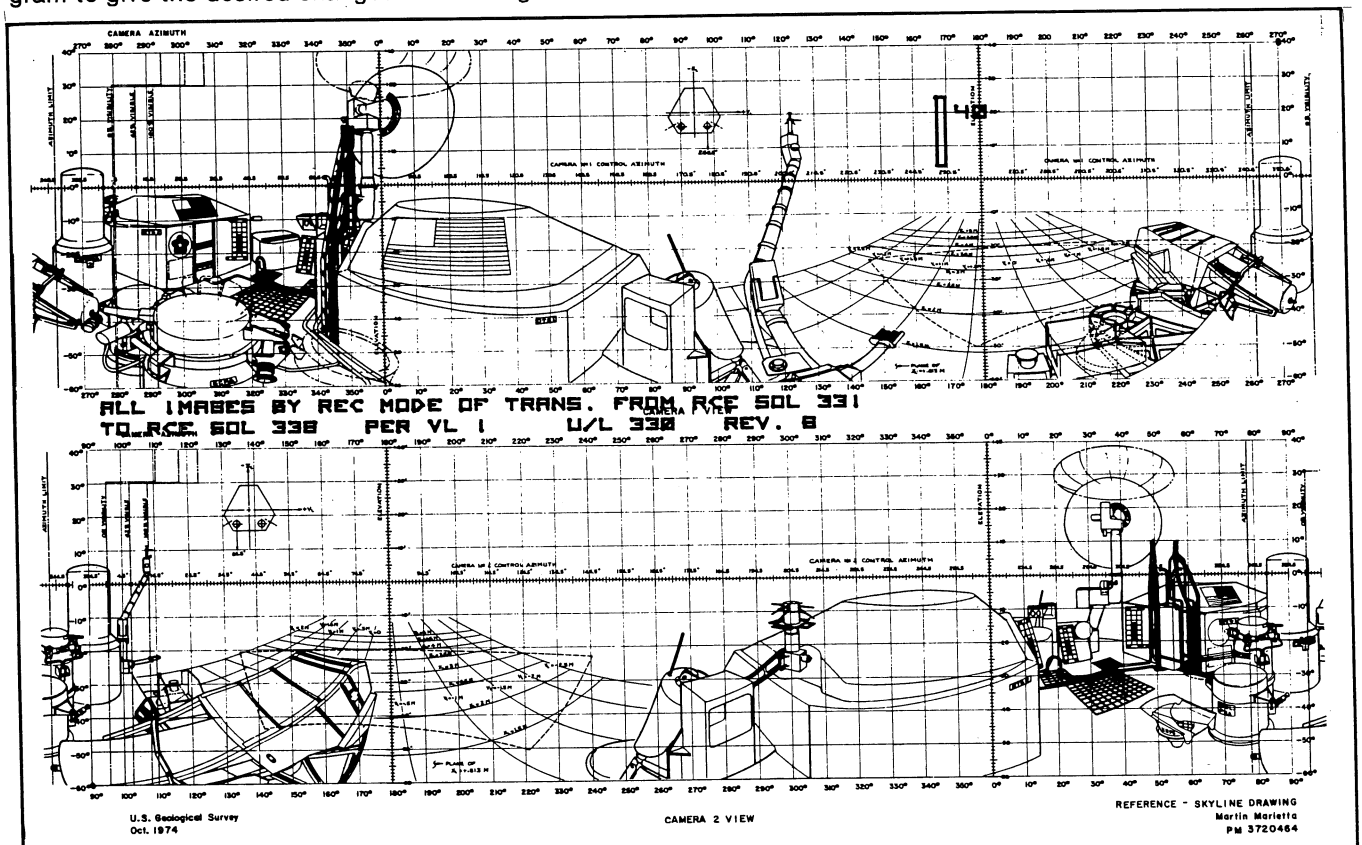
command sequentially so that the operator does not have to sit idly by waiting for the tape program to come back with questions every five or ten minutes.

PLAN: Plan is the last command to be executed in the control section of the program. It causes the plan program to be loaded, giving access to the options available in that program. The load time is on the order of a few minutes and puts some limitation on how many times the operator is willing to switch back and forth between the two programs. All the following operations are performed after entering the plan program.

USE LIST: The "Use List" command causes the program to go through the whole Mission file and find when and how each command is used, then list them in chronological order as shown in Figure 9. The list is used when planning a new UPLINK because it tells the reader which command can be changed and which have yet to be used for their designated purpose.

LSEQ: The "LSEQ" command gives a printout of the computer cards which are to be fed to the LSEQ program to give the desired changes. The listing is divided into four parts, "Insert table changes," "Remove table changes," "Insert MSET changes" and "Remove MSET changes." The use of Insert change is straightforward, a change is simply to be added. Remove change on the other hand is not so simple. In the case of a change to an MSET change the old MSET change has to be removed, then the new one inserted. Command changes are removed if a previously submitted command change has been rubbed completely. If a command change has simply been rechanged it would only show up on the Insert list as a "was"-"now" input where the "was" lists the change which is to be replaced and the "now" is what is to replace it. The LSEQ list is the most important part of the whole lander imaging SIP. It alone would be enough to command the lander if no mistakes were ever to be made so that no supplemental information was needed. A typical LSEQ listing is shown in Figure 10.

SKY: "Sky" is a command which is used to plot the images to be taken on what is called a skyline drawing. A typical skyline is shown in Figure 6. The skylines are plotted on a return-to-return basis, i.e. a skyline will contain all the images returned by RCE, DCS or REC on a



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LIST OF ALL IMAGES BY REC MODE OF
TRANSMISSION FROM RCE ON SOL 331
TO RCE SOL 336 PER VL 1 U/L- 330 REV. 8

RECORDED IMAGING

LIST NO.	TYPE PIC.	CAM.	START AZ.	END AZ.	EPA	TIME HR.:MIN	CMD.	BITS X10↑6	DUR.
IMAGES ON SOL 333									
1	SUN	1	247.5	250.0	14.4	9: 42	40	0.23	14.53
	GAIN: 0			REASON: DAILY AM SUN DIODE					
						TOTAL BITS THIS MODE:		0.23	

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SIP NO: VL 1- 330 U/L-CAM-REV 8

VIKING LANDER CAMERA SYSTEM

COMPLETE DATA BASE SUMMARY

(SCIENCE INSTRUMENT PARAMETER LIST)

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SIP NO: VL 1- 330 U/L-CAM-REV 8

RECORDED IMAGING MSET TABLE.
THE TOTAL NUMBER OF MSET ENTRIES IS: 94

SOL	TIME HR.:MIN:SEC.	CYC	CMD. NO.	CAM. NO.	PRE CAL	POST CAL	STOW	RE- SCAN	DUST
321	9: 32: 30	0	39	1	0	0	1	0	0
321	11: 9: 30	0	62	2	0	0	1	0	0
321	11: 11: 20	0	57	2	0	0	0	0	0
321	11: 16: 45	0	58	2	0	0	1	0	0
321	11: 22: 30	0	61	1	0	0	0	0	0
321	11: 26: 50	0	47	1	0	0	0	0	0
321	11: 27: 50	0	58	1	0	0	0	0	0
321	11: 32: 10	0	47	1	0	0	1	0	0
322	9: 32: 55	0	39	1	0	0	1	0	0
323	9: 33: 20	0	39	1	0	0	1	0	0
323	16: 32: 20	0	37	2	0	0	1	0	0
324	8: 32: 0	0	59	2	0	0	0	0	0
324	8: 41: 0	0	60	2	0	0	1	0	0
324	8: 58: 20	0	38	1	0	0	1	0	0
324	11: 52: 0	0	80	2	0	0	1	0	0
324	13: 7: 0	0	42	2	0	0	1	0	0
324	13: 18: 55	0	46	1	0	0	0	0	0
324	13: 20: 45	0	43	1	0	0	1	0	0
324	13: 22: 47	0	44	2	0	0	0	0	0
324	13: 23: 58	0	45	2	0	0	1	0	0
324	16: 38: 45	0	37	2	0	0	1	0	0
325	9: 34: 9	0	39	1	0	0	1	0	0
326	7: 0: 0	0	99	1	0	1	1	0	0
326	9: 34: 34	0	39	1	0	0	1	0	0
326	10: 0: 0	0	48	1	0	0	1	0	0
326	13: 0: 0	0	99	2	0	1	1	0	0
327	9: 34: 59	0	39	1	0	0	1	0	0
328	8: 7: 0	0	63	1	0	0	0	0	0
328	8: 8: 0	0	64	1	0	0	0	0	0
328	8: 9: 0	0	65	1	0	0	1	0	0
328	8: 55: 0	0	66	1	0	0	0	0	0
328	8: 57: 0	0	68	1	0	0	1	0	0
328	9: 50: 0	0	66	1	0	0	0	0	0
328	9: 51: 0	0	67	1	0	0	0	0	0
328	9: 52: 0	0	68	1	0	0	0	0	0
328	9: 55: 24	0	51	1	0	0	1	0	0
328	10: 35: 24	0	52	1	0	0	0	0	0
328	10: 37: 0	0	69	1	0	0	0	0	0
328	10: 39: 0	0	68	1	0	0	1	0	0
328	11: 55: 24	0	53	1	0	0	0	0	0
328	11: 57: 0	0	69	1	0	0	0	0	0
328	11: 58: 0	0	70	1	0	0	0	0	0
328	11: 59: 0	0	68	1	0	0	1	0	0
328	15: 0: 24	0	54	1	0	0	0	0	0
328	15: 2: 0	0	69	1	0	0	0	0	0
328	15: 3: 0	0	70	1	0	0	0	0	0
328	15: 4: 0	0	68	1	0	0	1	0	0
328	16: 10: 24	0	55	2	0	0	1	0	0
328	16: 12: 0	0	66	1	0	0	0	0	0
328	16: 13: 0	0	67	1	0	0	0	0	0
328	16: 14: 0	0	68	1	0	0	1	0	0
328	16: 50: 24	0	56	2	0	0	1	0	0

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SIP NO: VL 1- 330 U/L-CAM-REV 8

RECORDED IMAGING MSET TABLE.
THE TOTAL NUMBER OF MSET ENTRIES IS: 94

SOL	TIME HR.:MIN:SEC.	CYC	CMD. NO.	CAM. NO.	PRE CAL	POST CAL	STOW	RE- SCAN	DUST
328	16: 52: 0	0	66	1	0	0	0	0	0
328	16: 54: 0	0	68	1	0	0	1	0	0
328	17: 47: 0	0	63	1	0	0	0	0	0
328	17: 48: 0	0	64	1	0	0	0	0	0
328	17: 49: 0	0	65	1	0	0	1	0	0
329	9: 35: 48	0	39	1	0	0	1	0	0
330	9: 36: 13	0	39	1	0	0	1	0	0
330	14: 0: 0	0	79	2	0	0	1	0	0
331	9: 36: 38	0	39	1	0	0	1	0	0
333	9: 42: 27	0	40	1	0	0	1	0	0
337	9: 44: 6	0	40	1	0	0	1	0	0
337	18: 41: 36	0	54	2	0	0	0	0	0
337	18: 43: 0	0	55	2	0	0	0	0	0
337	18: 45: 0	0	56	2	0	0	0	0	0
337	18: 47: 0	0	57	2	0	0	1	0	0
337	19: 18: 0	0	58	2	0	0	0	0	0
337	19: 20: 0	0	59	2	0	0	1	0	0
338	9: 44: 31	0	40	1	0	0	1	0	0
338	12: 24: 0	0	48	2	0	0	1	0	0
338	12: 53: 40	0	49	2	0	0	1	0	0
338	13: 5: 0	0	17	2	0	0	1	0	0
339	9: 44: 56	0	40	1	0	0	1	0	0
339	12: 0: 0	0	81	2	0	0	1	0	0
340	9: 45: 21	0	40	1	0	0	1	0	0
354	10: 0: 0	1	71	1	0	0	1	0	0
354	10: 20: 0	1	82	1	0	0	0	0	0
354	10: 23: 0	1	83	1	0	0	0	0	0
354	10: 26: 0	1	84	1	0	1	1	0	0
354	10: 30: 0	1	76	2	0	1	1	0	0
359	9: 15: 0	1	90	1	0	0	1	0	0
359	10: 0: 0	1	72	1	0	0	1	0	0
359	10: 20: 0	1	79	2	0	0	1	0	0
359	11: 20: 0	1	81	2	0	1	1	0	0
364	10: 0: 0	1	71	1	0	0	1	0	0
364	10: 20: 0	1	82	1	0	0	0	0	0
364	10: 23: 0	1	83	1	0	0	0	0	0
364	10: 26: 0	1	84	1	0	1	1	0	0
364	10: 30: 0	1	76	2	0	1	1	0	0
369	9: 15: 0	1	90	1	0	0	1	0	0
369	10: 0: 0	1	72	1	0	0	1	0	0
369	10: 20: 0	1	79	2	0	0	1	0	0
369	11: 20: 0	1	81	2	0	1	1	0	0

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CMD NO.	GAIN	*** COMMAND TABLE *** DR.	CH.	MD.	OFF	DCI	START AZ.	END AZ.	EL	
1	4	0	5	2	1	0	77.5	87.5	0	.....
2	3	0	5	2	1	0	97.5	107.5	0	.....
3	4	0	0	2	1	0	105.0	115.0	-40	.....
4	5	0	8	2	1	0	235.0	245.0	-50	.....
5	4	1	14	3	1	0	35.0	40.0	-10	.....
6	3	1	9	1	1	0	35.0	40.0	-10	.....
7	3	1	1	1	1	0	35.0	40.0	-10	.....
8	4	1	14	3	1	0	305.0	310.0	-10	.....
9	4	1	9	1	1	0	305.0	310.0	-10	.....
10	4	1	1	1	1	0	305.0	310.0	-10	.....
11	4	1	1	1	1	0	232.5	250.0	10	.....
12	3	1	0	2	1	0	82.5	112.5	-30	.....
13	3	1	3	2	1	0	222.5	315.0	-20	.....
14	4	1	1	1	1	0	42.5	60.0	-20	.....
15	4	1	1	1	1	0	285.0	302.5	-20	.....
16	4	1	3	2	1	0	175.0	245.0	0	.....
17	4	1	14	3	1	0	152.5	162.5	-30	.....
18	3	1	13	2	1	0	82.5	87.5	-20	.....
19	3	1	13	2	1	0	207.5	217.5	-30	.....
20	3	1	13	2	1	0	22.5	32.5	-20	.....
21	2	1	1	1	1	0	55.0	137.5	-20	.....
22	2	1	0	2	1	0	85.0	167.5	-30	.....
23	2	1	8	2	1	0	75.0	157.5	-50	.....
24	2	1	1	1	1	0	150.0	232.5	-20	.....
25	2	1	13	2	1	0	150.0	232.5	-10	.....
26	2	1	8	2	1	0	182.5	265.0	-50	.....
27	4	0	1	1	1	0	187.5	187.5	10	.....
28	2	0	1	1	1	0	190.0	190.0	10	.....
29	0	0	1	1	1	0	192.5	192.5	10	.....
30	0	0	1	1	1	0	55.0	55.0	10	.....
31	2	0	1	1	1	0	57.5	57.5	10	.....
32	4	0	1	1	1	0	60.0	60.0	10	.....
33	1	1	4	2	1	0	167.5	170.0	30	.....
34	1	1	4	2	1	0	75.0	77.5	30	.....
35	0	1	4	2	1	0	252.5	255.0	30	.....
36	0	1	4	2	1	0	170.0	172.5	20	.....
37	1	1	4	2	1	0	170.0	172.5	20	.....
38	0	1	4	2	1	0	242.5	245.0	10	.....
39	0	1	4	2	1	0	247.5	250.0	20	.....
40	0	1	4	2	1	0	247.5	250.0	20	.....
41	1	1	4	2	1	0	172.5	175.0	20	.....
42	4	1	8	2	1	0	17.5	22.5	-10	.....
43	4	1	13	2	1	0	267.5	280.0	-20	.....
44	4	1	13	2	1	0	87.5	92.5	-20	.....
45	4	1	13	2	1	0	77.5	85.0	-20	.....
46	4	1	0	2	1	0	215.0	227.5	-30	.....
47	1	1	4	3	1	0	267.5	272.5	10	.....
48	3	1	8	2	1	0	150.0	155.0	0	.....
49	4	1	8	2	1	0	27.5	35.0	-10	.....
50	3	1	8	2	3	0	27.5	35.0	-10	.....

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CMD NO.	GAIN	*** COMMAND TABLE *** DR.	CH.	MD.	OFF	DCI	START AZ.	END AZ.	EL	
51	1	1	4	3	1	0	250.0	252.5	10	.....
52	1	1	4	3	1	0	257.5	260.0	10	.....
53	2	1	4	3	1	0	275.0	277.5	10	.....
54	2	1	1	3	1	0	185.0	187.5	10	.....
55	2	1	2	3	1	0	185.0	187.5	10	.....
56	1	1	3	3	1	0	185.0	187.5	10	.....
57	1	1	2	3	1	0	185.0	187.5	10	.....
58	0	1	1	3	1	0	185.0	187.5	10	.....
59	1	1	2	3	1	0	185.0	187.5	10	.....
60	3	1	9	1	1	0	155.0	237.5	10	.....
61	5	1	9	1	16	0	235.0	275.0	10	.....
62	4	1	9	1	1	0	285.0	295.0	-10	.....
63	2	1	1	1	1	0	210.0	212.5	0	.....
64	2	1	9	1	1	0	210.0	212.5	0	.....
65	2	1	14	3	1	0	210.0	212.5	0	.....
66	3	1	1	1	1	0	210.0	212.5	0	.....
67	3	1	9	1	1	0	210.0	212.5	0	.....
68	3	1	14	3	1	0	210.0	212.5	0	.....
69	4	1	1	1	1	0	210.0	212.5	0	.....
70	4	1	9	1	1	0	210.0	212.5	0	.....
71	3	1	13	2	1	0	150.0	220.0	-10	.....
72	3	1	0	2	1	0	160.0	250.0	-30	.....
73	3	1	8	2	1	0	182.5	270.0	-50	.....
74	3	1	5	2	1	0	70.0	115.0	0	.....
75	3	1	1	1	1	0	55.0	155.0	-30	.....
76	4	1	0	2	1	0	95.0	145.0	-30	.....
77	3	1	8	2	1	0	55.0	117.5	-50	.....
78	4	1	13	2	1	0	5.0	35.0	-10	.....
79	3	1	0	2	1	0	12.5	35.0	-20	.....
80	4	1	1	1	1	0	280.0	322.5	-20	.....
81	4	1	1	1	1	0	280.0	315.0	-20	.....
82	4	1	8	2	1	0	182.5	195.0	-50	.....
83	4	1	8	2	1	0	205.0	227.5	-50	.....
84	4	1	8	2	1	0	235.0	250.0	-50	.....
85	3	1	9	1	1	0	0.0	0.0	0	.....
86	2	1	1	2	1	0	0.0	0.0	0	.....
87	2	1	1	2	1	0	0.0	0.0	0	.....
88	1	1	1	2	1	0	0.0	0.0	0	.....
89	1	1	1	2	1	0	0.0	0.0	0	.....
90	3	1	4	3	1	0	225.0	265.0	10	.....
91	3	1	14	2	1	0	20.0	20.0	-10	.....
92	2	1	0	2	1	0	95.0	105.0	-20	.....
93	1	1	0	2	1	0	95.0	105.0	-20	.....
94	4	1	1	2	1	0	197.5	220.0	-30	.....
95	4	1	3	2	1	0	197.5	220.0	-30	.....
96	4	1	2	2	1	0	197.5	220.0	-30	.....
97	3	1	1	1	1	0	55.0	150.0	-30	.....
98	4	1	8	2	1	0	177.5	195.0	-50	.....
99	4	1	8	3	1	0	0.0	5.0	0	.....

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DCS PARAMETER TABLE

TABLE	OPT.	CMD.	DUR.	CAM.	STOW
1	1	1	2820.0	2	1
1	2	2	2820.0	2	1
2	1	3	1620.0	2	1
2	2	4	3420.0	1	1

DCS MSET TABLE.

SOL	TIME HR.:MIN:SEC	PAR.	OPTIONS
327	10 0 0	2	0, 0
331	10 0 0	2	0, 0
334	12 30 0	2	0, 0
338	16 30 0	2	0, 0
339	16 0 0	2	0, 0
344	13 0 0	2	1, 0
345	12 0 0	2	0, 0
346	11 30 0	2	0, 0

Figure 7.

Figure 7. Cont.

```
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RCE PARAMETER TABLE

TABLE   OPT. CMD.   DUR.     CAM. STOW

   1     1    11    96.0      2     1
   1     2    12   170.0      2     1
   1     3    13   494.4      1     1
   1     4    14   100.0      1     1
   1     5    15   100.0      2     1
   1     6    16   373.0      2     1
   2     1    21   448.0      2     1
   2     2    22   448.0      2     1
   2     3    23   448.0      2     1
   2     4    24   438.0      1     1
   2     5    25   438.0      1     1
   2     6    26   438.0      1     1

RCE MSET TABLE

 SOL        TIME          PAR.   OPTIONS
          HR.:MIN:SEC

 323     10 14 53          1     12,    0
 324      9  8 48          1      0,   45
 325      7 21 20          1      1,    0
 327     10  0  0          1      0,    0
 330      2  0  0          1      0,    0
 331     10  0  0          1      0,    0
 336     20 40  0          1      0,    0
 338     16 30  0          1      0,    0
 339     16  0  0          1      0,    0
 343      8  0  0          1    123,  456
 344     12 30  0          1      0,    0
 345     12  0  0          1      0,    0
 347     22 30  0          1      1,    0
 355      8  6 15          2      1,    4
 355     17 58 27          2      1,    4
 360      8  6  0          2      1,    4
 360     17 58  0          2      1,    4
 365      8  6  0          2      2,    5
 365     17 58  0          2      2,    5
 370      8  6  0          2      3,    6
 370     17 58  0          2      3,    6

----------
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IMAGING DATA BASE PARAMETERS: (INCOMPLETE LIST)

RSCN.DT          1500.00 SEC.
RUNUP.RESCAN        1.20 SEC.
```

specified link, show where the pictures are located, which commands were used, which camera, the time of the pictures, how many megabits of data they used, the duration of the images, the gains used and finally what were the reasons for the pictures. The skylines are produced on a Hewlett Packard 9862A plotter of 15 by 10 inches. (See Figures 6a and 6b and listing).

REV RECORD: The "Rev Record" lists the history of an UPLINK package. It lists the number of the revisions; on which sol the UPLINK is to take place; on which date the rev was created and by whom. The primary purpose of the listing is to simplify error searching by immediately defining who did what, when. Figures 11a and 11b show the revision record for the SIP of the 330 UPLINK.

CONTROL: The "CONT" or "Control" command reloads the control program in place of plan. Thus if a skyline has shown that too many megabits were used on a particular return the operator will return to the control program to make a new revision which will hopefully bring the data within allocation.

ADDITIONAL BOOKKEEPING

In addition to the bookkeeping performed in the programs there is also manual bookkeeping to keep track of the automated bookkeeping. There are three things which have to be tracked: what changes were rolled where and when, why was a revision created and finally which revision was used to create a SIP which was submitted to LSEQ.

Two charts are kept for this bookkeeping, one being a subset of the other. Figure 11b shows the chart on which LSEQ submissions and revision reasons are tracked. It also tracks the operator who created the changes, when the change was made, which revision of the previous UPLINK was used to create the data base,

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UPLINK SUMMARY

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SIP NO: VL 1- 330 U/L-CAM-REV 8

TABLE OF IMAGING COMMAND CHANGES:

	CMD. NO.	GAIN	DR.	CH.	MD.	OFF	DCI	START AZ.	END AZ.	EL
WAS:		3	###	13	2	###	###	275.0	280.0	-20
NOW:	17	4	1	14	3	1	0	152.5	162.5	-30
WAS:		1	###	###	###	###	###	######	#####+	###
NOW:	40	0	1	4	2	1	0	247.5	250.0	20
WAS:		2	###	###	###	###	###	170.0	172.5	###
NOW:	41	1	1	4	2	1	0	172.5	175.0	20
WAS:		4	###	5	###	###	###	160.0	167.5	-10
NOW:	48	3	1	8	2	1	0	150.0	155.0	0
WAS:		###	###	0	###	###	###	180.0	260.0	-30
NOW:	49	4	1	8	2	1	0	27.5	35.0	-10
WAS:		###	###	4	###	###	###	327.5	330.0	###
NOW:	54	2	1	1	3	1	0	185.0	187.5	10
WAS:		1	###	4	###	###	###	165.0	167.5	###
NOW:	55	2	1	2	3	1	0	185.0	187.5	10
WAS:		0	###	4	###	###	###	172.5	175.0	###
NOW:	56	1	1	1	3	1	0	185.0	187.5	10
WAS:		4	###	1	1	###	###	285.0	295.0	-10
NOW:	57	1	1	2	3	1	0	185.0	187.5	10
WAS:		5	###	###	1	16	###	235.0	27[illegible].0	###
NOW:	58	0	1	1	3	1	0	185.0	187.5	10
WAS:		3	###	1	1	###	###	155.0	237.5	###
NOW:	59	1	1	2	3	1	0	185.0	187.5	10

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SIP NO: VL 1- 330 U/L-CAM-REV 8

CHANGES TO THE MSET TABLE FOR RECORDED IMAGING:

SOL	TIME HR:MIN:SEC.	CYC.	CMD. NO.	CAM. NO.	PRE CAL	POST CAL	STOW	RE- SCAN	DUST
ADD: 333	9: 42: 27	0	40	1	0	0	1	0	0
ADD: 337	9: 44: 6	0	40	1	0	0	1	0	0
ADD: 337	18: 41: 36	0	54	2	0	0	0	0	0
ADD: 337	18: 43: 0	0	55	2	0	0	0	0	0
ADD: 337	18: 45: 0	0	56	2	0	0	0	0	0
ADD: 337	18: 47: 0	0	57	2	0	0	1	0	0
ADD: 337	19: 18: 0	0	58	2	0	0	0	0	0
ADD: 337	19: 20: 0	0	59	2	0	0	1	0	0
ADD: 338	9: 44: 31	0	40	1	0	0	1	0	0
ADD: 338	12: 24: 0	0	48	2	0	0	1	0	0
ADD: 338	12: 53: 40	0	49	2	0	0	1	0	0
ADD: 338	13: 5: 0	0	17	2	0	0	1	0	0
ADD: 339	9: 44: 56	0	40	1	0	0	1	0	0
ADD: 339	12: 0: 0	0	81	2	0	0	1	0	0
ADD: 340	9: 45: 21	0	40	1	0	0	1	0	0
ADD: 359	9: 15: 0	1	90	1	0	0	1	0	0
ADD: 359	10: 0: 0	1	72	1	0	0	1	0	0
ADD: 359	10: 20: 0	1	79	2	0	0	1	0	0
ADD: 359	11: 20: 0	1	81	2	0	1	1	0	0
ADD: 364	10: 0: 0	1	71	1	0	0	1	0	0
ADD: 364	10: 20: 0	1	82	1	0	0	0	0	0
ADD: 364	10: 23: 0	1	83	1	0	0	0	0	0
ADD: 364	10: 26: 0	1	84	1	0	1	1	0	0
ADD: 364	10: 30: 0	1	76	2	0	1	1	0	0
ADD: 369	9: 15: 0	1	90	1	0	0	1	0	0
ADD: 369	10: 0: 0	1	72	1	0	0	1	0	0
ADD: 369	10: 20: 0	1	79	2	0	0	1	0	0
ADD: 369	11: 20: 0	1	81	2	0	1	1	0	0
DEL: 339	9: 15: 0	1	90	1	0	0	1	0	0
DEL: 339	10: 0: 0	1	72	1	0	0	1	0	0
DEL: 339	10: 20: 0	1	79	2	0	0	1	0	0
DEL: 339	11: 20: 0	1	81	2	0	1	1	0	0
DEL: 344	10: 0: 0	1	71	1	0	0	1	0	0
DEL: 344	10: 20: 0	1	82	1	0	0	0	0	0
DEL: 344	10: 23: 0	1	83	1	0	0	0	0	0
DEL: 344	10: 26: 0	1	84	1	0	1	1	0	0
DEL: 344	10: 30: 0	1	76	2	0	1	1	0	0
DEL: 349	9: 15: 0	1	90	1	0	0	1	0	0
DEL: 349	10: 0: 0	1	72	1	0	0	1	0	0
DEL: 349	10: 20: 0	1	79	2	0	0	1	0	0
DEL: 349	11: 20: 0	1	81	2	0	1	1	0	0

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SIP NO: VL 1- 330 U/L-CAM-REV 8

CHANGES TO THE DCS PARAMETER TABLE:

	TAB.	OPT.	CMD.	TIME SEC.	CAM.	STOW
FROM			3	3420.0	2	1
TO	2	1	3	1620.0	2	1

CHANGES TO THE DCS MSET IMAGING PARAMETERS:

SOL	TIME HR.:MIN:SEC.	PAR.	OPTIONS
ADD 334	12 30 0	2	0, 0
ADD 338	16 30 0	2	0, 0
ADD 339	16 0 0	2	0, 0
ADD 344	13 0 0	2	1, 0
ADD 345	12 0 0	2	0, 0
ADD 346	11 30 0	2	0, 0

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CHANGES TO THE RCE PARAMETER TABLE:

	TAB.	OPT.	CMD.	TIME SEC.	CAM.	STOW

CHANGES TO THE RCE MSET IMAGING PARAMETERS:

SOL	TIME HR.:MIN:SEC.	PAR.	OPTIONS
ADD 336	20 40 0	1	0, 0
ADD 338	16 30 0	1	0, 0
ADD 339	16 0 0	1	0, 0
ADD 341	14 0 0	1	0, 0
ADD 343	8 0 0	1	123, 456
ADD 344	12 30 0	1	0, 0
ADD 345	12 0 0	1	0, 0
ADD 347	22 30 0	1	1, 0
ADD 360	17 58 0	2	1, 4
ADD 360	8 6 0	2	1, 4
ADD 365	17 58 0	2	2, 5
ADD 365	8 6 0	2	2, 5
ADD 370	17 58 0	2	3, 6
ADD 370	8 6 0	2	3, 6
DEL 340	17 58 0	2	1, 4
DEL 340	8 6 0	2	1, 4
DEL 341	14 0 0	1	0, 0
DEL 345	17 58 0	2	2, 5
DEL 345	8 6 0	2	2, 5
DEL 350	17 58 0	2	3, 6
DEL 350	8 6 0	2	3, 6

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SIP NO: VL 1- 330 U/L-CAM-REV 8

IMAGING DATA BASE PARAMETER CHANGES:

WAS:		1500.00
NOW:	RSCN.DT	1500.00
WAS:		2.50
NOW:	PUNUP.RESCAN	1.20

***APPROXIMATE U/L COMMAND WORD COUNT IS: 153 ***

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LIST OF THE ORDER OF USE OF EACH COMMAND IN MISSION VL 1 U/L 330, REV. 8

CMD.	MODE	CAM.	SOL	HR.:MIN.	**AZ.
3	DCS PRE	2	344	13: 0	10.00
11	RCE PRE	2	323	10: 14	17.50
11	RCE PRE	2	325	7: 21	17.50
11	RCE PRE	2	343	8: 0	17.50
11	RCE PRE	2	347	22: 30	17.50
12	RCE PRE	2	323	10: 14	30.00
12	RCE PRE	2	343	8: 0	30.00
13	RCE PRE	1	343	8: 0	92.50
14	RCE PST	1	324	9: 8	17.50
14	RCE PST	1	343	8: 0	17.50
15	RCE PST	2	324	9: 8	17.50
15	RCE PST	2	343	8: 0	17.50
16	RCE PST	2	343	8: 0	70.00
17	REC	2	338	13: 5	3.33
21	RCE PRE	2	355	8: 6	82.50
21	RCE PRE	2	355	17: 58	82.50
21	RCE PRE	2	360	8: 6	82.50
21	RCE PRE	2	360	17: 58	82.50
22	RCE PRE	2	365	8: 6	82.50
22	RCE PRE	2	365	17: 58	82.50
23	RCE PRE	2	370	8: 6	82.50
23	RCE PRE	2	370	17: 58	82.50
24	RCE PST	1	355	8: 6	82.50
24	RCE PST	1	355	17: 58	82.50
24	RCE PST	1	360	8: 6	82.50
24	RCE PST	1	360	17: 58	82.50
25	RCE PST	1	365	8: 6	82.50
25	RCE PST	1	365	17: 58	82.50
26	RCE PST	1	370	8: 6	82.50

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LIST OF THE ORDER OF USE OF EACH COMMAND IN MISSION VL 1 U/L 330, REV. 8

CMD.	MODE	CAM.	SOL	HR.:MIN.	**AZ.
26	RCE PST	1	370	17: 58	82.50
37	REC	2	323	16: 38	2.50
37	REC	2	324	16: 38	2.50
38	REC	1	324	8: 58	2.50
39	REC	1	321	9: 32	2.50
39	REC	1	322	9: 32	2.50
39	REC	1	323	9: 33	2.50
39	REC	1	325	9: 34	2.50
39	REC	1	326	9: 34	2.50
39	REC	1	327	9: 34	2.50
39	REC	1	329	9: 35	2.50
39	REC	1	330	9: 36	2.50
39	REC	1	331	9: 36	2.50
40	REC	1	333	9: 42	2.50
40	REC	1	337	9: 44	2.50
40	REC	1	338	9: 44	2.50
40	REC	1	339	9: 44	2.50
40	REC	1	340	9: 45	2.50
42	REC	2	324	13: 7	5.00
43	REC	1	324	13: 20	12.50
44	REC	2	324	13: 22	5.00
45	REC	2	324	13: 23	7.50
46	REC	1	324	13: 18	12.50
47	REC	1	321	11: 26	1.67
47	REC	1	321	11: 32	1.67
48	REC	1	326	10: 0	5.00
48	REC	2	338	12: 24	5.00
49	REC	2	338	12: 53	7.50
50	REC	2	321	11: 16	7.50

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LIST OF THE ORDER OF USE OF EACH COMMAND IN MISSION VL 1 U/L 330, REV. 8

CMD.	MODE	CAM.	SOL	HR.:MIN.	**AZ.
51	REC	1	328	9: 55	0.83
52	REC	1	328	10: 35	0.83
53	REC	1	328	11: 55	0.83
54	REC	1	328	15: 0	0.83
54	REC	2	337	18: 41	0.83
55	REC	2	328	16: 10	0.83
55	REC	2	337	18: 43	0.83
56	REC	2	328	16: 50	0.83
56	REC	2	337	18: 45	0.83
57	REC	2	321	11: 11	0.83
57	REC	2	337	18: 47	0.83
58	REC	1	321	11: 27	0.83
58	REC	2	337	19: 18	0.83
59	REC	2	324	8: 32	0.83
59	REC	2	337	19: 20	0.83
60	REC	2	324	8: 41	82.50
61	REC	1	321	11: 22	40.00
62	REC	2	321	11: 9	10.00
63	REC	1	328	8: 7	2.50
63	REC	1	328	17: 47	2.50
64	REC	1	328	8: 8	2.50
64	REC	1	328	17: 48	2.50
65	REC	1	328	8: 9	0.83
65	REC	1	328	17: 49	0.83
66	REC	1	328	8: 55	2.50
66	REC	1	328	9: 50	2.50
66	REC	1	328	16: 12	2.50
66	REC	1	328	16: 52	2.50
67	REC	1	328	9: 51	2.50
67	REC	1	328	16: 13	2.50
68	REC	1	328	8: 57	0.83
68	REC	1	328	9: 52	0.83
68	REC	1	328	10: 39	0.83
68	REC	1	328	11: 59	0.83
68	REC	1	328	15: 4	0.83
68	REC	1	328	16: 14	0.83
68	REC	1	328	16: 54	0.83

LIST OF THE ORDER OF USE OF EACH COMMAND IN MISSION VL 1 U/L 330, REV. 8

CMD.	MODE	CAM.	SOL	HR.:MIN.	**AZ.
69	REC	1	328	10: 37	2.50
69	REC	1	328	11: 57	2.50
69	REC	1	328	15: 2	2.50
70	REC	1	328	11: 58	2.50
70	REC	1	328	15: 3	2.50
71	REC CYC	1	354	10: 0	70.00
71	REC CYC	1	364	10: 0	70.00
72	REC CYC	1	359	10: 0	90.00
72	REC CYC	1	369	10: 0	90.00
76	REC CYC	2	354	10: 30	50.00
76	REC CYC	2	364	10: 30	50.00
79	REC	2	330	14: 0	22.50
79	REC CYC	2	359	10: 20	22.50
79	REC CYC	2	369	10: 20	22.50
80	REC	2	324	11: 52	42.50
81	REC	2	339	12: 0	35.00
81	REC CYC	2	359	11: 20	35.00
81	REC CYC	2	369	11: 20	35.00
82	REC CYC	1	354	10: 20	12.50
82	REC CYC	1	364	10: 20	12.50
83	REC CYC	1	354	10: 23	22.50
83	REC CYC	1	364	10: 23	22.50
84	REC CYC	1	354	10: 26	15.00
84	REC CYC	1	364	10: 26	15.00
90	REC CYC	1	359	9: 15	13.33
90	REC CYC	1	369	9: 15	13.33

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LIST OF THE ORDER OF USE OF EACH COMMAND IN MISSION VL 1 U/L 330, REV. 8

CMD.	MODE	CAM.	SOL	HR.:MIN.	**AZ.
99	REC	1	326	7: 0	1.67
99	REC	2	326	13: 0	1.67

when the data base was stored, who stored the data base and whether or not the data base was "cleaned" before storage.

The other chart, shown in Figure 12, tracks the progression of revision rolling, and revision creation. Whenever a change is made and rolled into the subsequent UPLINK the revision number is entered on the line of the UPLINK sol and the revision of the subsequent UPLINK at the time of the roll is entered on the line of that UPLINK. The line which is drawn on the outside of the revision numbers helps identify the progression.

PAST HISTORY OF THE UPLINK GENERATION —TEARS AND CHUCKLES

As was stated earlier, the equipment has had an almost trouble-free history but that does not mean that problems have been absent during the extensive length of time the machines have been in use. The worst problem encountered had to do with interference from a silent 700 terminal located in the same room as one of the HP's and fed from the same power line. Using the silent 700 would sometimes cause the tape drives to take off on their own, once wiping out a whole program tape which was being changed and of which there was no copy yet. As anyone who has ever lost a program knows, it is infinitely worse to have to reenter changes in the middle of rewriting than it is to make the changes initially. The erasure caused a large measure of grief and a very urgent call to the HP repair service. The problem was never really solved, but rather was successfully circumvented by plugging the silent 700 into an alternate outlet. Less disastrous manifestations of the interference was that the plotter pen would shoot across the plotter bed without warning. This produced startled looks and laughter rather than disaster. A few times the calculator would go into a "I won't talk to anyone" state also as a result of the interference. The only solution in this case was to punish the machine by shutting off its power until it forgot what it was up to.

Another problem which existed for a short while had to do with the plotter spring intended to lift the pen off the paper. Hewlett Packard had apparently switched spring suppliers and the springs which were being distributed would only last a few days under our heavy use before breaking. In utter desperation a piece of foam rubber was put in place of the spring, but the solution was hardly adequate since it prevented pen movement over the whole plotter area. The pen would be restricted by the foam rubber piece before reaching the edges.

The third problem encountered had to do with solenoids. One solenoid in the internal tape drive got stuck so that the tape drive would not function. Another had to be replaced in the plotter. The solenoid in the tape drive had only to be lubricated to get back into shape.

Considering that the machines have now been used for over a year and that six months that year were spent in operation of 24-hour days and 7-day weeks, one would be hard-pressed to justify any complaints.

The problems which cropped up were all severe, but only because of the high pressure situation under which they occurred. No problem was unresolved for more than a day and during that day one of the other HP's would carry the load normally carried by the machine which was down.

PRESENT OTHER USES AND FUTURE USE OF THE COMPUTERS

Viking is now in the extended mission and UPLINKS occur with lower frequency than during the primary mission, but the Hewlett Packards are doing anything but resting. As time has gone on more and more people have realized what a convenient slave the machines

```
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INSERT CARDS FOR LSEQ TABLE CHANGES

IN LSEQ CHANGE BASE OF VL 1 330 U/L-CAM-REV.  0 TO MAKE
IT THE CHANGE BASE OF VL 1 330 U/L-CAM-REV.  8

TBL.CMD,41,1,1,4,2,1,0,172.5,175,20
TBL.CMD,49,4,1,8,2,1,0,27.5,35,-10
TBL.CMD,54,2,1,1,3,1,0,185,187.5,10
TBL.CMD,55,2,1,2,3,1,0,185,187.5,10
TBL.CMD,56,1,1,1,3,1,0,185,187.5,10
TBL.CMD,57,1,1,2,3,1,0,185,187.5,10
TBL.CMD,58,0,1,1,3,1,0,185,187.5,10
TBL.CMD,59,1,1,2,3,1,0,185,187.5,10
TBL.CMD,48,3,1,8,2,1,0,150,155,0
TBL.CMD,17,4,1,14,3,1,0,152.5,162.5,-30
TBL.CMD,40,0,1,4,2,1,0,247.5,250,20


*DLPAR,2
IMGRT,1,3,1620,2,1,19,*

RUNUP.RESCAN,1.2

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REMOVE CARDS FOR LSEQ TABLE CHANGES.

IN LSEQ CHANGE BASE OF VL 1 330 U/L-CAM-REV.  0 TO MAKE
IT THE CHANGE BASE OF VL 1 330 U/L-CAM-REV.  8

INSERT CARDS FOR LSEQ MSET CHANGES

IN LSEQ CHANGE BASE OF VL 1 330 U/L-CAM-REV.  0 TO MAKE
IT THE CHANGE BASE OF VL 1 330 U/L-CAM-REV.  8


ADD   DCS,338,**,**,**,0,2,**
ADD   DCS,339,**,**,**,0,2,**
ADD   DCS,334,**,**,**,0,2,**
ADD   DCS,345,**,**,**,0,2,**
ADD   DCS,344,**,**,**,0,2,**,RTI1
ADD   DCS,346,**,**,**,0,2,**


ADD   RCE,360,**,**,**,0,2,**,RTI1,RTI4
ADD   RCE,360,**,**,**,0,2,**,RTI1,RTI4
ADD   RCE,365,**,**,**,0,2,**,RTI2,RTI5
ADD   RCE,365,**,**,**,0,2,**,RTI2,RTI5
ADD   RCE,336,**,**,**,0,1,**
ADD   RCE,338,**,**,**,0,1,**
ADD   RCE,339,**,**,**,0,1,**
ADD   RCE,341,**,**,**,0,1,**
ADD   RCE,343,**,**,**,0,1,**,RTI1,RTI2,RTI3,RTI4,RTI5,RTI6
ADD   RCE,344,**,**,**,0,1,**
ADD   RCE,345,**,**,**,0,1,**
ADD   RCE,347,**,**,**,0,1,**,RTI1
ADD   RCE,370,**,**,**,0,2,**,RTI3,RTI6
ADD   RCE,370,**,**,**,0,2,**,RTI3,RTI6

DEL   RCE,340,**,**,**,0,2,**,RTI1,RTI4
DEL   RCE,340,**,**,**,0,2,**,RTI1,RTI4
DEL   RCE,345,**,**,**,0,2,**,RTI2,RTI5
DEL   RCE,345,**,**,**,0,2,**,RTI2,RTI5
DEL   RCE,341,**,**,**,0,1,**
DEL   RCE,350,**,**,**,0,2,**,RTI3,RTI6
DEL   RCE,350,**,**,**,0,2,**,RTI3,RTI6

ADD   IMG,333,9,42,27,0,40,1,STOW
ADD   IMG,337,9,44,6,0,40,1,STOW
ADD   IMG,339,9,44,56,0,40,1,STOW
ADD   IMG,340,9,45,21,0,40,1,STOW
ADD   IMG,338,12,24,0,0,48,2,STOW
ADD   IMG,339,12,0,0,0,81,2,STOW
ADD   IMG,338,9,44,31,0,40,1,STOW
ADD   IMG,359,9,15,0,1,90,1,STOW
ADD   IMG,359,10,0,0,1,72,1,STOW
ADD   IMG,359,10,20,0,1,79,2,STOW
ADD   IMG,359,11,20,0,1,81,2,CAL2,STOW
ADD   IMG,364,10,0,0,1,71,1,STOW
ADD   IMG,364,10,20,0,1,82,1
ADD   IMG,364,10,23,0,1,83,1
ADD   IMG,364,10,26,0,1,84,1,CAL2,STOW
ADD   IMG,364,10,30,0,1,76,2,CAL2,STOW
ADD   IMG,337,18,41,36,0,54,2
ADD   IMG,337,18,43,0,0,55,2
ADD   IMG,337,18,45,0,0,56,2
ADD   IMG,337,18,47,0,0,57,2,STOW
ADD   IMG,337,19,18,0,0,58,2
ADD   IMG,337,19,20,0,0,59,2,STOW
ADD   IMG,338,12,53,40,0,49,2,STOW
ADD   IMG,369,9,15,0,1,90,1,STOW
ADD   IMG,369,10,0,0,1,72,1,STOW
ADD   IMG,369,10,20,0,1,79,2,STOW
ADD   IMG,369,11,20,0,1,81,2,CAL2,STOW
ADD   IMG,338,13,5,0,0,17,2,STOW
```

```
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INSERT CARDS FOR LSEQ MSET CHANGES

IN LSEQ CHANGE BASE OF VL 1 330 U/L-CAM-REV.  0 TO MAKE
IT THE CHANGE BASE OF VL 1 330 U/L-CAM-REV.  8


DEL   IMG,339,9,15,0,1,90,1,STOW
DEL   IMG,339,10,0,0,1,72,1,STOW
DEL   IMG,339,10,20,0,1,79,2,STOW
DEL   IMG,339,11,20,0,1,81,2,CAL2,STOW
DEL   IMG,344,10,0,0,1,71,1,STOW
DEL   IMG,344,10,20,0,1,82,1
DEL   IMG,344,10,23,0,1,83,1
DEL   IMG,344,10,26,0,1,84,1,CAL2,STOW
DEL   IMG,344,10,30,0,1,76,2,CAL2,STOW
DEL   IMG,349,9,15,0,1,90,1,STOW
DEL   IMG,349,10,0,0,1,72,1,STOW
DEL   IMG,349,10,20,0,1,79,2,STOW
DEL   IMG,349,11,20,0,1,81,2,CAL2,STOW


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REMOVE CARDS FOR LSEQ MSET CHANGES

IN LSEQ CHANGE BASE OF VL 1 330 U/L-CAM-REV.  0 TO MAKE
IT THE CHANGE BASE OF VL 1 330 U/L-CAM-REV.  8
```

Figure 10.

Revision Table for the tape on which the change file for Sol 330 Rev. 8 resides.

Rev. No.	Sol	Date Mo-Day-Year	Operator
0	330	6- 1-77	5
1	330	6- 3-77	5
2	330	6- 5-77	2
3	330	6- 6-77	5
4	330	6- 7-77	5
5	330	6- 8-77	5
6	330	6- 8-77	5
7	330	6-12-77	2
8	330	6-17-77	2

Figure 11a.

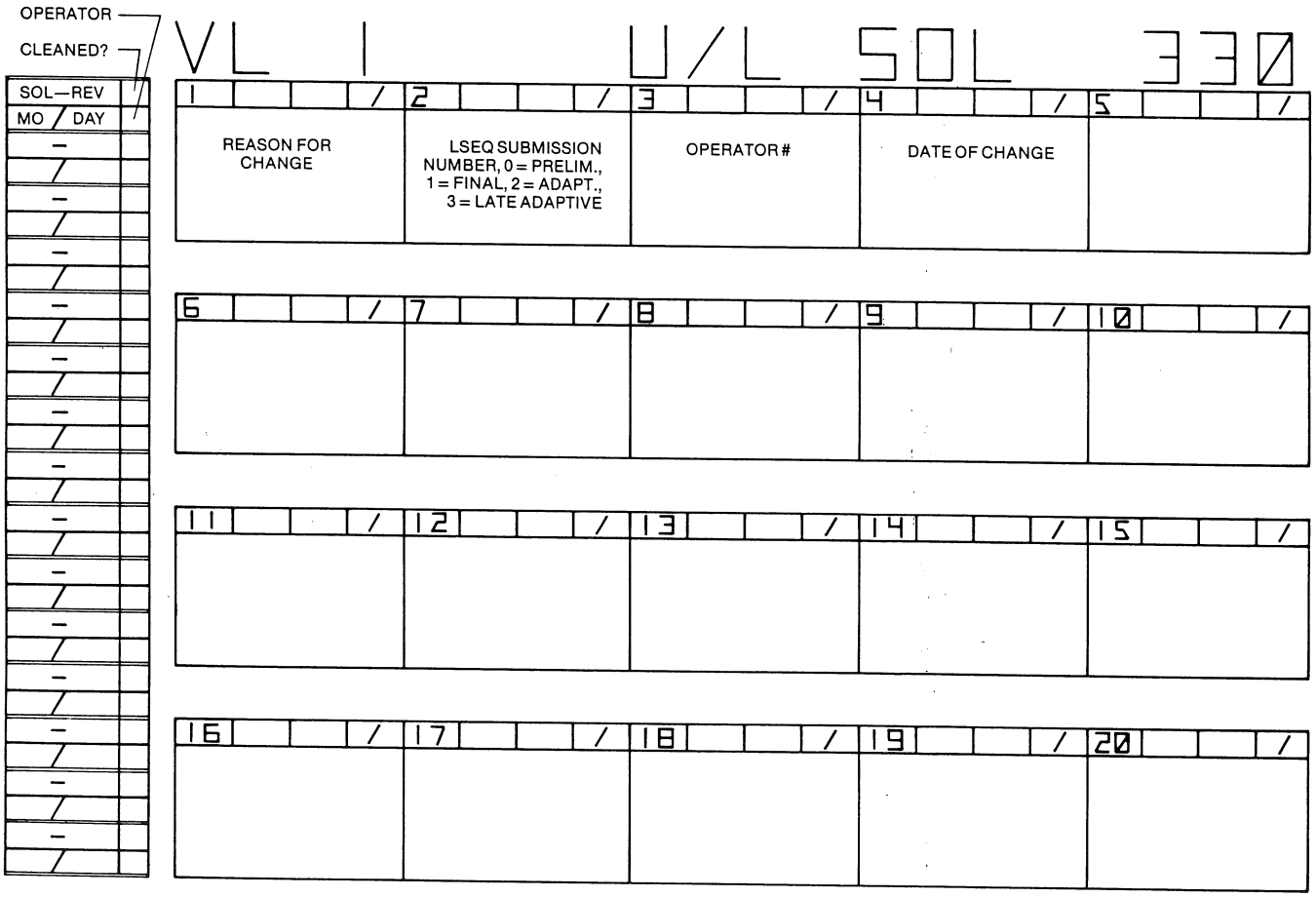

Figure 11b. Revision Record Chart

make. They are now extensively used to produce plots of various kinds which were formerly drawn by hand. The plots are used in the planning of a multitude of scheduling problems such as DOWNLINK opportunities, vacation schedules, major event plots, temperature plots (Martian), and Martian-to-Pacific time calendar plots, the plots used manually to track the bookkeeping and many many others. The rough draft of this article was written using the limited text editing functions made available by the data communications ROM which is normally used to interface the HP into other machines via a phone coupler.

A Viking Mission for 1984 is presently being investigated and it seems clear that even if these HP's have been gracefully retired by '84, other miniaturized computers will have taken their place in the operation of the mission. These HP's still have a planned year or two left during which they will be supporting the extended and then continuing mission. More tasks are dreamt up every day to simplify daily chores now carried out manually. As the Viking flight team is cut back every few weeks the HP's will be asked to help the remaining Vikings to carry out the job in more and more ways.

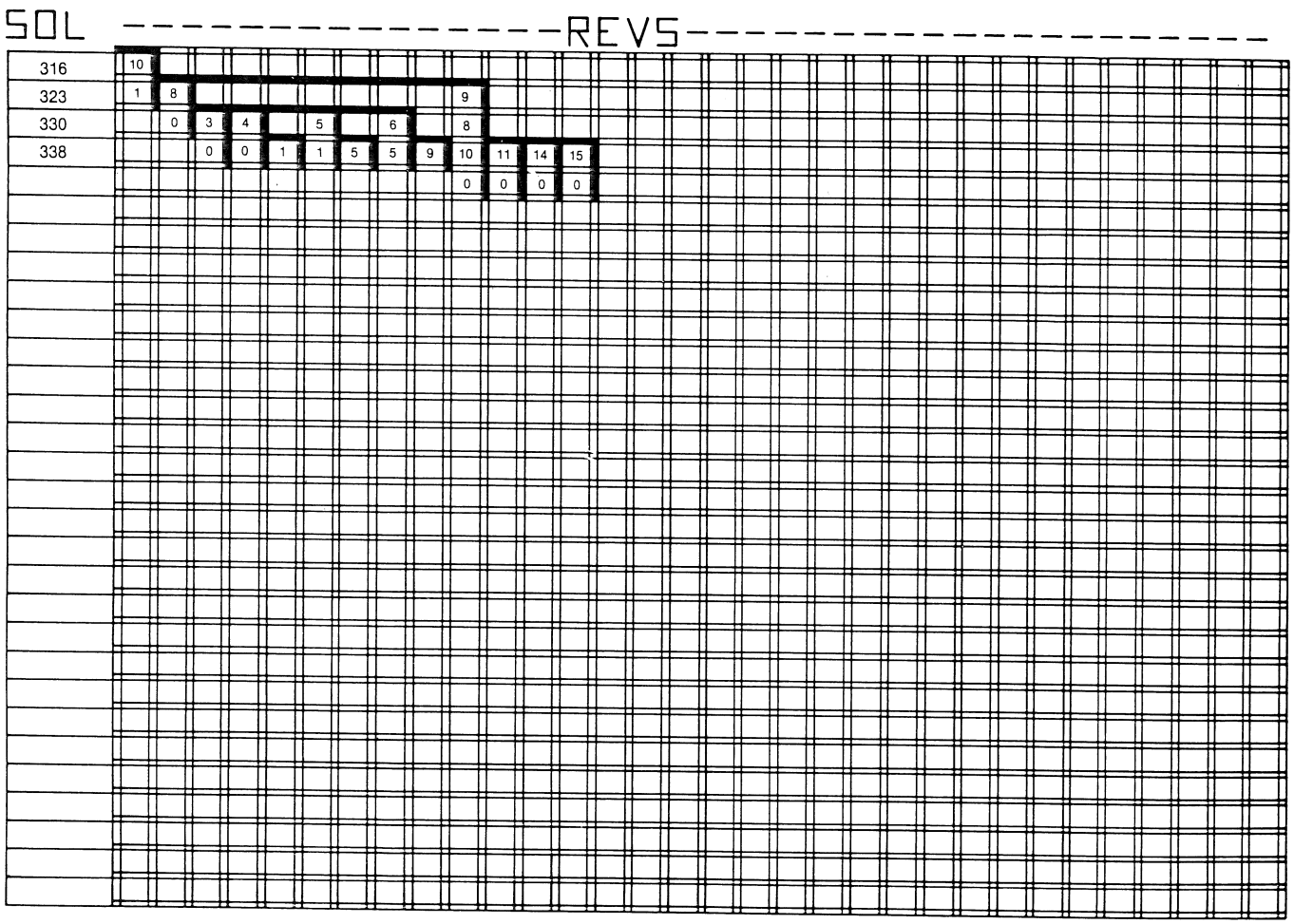

Figure 12. Revision Record Graph

UPLINK/DOWNLINK LISTING

Figure 2.

```
10 COM PI[186,10],CI[101,11],ZI[9],AI[242],VI[34]
13 PRT-ALL 1
15 DIM B$[25],D$[7],FI[100,2],0$[26],UI[5],EI[5],A$[15]
16 MAT U=ZER
20 MAT A=ZER
25 FOR L=1 TO 8
30 Z[L]=0
35 NEXT L
40 BEEP
41 DISP "ENTER A CONTROL LEVEL COMMAND";
45 INPUT B$
50 D$=B$[1,7]
55 IF D$[1,4]="LIST" THEN 3500
60 IF D$[1,4]="PLAN" THEN 1750
65 IF D$="CALL MI" THEN 120
70 IF D$="CALL CH" THEN 130
75 IF D$[1,6]="CREATE" THEN 230
80 IF D$[1,6]="ADD TO" THEN 245
85 IF D$="STORE C" THEN 2690
90 IF D$="STORE M" THEN 2780
95 IF D$="APPLY C" THEN 1755
100 IF D$[1,4]="BOOK" THEN 6500
105 IF D$[1,4]="STOP" THEN 2835
110 PRINT "INCORRECT INPUT COMMAND."
115 GOTO 40
120 LOAD  DATA 1,F
125 GOTO 40
130 LOAD  DATA 0,A
135 DISP "DO YOU WANT LATEST CHANGE FILE?";
140 INPUT B$
145 IF B$[1,1]="Y" THEN 220
150 DISP "ENTER DESIRED REV. NO.";
155 INPUT G4
160 G1=6*G4+2
165 OUTPUT (15,170)"SIP NO: VLX-"A[G1+5];"U/L-CAM-REV"$A[G1+4];
166 OUTPUT (15,170)" WAS DONE BY OPERATOR"$A[G1];
170 FORMAT F4.0,2F3.0
175 OUTPUT (15,170)" ON"$A[G1+1];"-"$A[G1+2];"-"$A[G1+3]
180 PRINT "IS THIS THE ONE YOU WANT?"
185 PRINT
190 INPUT B$
195 IF B$[1,1]="N" THEN 40
196 G4=G4+1
200 LOAD  DATA G4+1,C
201 REWIND
205 Z[8]=1
210 Z[9]=0
215 GOTO 40
220 G4=A[1]
225 GOTO 200
230 MAT C=ZER
235 C[101,5]=-1
240 GOTO 250
245 OUTPUT (15,170)"THIS IS SOL";C[101,5];" REV.";C[101,4]
250 PRINT
255 Z[9]=1
260 Y1=C[101,6]
265 BEEP
266 DISP "ENTER CHANGE COMMAND";
270 INPUT B$
275 IF B$[1,3]="RUB" THEN 1220
280 D$=B$[1,7]
285 IF Y1>99 THEN 1490
287 IF D$="TABLE C" THEN 355
290 IF D$="DCS TAB" THEN 755
295 IF D$="RCE TAB" THEN 955
300 IF D$="DATA BA" THEN 975
305 IF D$="DCS ADD" THEN 1100
306 IF D$="DCS DEL" THEN 1164
310 IF D$="RCE ADD" THEN 1205
311 IF D$="RCE DEL" THEN 1214
315 D$=B$[1,3]
320 IF D$="ADD" THEN 1325
325 IF D$="DEL" THEN 1425
330 IF D$="FIN" THEN 1490
340 PRINT "INCORRECT CHANGE COMMAND. TRY AGAIN."
345 PRINT
350 GOTO 265
355 DISP "ENTER COMMAND NUMBER";
360 INPUT N
363 IF N>99 THEN 265
365 G=P[N,1]
370 GOSUB 2815
375 DISP "GAIN IS:"$G2;"CHANGE?";
380 INPUT B$
385 IF B$[1,1]=" " THEN 410
390 G4=VAL(B$)
395 IF G4<0 THEN 375
400 IF G4>5 THEN 375
405 G2=INT(G4)
410 DISP "DR IS:"$G1;"CHANGE?";
415 INPUT B$
420 IF B$[1,1]=" " THEN 445
425 G4=VAL(B$)
430 IF G4<0 THEN 410
435 IF G4>1 THEN 410
440 G1=INT(G4)
445 DISP "CH. IS:"$G3;"CHANGE?";
450 INPUT B$
455 IF B$[1,1]=" " THEN 480
460 G4=VAL(B$)
465 IF G4<0 THEN 445
470 IF G4>15 THEN 445
475 G3=INT(G4)
480 C[Y1+1,1]=G1*10↑4+G2*10↑2+G3
485 G=P[N,2]
490 GOSUB 2815
495 DISP "MODE IS:"$G3;"CHANGE?";
500 INPUT B$
505 IF B$[1,1]=" " THEN 530
510 G4=VAL(B$)
515 IF G4<0 THEN 495
520 IF G4>7 THEN 495
525 G3=INT(G4)
530 DISP "OFF. IS:"$G2;"CHANGE?";
535 INPUT B$
540 IF B$[1,1]=" " THEN 565
545 G4=VAL(B$)
550 IF G4<0 THEN 530
555 IF G4>32 THEN 530
560 G2=INT(G4)
565 DISP "DCI IS:"$G1;"CHANGE?";
570 INPUT B$
575 IF B$[1,1]=" " THEN 600
580 G4=VAL(B$)
585 IF G4<0 THEN 565
590 IF G4>1 THEN 565
595 G1=INT(G4)
600 C[Y1+1,2]=G1*10↑4+G2*10↑2+G3
605 G4=P[N,3]/10
610 DISP "START AZ. IS:"G4;"CHANGE?";
615 INPUT B$
620 IF B$[1,1]=" " THEN 645
625 G4=VAL(B$)
630 IF G4<0 THEN 605
635 IF G4>340 THEN 605
640 IF ABS(INT(G4/2.5)*2.5-G4)<>0 THEN 605
645 C[Y1+1,3]=G4*10
650 G4=P[N,4]/10
655 DISP "END AZ. IS:"G4;"CHANGE?";
660 INPUT B$
665 IF B$[1,1]=" " THEN 690
670 G4=VAL(B$)
675 IF G4<0 THEN 650
680 IF G4>342.5 THEN 650
685 IF ABS(INT(G4/2.5)*2.5-G4)<>0 THEN 650
690 C[Y1+1,4]=G4*10
695 IF C[Y1+1,4]<C[Y1+1,3] THEN 605
700 G4=P[N,5]
705 DISP "EPA. IS:"G4;"CHANGE?";
710 INPUT B$
715 IF B$[1,1]=" " THEN 730
720 G4=VAL(B$)
725 IF ABS(G4)>50 THEN 700
730 C[Y1+1,5]=10*INT(G4/10)
735 Y1=Y1+1
740 C[Y1,6]=1000+N
745 M1=0
750 GOTO 1080
755 J=0
760 DISP "ENTER DCS TBL. NO. & OPT. NO.";
765 INPUT G1,G2
770 IF ABS(G2)>2 THEN 265
775 N=J*12+G1*6+G2+155
780 G4=P[N,6]
785 DISP "COMMAND NO. IS:"$P[N,6];"CHANGE?";
790 INPUT B$
795 IF B$[1,1]=" " THEN 815
800 G4=VAL(B$)
805 IF G4<0 THEN 780
810 IF G4>99 THEN 780
815 C[Y1+1,1]=INT(G4)
820 G4=P[N,7]+P[N,8]/10
825 C[Y1+1,3]=P[N,8]
830 DISP "DURATION IS:"G4;"CHANGE?";
835 INPUT B$
840 IF B$[1,1]=" " THEN 855
845 G4=VAL(B$)
850 IF ABS(G4)>5400 THEN 820
855 C[Y1+1,2]=INT(ABS(G4))
857 C[Y1+1,3]=INT(10*(ABS(G4)-C[Y1+1,2]))
860 G4=P[N,9]
865 DISP "CAM. NO. IS:"G4;"CHANGE?";
870 INPUT B$
875 IF B$[1,1]=" " THEN 890
880 G4=VAL(B$)
885 IF G4>2 OR G4<1 THEN 860
890 C[Y1+1,4]=INT(G4)
895 G4=P[N,10]
900 DISP "STOW IS:"G4;"CHANGE?";
905 INPUT B$
910 IF B$[1,1]=" " THEN 925
915 G4=VAL(B$)
920 IF ABS(G4)>1 THEN 895
925 C[Y1+1,5]=ABS(INT(G4))
930 C[Y1+1,6]=2000+N+J*1000
935 Y1=Y1+1
940 M1=5
945 C[Y1,6]=2000+J*1000+N
950 GOTO 1080
955 J=1
960 DISP "ENTER RCE TBL. NO. & OPT. NO.";
965 INPUT G1,G2
970 GOTO 775
975 G4=P[100,1]
980 C[Y1+1,2]=P[100,2]
985 DISP "RSCN.DT IS"G4+P[100,2]/10;"CHANGE?";
990 INPUT B$
995 IF B$[1,1]=" " THEN 1015
1000 G4=VAL(B$)
1005 G4=ABS(G4)
1010 C[Y1+1,2]=INT(10*(G4-INT(G4)))
1015 C[Y1+1,1]=INT(G4)
1020 G4=P[100,3]/100
1025 DISP "RUNUP.RESCAN IS"G4;"CHANGE?";
1030 INPUT B$
1035 IF B$[1,1]=" " THEN 1045
1040 G4=VAL(B$)
1045 Y1=Y1+1
1050 C[Y1,3]=INT(G4*100)
1055 C[Y1,6]=4100
1060 C[Y1,5]=0
1065 C[Y1,4]=0
1070 M1=0
1075 N=100
1080 SEND P[N,1+M1] TO E[1]
1085 SEND E[1] TO C[Y1,7]
1095 GOTO 265
1100 J1=0
1125 DISP "ENTER THE SOL, HR,MIN,SEC. TO ADD";
1129 INPUT G1,G2,G3,G4
1130 G1=G1-200
1131 Y1=Y1+1
1135 C[Y1,1]=G1*10↑2+G2
1140 C[Y1,2]=G3*10↑2+G4
1145 DISP "ENTER PAR. AND TWO OPTION SETS.";
1150 INPUT C[Y1,3],C[Y1,4],C[Y1,5]
1155 C[Y1,6]=5000+J1*1000
1160 GOTO 265
1164 J1=0
1165 DISP "ENTER THE SOL, HR.,MIN,SEC, TO DELETE";
1169 INPUT G1,G2,G3,G4
1170 G1=G1-200
1171 Y1=Y1+1
1175 C[Y1,1]=G1*100+G2
1180 C[Y1,2]=G3*100+G4
1185 C[Y1,6]=5500+J1*1000
1190 DISP "ENTER PAR. AND TWO OPTION SETS";
1195 INPUT C[Y1,3],C[Y1,4],C[Y1,5]
1200 GOTO 265
1205 J1=1
1210 GOTO 1125
1214 J1=1
1215 GOTO 1165
1220 DISP "ENTER RUB NO.";
1225 INPUT G4
1230 IF G4<1000 OR G4>8001 THEN 265
1235 FOR I=1 TO Y1
1240 IF C[I,6]#G4 THEN 1305
1245 G=C[I,1]
1250 GOSUB 2815
1255 M1=G2
1260 M2=G3
```

```
1265 G=C[I,2]
1270 GOSUB 2815
1275 M3=C[I,3]-INT(C[I,3]/10)*10
1280 OUTPUT (15,1285)"SOL:";M1;"HR:MIN:SEC";M2;G2;G3;" CAM:";M3;" RUB?"
1285 FORMAT F4.0,4F3.0
1290 PRINT
1295 INPUT B$
1300 IF B$[1,1]="Y" THEN 1315
1305 NEXT I
1310 GOTO 265
1315 C[I,6]=0
1320 GOTO 265
1325 DISP "ENTER TIME AS SOL,HR,MIN,SEC.";
1330 INPUT G1,G2,G3,G4
1331 G1=G1-200
1335 C[Y1+1,1]=G1*10↑2+G2
1340 C[Y1+1,2]=G3*10↑2+G4
1345 DISP "ENTER CYC.,CMD.,CAM.";
1350 INPUT M1,M2,M3
1355 IF M1>1 OR M2>99 OR M3>2 THEN 1345
1360 IF M1<0 OR M2<1 OR M3<1 THEN 1415
1365 C[Y1+1,3]=INT(M1)*10↑4+INT(M2)*10↑2+INT(M3)
1370 DISP "CALPRE,CALPOST,STOW,RSCN,DUST?";
1375 INPUT M1,M2,M3,G1,G2
1380 IF M1>1 OR M2>1 OR M3>2 OR G1>1 OR G2>1 THEN 1370
1385 IF M1<0 OR M2<0 OR M3<0 OR G1<0 OR G2<0 THEN 1415
1390 C[Y1+1,4]=INT(M1)*10↑4+INT(M2)*10↑2+INT(M3)
1395 C[Y1+1,5]=INT(G1)*10↑2+INT(G2)
1400 Y1=Y1+1
1405 C[Y1,6]=7000
1410 GOTO 265
1415 PRINT "MSET CHANGE IGNORED"
1420 GOTO 265
1425 DISP "ENTER TIME AS SOL,HR,MIN,SEC.";
1430 INPUT G1,G2,G3,G4
1431 G1=G1-200
1435 C[Y1+1,1]=G1*10↑2+G2
1440 C[Y1+1,2]=G3*10↑2+G4
1445 DISP "ENTER CAM. NO.";
1450 INPUT G4
1455 IF G4<1 OR G4>2 THEN 1415
1460 C[Y1+1,3]=INT(G4)
1465 Y1=Y1+1
1470 C[Y1,4]=0
1471 C[Y1,7]=0
1475 C[Y1,5]=0
1480 C[Y1,6]=8000
1485 GOTO 265
1490 C[101,6]=Y1
1495 FOR I=1 TO 4
1500 J=1
1505 G1=I*1000
1510 G2=G1+450
1515 IF I>4 THEN 1555
1520 FOR L=1 TO C[101,6]
1525 IF C[L,6]<G1 OR C[L,6]>G2 THEN 1545
1530 F[J,1]=C[L,6]-G1
1535 F[J,2]=L
1540 J=J+1
1545 NEXT L
1550 GOTO 1585
1555 FOR L=1 TO C[101,6]
1560 IF C[L,6]<G1 OR C[L,6]>G2 THEN 1580
1565 F[J,1]=INT(C[L,1]/100)
1570 F[J,2]=L
1575 J=J+1
1580 NEXT L
1585 IF J<3 THEN 1635
1590 FOR L=1 TO J-2
1595 FOR K=L TO J-2
1600 M1=J-L
1605 M2=J-K-1
1610 IF F[M1,1]=F[M2,1] THEN 1620
1615 GOTO 1625
1620 C[F[M2,2],6]=0
1625 NEXT K
1630 NEXT L
1635 NEXT I
1640 IF Y1<3 THEN 2840
1645 Y2=0
1650 FOR K=1 TO Y1
1655 IF C[K,6]>1 THEN 1715
1660 IF K>Y1-Y2 THEN 1720
1665 FOR L=K TO Y1-1
1670 SEND C[L+1,7] TO E[1]
1672 SEND E[1] TO C[L,7]
1674 SEND C[L+1,2] TO E[1]
1676 SEND E[1] TO C[L,2]
1678 C[L,1]=C[L+1,1]
1685 NEXT L
1690 FOR K1=1 TO 11
1695 C[Y1,K1]=0
1700 NEXT K1
1705 Y2=Y2+1
1710 IF C[K,6]<1 THEN 1660
1715 NEXT K
1720 Y1=Y1-Y2
1725 C[101,6]=Y1
1730 GOTO 2840
1750 LOAD #5,4
1755 Q1=0
1760 IF C[101,5]=P[186,6] THEN 1770
1765 GOTO 1790
1770 IF C[101,4]=P[186,7] THEN 1780
1775 GOTO 1790
1780 PRINT "SOL/REV NO.S SAME. NO DB COMPARE."
1785 GOTO 1830
1790 IF Z[9]<1 THEN 1805
1795 PRINT "CHANGE FILE IN PROGRESS. NO DB COMPARE."
1800 GOTO 1830
1805 DISP "DO YOU WANT A DATA BASE COMPARE?";
1810 INPUT B$
1815 IF B$[1,1]="Y" THEN 1825
1820 GOTO 1830
1825 Q1=1
1830 FOR I=1 TO C[101,6]
1835 IF C[I,6]=8000 THEN 2325
1840 IF C[I,6]=7000 THEN 2480
1845 IF C[I,6]<999 THEN 2565
1850 IF C[I,6]>1099 THEN 1875
1855 N=C[I,6]-1000
1860 Q=1
1865 J=0
1870 GOTO 2130
1875 IF C[I,6]>2186 THEN 1900
1880 N=C[I,6]-2000
1885 Q=2
1890 J=1
1895 GOTO 2130
1900 IF C[I,6]>3187 THEN 1925
1905 N=C[I,6]-3000
1910 Q=3
1915 J=1
1920 GOTO 2130
1925 IF C[I,6]>4105 THEN 1950
1930 N=C[I,6]-4000
1935 Q=4
1940 J=0
1945 GOTO 2130
1950 K1=INT(C[I,6]/1000)-5
```

```
1955 J=(INT(C[I,6]/100)-50-K1*10)/5
1960 J1=103+K1*42
1965 G1=C[I,1]
1970 G2=C[I,2]
1975 FOR K=J1 TO J1+41
1980 IF J=1 AND G1=P[K,1] AND G2=P[K,2] THEN 2080
1985 IF G1<P[K,1] OR P[K,1]=0 THEN 2000
1990 NEXT K
1995 K=K-1
2000 G3=K
2005 IF J=1 THEN 2060
2010 FOR K=G3 TO J1+41
2015 N=J1+40+G3-K
2020 SEND P[N,1] TO E[1]
2025 SEND E[1] TO P[N+1,1]
2035 NEXT K
2040 SEND C[I,1] TO E[1]
2045 SEND E[1] TO P[G3,1]
2055 GOTO 2565
2060 IF G3>40+J1 THEN 2070
2065 GOTO 1990
2070 PRINT "NO DCS/RCE MSET FOUND FOR";K1;C[I,1]/100
2075 GOTO 2565
2080 G3=K
2085 FOR K=G3 TO J1+40
2090 SEND P[K+1,1] TO E[1]
2095 SEND E[1] TO P[K,1]
2105 NEXT K
2110 SEND U[1] TO P[J1+41,1]
2125 GOTO 2565
2130 M1=0
2135 IF Q1<0.5 THEN 2300
2140 FOR K=1 TO 5
2145 IF C[I,K]=P[N,5*J+K] THEN 2155
2150 GOTO 2170
2155 NEXT K
2160 M1=1
2165 GOTO 2195
2170 FOR K=1 TO 5
2175 IF C[I,K+6]=P[N,5*J+K] THEN 2185
2180 M1=2
2185 NEXT K
2190 IF M1<0.5 THEN 2300
2195 Z[9]=1
2200 OUTPUT (15,2205)"CONFLICT FOR CHG. SOL";C[101,5];" REV.";C[101,4]
2205 FORMAT 5F4.0
2210 OUTPUT (15,2205)" ONTO MISSION OF SOL";P[186,6];" REV.";P[186,7]
2215 IF M1>1.5 THEN 2235
2220 PRINT
2225 PRINT "CHANGE DELETED"
2230 C[I,6]=0
2235 IF Q>1 THEN 2250
2240 PRINT "TABLE CMD.";N
2245 GOTO 2285
2250 IF Q>2 THEN 2265
2255 PRINT "DCS PAR";N-161
2260 GOTO 2285
2265 IF Q>3 THEN 2280
2270 PRINT "RCE PAR.";N-173
2275 GOTO 2285
2280 PRINT "DATA BASE"
2285 PRINT "MISSION FROM";P[N,5*J+1];P[N,5*J+2];P[N,5*J+3];P[N,5*J+4];P[N,5*J+5]
2290 PRINT " CHANGE FROM";C[I,7];C[I,8];C[I,9];C[I,10];C[I,11]
2294 PRINT " CHANGE   TO";C[I,1];C[I,2];C[I,3];C[I,4];C[I,5]
2300 SEND P[N,1+J*5] TO E[1]
2305 SEND E[1] TO C[I,7]
2310 SEND C[I,1] TO E[1]
2315 SEND E[1] TO P[N,1+5*J]
2320 GOTO 2565
2325 M3=C[I,1]
2330 M4=C[I,2]
2335 FOR K=1 TO P[186,8]
2340 IF P[K,6]=M3 AND P[K,7]=M4 THEN 2355
2345 NEXT K
2350 GOTO 2375
2355 G=P[K,8]
2360 GOSUB 2815
2365 IF G3=C[I,3] OR G=C[I,3] THEN 2425
2370 IF K<161 THEN 2345
2375 G=C[I,1]
2380 GOSUB 2815
2385 M1=G2
2390 M2=G3
2395 G=C[I,2]
2400 GOSUB 2815
2405 OUTPUT (15,2415)"NO MSET ENTRY FOR SOL";M1;"AT";M2;G2;G3;"WITH CAM";C[I,3]
2410 PRINT
2415 FORMAT 5F4.0
2420 GOTO 2565
2425 M1=K
2426 M2=P[186,8]
2430 FOR K1=M1 TO M2
2435 SEND P[K1+1,6] TO E[1]
2440 SEND E[1] TO P[K1,6]
2450 NEXT K1
2455 SEND U[1] TO P[M2,6]
2470 P[186,8]=P[186,8]-1
2475 GOTO 2565
2480 G3=C[I,1]*10↑5+C[I,2]
2485 FOR K=1 TO P[186,8]
2490 G4=P[K,6]*10↑5+P[K,7]
2495 IF G4>G3 THEN 2505
2500 NEXT K
2505 M1=K
2510 M2=P[186,8]+M1+1
2511 IF P[186,8]<161 THEN 2517
2512 M2=161+M1
2517 FOR K=M1 TO P[186,8]-(P[186,8]=161)
2520 SEND P[M2-K-1,6] TO E[1]
2525 SEND E[1] TO P[M2-K,6]
2535 NEXT K
2540 SEND C[I,1] TO E[1]
2545 SEND E[1] TO P[M1,6]
2550 IF P[186,8]=161 THEN 2565
2555 P[186,8]=P[186,8]+1
2560 GOTO 2565
2565 NEXT I
2570 IF Z[9]=1 THEN 2590
2575 P[186,6]=C[101,5]
2580 P[186,7]=C[101,4]
2581 FOR I=1 TO 60
2582 BEEP
2583 WAIT 1000
2584 NEXT I
2585 GOTO 40
2590 DISP "ROLL REVISION?";
2595 INPUT B$
2600 IF B$[1,1]="N" THEN 2640
2605 GOSUB 2650
2610 LOAD  DATA 0,A
2615 P[186,6]=Z[6]
2620 P[186,7]=A[1]
2625 Z[5]=A[1]
2630 Z[9]=0
2635 GOTO 2705
2640 P[186,9]=0
2645 GOTO 40
2650 IF Z[4]>70 THEN 2675
2655 DISP "ENTER YOUR OPERATOR NO.";
2660 INPUT Z[1]
2665 DISP "ENTER THE DATE AS MO.,DAY,YR.";
2670 INPUT Z[2],Z[3],Z[4]
2675 DISP "ENTER THE SOL OF THIS REVISION";
2680 INPUT Z[6]
2685 RETURN
2690 LOAD  DATA 0,A
2695 Z[5]=A[1]
2700 GOSUB 2650
2705 FOR I=1 TO 6
2710 J=A[1]*6+1
2715 A[J+I]=Z[I]
2720 NEXT I
2725 A[1]=A[1]+1
2730 STORE  DATA 0,A
2735 C[101,5]=Z[6]
2736 C[101,7]=P[186,10]
2740 C[101,4]=A[1]-1
2745 STORE  DATA A[1]+1,C
2750 PRINT "A CHANGE FILE FOR SOL:";Z[6];" HAS BEEN STORED FS REV.";C[101,4]
2755 Z[8]=1
2760 Z[9]=0
2765 IF P[186,3]=1 THEN 40
2770 P[186,9]=1
2775 GOTO 2575
2780 IF P[186,9]=1 THEN 2805
2785 PRINT "MISSION IN CALCULATOR HAS UNROLLED CHANGE";
2790 PRINT "COMMAND NOT EXECUTED."
2795 PRINT
2800 GOTO 40
2805 STORE  DATA 1,P
2810 GOTO 40
2815 G1=INT(G/10↑4)
2820 G2=INT(G/10↑2)-G1*10↑2
2825 G3=G-G1*10↑4-G2*10↑2
2830 RETURN
2835 STOP
2840 FOR L=1 TO Y1
2845 IF C[L,6]#8000 OR C[L,7]#0 THEN 2920
2855 FOR K=1 TO P[186,8]
2860 IF C[L,1]#P[K,6] OR C[L,2]#P[K,7] THEN 2900
2865 G=P[K,8]-10*INT(P[K,8]/10)
2870 IF C[L,3]#G THEN 2900
2875 C[L,3]=P[K,8]
2880 C[L,4]=P[K,9]
2885 C[L,5]=P[K,10]
2890 C[L,7]=1
2895 GOTO 2920
2900 NEXT K
2905 PRINT
2910 OUTPUT (15,2915)"DEL REC MSET NOT FOUND AS:";C[L,1];C[L,2];C[L,3]
2915 FORMAT 3F6.0
2920 NEXT L
2925 GOTO 40
3500 O$="DUSTCAL.STOWPOS.S.V.ADDDEL"
3505 Z[7]=0
3507 BEEP
3508 DISP "DATE";
3509 INPUT A$
3510 TRANSFER A$ TO V[1]
3511 DISP "ENTER A LIST LEVEL COMMAND";
3515 INPUT B$
3520 IF B$[1,2]="CH" THEN 4450
3525 IF B$[1,2]="SU" THEN 3695
3535 IF B$[1,3]="U/L" THEN 3541
3540 GOTO 40
3541 DISP "LSE0 QUESTION: IS THERE A SOURCE";
3542 INPUT B$
3543 IF B$[1,1]="Y" THEN 3546
3544 Z[7]=1
3545 GOTO 3695
3546 DISP "ENTER REV. OF SOURCE";
3547 INPUT Z[7]
3548 Z[7]=Z[7]+1
3695 GOSUB 8000
3700 M7=15
3705 GOSUB 6175
3706 M7=1
3707 GOSUB 6130
3708 PRINT
3709 PRINT
3710 PRINT "VIKING LANDER CAMERA SYSTEM"
3715 PRINT
3720 PRINT
3725 PRINT "COMPLETE DATA BASE SUMMARY"
3730 PRINT
3735 PRINT
3740 PRINT "(SCIENCE INSTRUMENT PARAMETER LIST)"
3745 PRINT
3750 PRINT
3755 IF Z[4]<70 THEN 3775
3760 OUTPUT (15,4485)"PREPARED BY OPERATOR:";Z[1];" ON";Z[2];"-";Z[3];"-";Z[4]
3775 FOR K=1 TO 40
3780 PRINT
3785 NEXT K
3790 GOSUB 8000
3795 FOR K1=0 TO 3
3800 M7=3
3805 GOSUB 6125
3810 PRINT "RECORDED IMAGING MSET TABLE."
3815 PRINT "THE TOTAL NUMBER OF MSET ENTRIES IS:";P[186,8]
3820 PRINT
3825 PRINT " SOL      TIME      CYC  CMD.  CAM.   PRE   POST  STOW  RE-  DUST"
3830 PRINT "       HR.:MIN:SEC.      NO.   NO.    CAL   CAL        SCAN"
3835 PRINT
3840 FOR K=1 TO 52
3845 J1=K+K1*52
3850 IF J1>P[186,8] THEN 3955
3855 G=P[J1,6]
3860 M1=INT(G/100)
3865 M2=G-100*M1
3875 G=P[J1,7]
3880 GOSUB 6105
3885 M3=G2
3890 M4=G3
3895 G=P[J1,8]
3900 GOSUB 6105
3905 M5=G1
3910 M6=G2
3915 M7=G3
3920 G=P[J1,9]
3925 GOSUB 6105
3930 T=INT(P[J1,10]/100)
3935 G4=P[J1,10]-100*T
3940 OUTPUT (15,3945)M1+200;M2;":";M3;":";M4;M5;M6;M7;G1;G2;G3;T;G4
3945 FORMAT F4.0,F5.0,2F3.0,F4.0,7F6.0
3950 NEXT K
3955 M7=57-K
3960 GOSUB 6175
3975 GOSUB 8000
3980 IF K1*52+52>P[186,8] THEN 3987
3985 NEXT K1
3987 K=0
3988 M7=1
3990 GOSUB 8000
3995 GOSUB 6125
4000 PRINT " CMD        *** COMMAND TABLE ***        START  END"
4010 PRINT " NO.  GAIN   DR.   CH.   MD.   OFF   DCI  AZ.   AZ.   EL"
```

```
4012 IF K>1 THEN 4100
4025 FOR K=1 TO 99
4030 G=PEK,1]
4035 GOSUB 6105
4040 M1=G1
4045 M2=G2
4050 M3=G3
4055 G=PEK,2]
4060 GOSUB 6105
4070 OUTPUT (15,3945)K]
4090 OUTPUT (15,4095)M2]M1]M3]G3]G2]G1]PEK,3]/10]PEK,4]/10]PEK,5]
4095 FORMAT 6F6.0,2F6.1,F6.0,3X,20","
4097 M7=4
4098 IF K=50 THEN 3990
4100 NEXT K
4110 PRINT
4115 GOSUB 8000
4120 J1=0
4125 M7=3
4130 GOSUB 6125
4135 PRINT "DCS PARAMETER TABLE"
4140 PRINT
4145 PRINT
4150 PRINT "TABLE   OPT. CMD.  DUR.    CAM. STOW"
4155 PRINT
4160 FOR K=1 TO 2
4165 FOR K1=1 TO 6
4170 IF J1=1 THEN 4180
4175 IF K1>2 THEN 4200
4180 G1=J1*12+K*6+K1+155
4185 G2=PEG1,7]+PEG1,8]/10
4190 OUTPUT (15,4195)K]K1]PEG1,6]G2]PEG1,9],PEG1,10]
4195 FORMAT F4.0,2F6.0,F7.1,2F6.0
4200 NEXT K1
4205 NEXT K
4210 FOR K=1 TO 4
4215 PRINT
4220 NEXT K
4225 IF J1=1 THEN 4370
4230 PRINT "DCS MSET TABLE."
4235 PRINT
4240 PRINT " SOL       TIME       PAR.  OPTIONS"
4245 PRINT "        HR.:MIN:SEC"
4250 PRINT
4255 FOR K=1 TO 42
4260 N=K+J1*42+102
4265 G=PEN,1]
4270 IF G=0 THEN 4315
4275 M2=INT(G/100)
4280 M3=G-100*M2
4290 G=PEN,2]
4295 GOSUB 6105
4300 OUTPUT (15,4305)M2+200]M3]G2]G3]PEN,3]PEN,4]","]PEN,5]
4305 FORMAT F4.0,F6.0,2F3.0,F7.0,F6.0,F5.0
4310 GOTO 4320
4315 PRINT
4320 NEXT K
4325 M7=2
4330 GOSUB 6175
4335 GOSUB 8000
4340 M1=1
4345 IF J1=1 THEN 4380
4350 J1=1
4355 GOSUB 6125
4360 PRINT "RCE PARAMETER TABLE"
4365 GOTO 4140
4370 PRINT "RCE MSET TABLE"
4375 GOTO 4235
4380 M7=3
```

```
4385 GOSUB 6125
4390 PRINT "IMAGING DATA BASE PARAMETERS: (INCOMPLETE LIST)"
4395 PRINT
4400 PRINT
4405 OUTPUT (15,4415)"RSCN.DT       "¦P[100,1]+P[100,2]/10¦" SEC."
4410 OUTPUT (15,4415)"RUNUP.RESCAN  "¦P[100,3]/100¦" SEC."
4415 FORMAT 2F8.2
4420 M7=50
4425 GOSUB 6175
4435 GOSUB 8000
4440 IF Z[7]>0.5 THEN 4450
4445 GOTO 40
4450 GOSUB 8000
4455 M7=15
4460 GOSUB 6175
4465 M7=1
4466 GOSUB 6160
4470 PRINT
4480 PRINT "UPLINK SUMMARY"
4485 FORMAT F3.0,3F3.0
4490 PRINT
4492 IF Z[4]<70 THEN 4500
4495 OUTPUT (15,4485)"PREPARED BY OPERATOR:"¦Z[1]¦"-"¦Z[2]¦"  -"¦Z[3]¦"-"¦Z[4]
4500 M7=47
4505 GOSUB 6175
4510 GOSUB 8000
4515 M7=5
4520 GOSUB 6160
4525 D9=0
4530 PRINT "TABLE OF IMAGING COMMAND CHANGES:"
4535 PRINT
4540 PRINT
4545 PRINT        CMD.  GAIN   DR.   CH.   MD.   OFF   DCI   START   END   EL"
4550 PRINT          NO.                                      AZ.     AZ."
4555 PRINT
4560 J=1
4565 FOR I=1 TO C[101,6]
4570 IF C[I,6]<1000 THEN 4595
4575 IF C[I,6]>1099 THEN 4595
4580 F[J,1]=I
4585 F[J,2]=C[I,6]-1000
4590 J=J+1
4595 NEXT I
4600 IF J=1 THEN 5060
4605 J1=0
4625 J1=1
4630 T=F[1,2]
4635 M1=1
4640 G4=F[1,1]
4645 FOR L=1 TO J-1
4650 FOR I=1 TO J-1
4655 IF F[I,2]>T THEN 4675
4660 T=F[I,2]
4665 G4=F[I,1]
4670 M7=I
4675 NEXT I
4680 IF J1=0 THEN 4940
4685 G=C[G4,7]
4690 GOSUB 6105
4695 M1=G1
4700 M2=G2
4705 M3=G3
4707 D7=M1*(10↑6)
4708 D8=M2*1E+05+M3*100
4710 G=C[G4,1]
4715 GOSUB 6105
4720 IF M1=G1 THEN 4730
4725 GOTO 4735
4730 M1=1000
```



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4735 IF M2=G2 THEN 4745
4740 GOTO 4750
4745 M2=1000
4750 IF M3=G3 THEN 4760
4755 GOTO 4765
4760 M3=100
4765 G=C[G4,8]
4770 GOSUB 6105
4775 M4=G1
4780 M5=G2
4785 M6=G3
4787 D7=D7+2*M4*(10↑6)
4788 D8=D8+M6*1E+04+M5
4790 G=C[G4,2]
4795 GOSUB 6105
4800 IF M4=G1 THEN 4810
4805 GOTO 4815
4810 M4=1000
4815 IF M5=G2 THEN 4825
4820 GOTO 4830
4825 M5=1000
4830 IF M6=G3 THEN 4840
4835 GOTO 4845
4840 M6=1000
4845 IF C[G4,3]=C[G4,9] THEN 4860
4850 G1=C[G4,9]/10
4855 GOTO 4865
4860 G1=10000
4865 IF C[G4,4]=C[G4,10] THEN 4880
4870 G2=C[G4,10]/10
4875 GOTO 4885
4880 G2=10000
4885 IF C[G4,5]=C[G4,11] THEN 4900
4890 G3=C[G4,11]
4895 GOTO 4905
4900 G3=10000
4905 PRINT
4910 D7=C[G4,11]*(10↑6)+D7+C[G4,9]*40+C[G4,10]/5
4920 OUTPUT (15,4925)"WAS:          "¦M2¦"    "¦M1¦"    "¦M3¦"    "¦M6¦"    "¦M5¦
4925 FORMAT 6F3.0,2F7.1,F3.0
4930 OUTPUT (15,4935)"    "¦M4¦"    "¦G1¦" "¦G2¦"    "¦G3
4935 FORMAT F3.0,2F6.1,F3.0
4940 G=C[G4,1]
4945 GOSUB 6105
4950 M1=G1
4955 M2=G2
4960 M3=G3
4965 G=C[G4,2]
4970 M8=C[G4,6]-1000
4975 GOSUB 6105
5010 OUTPUT (15,5025)"NOW:  "¦M8¦
5015 OUTPUT (15,5020)M2¦M1¦M3¦G3¦G2¦G1¦C[G4,3]/10¦C[G4,4]/10¦C[G4,5]
5020 FORMAT 6F6.0,F9.1,F7.1,F6.0
5025 FORMAT F3.0
5027 IF ABS(D7-C[G4,5]*1E+06-(M1+2*G1)*1E+06-C[G4,3]*40-C[G4,4]/5)<0.5 THEN 5030
5028 D9=D9+1
5030 IF ABS(D8-M2*1E+05-G3*1E+04-M3*1E+02-G2)<0.05 THEN 5040
5035 D9=D9+1
5040 T=101
5045 F[M7,2]=101
5050 NEXT L
5055 GOTO 5075
5060 PRINT
5065 PRINT "NO COMMAND CHANGES IN THIS CHANGE FILE."
5070 J1=0
5075 M7=59-J*(1+2*J1)
5080 GOSUB 6175
5085 GOSUB 8000
5090 M7=4
5095 GOSUB 6160
5100 PRINT "CHANGES TO THE MSET TABLE FOR RECORDED IMAGING:"
5105 PRINT
5110 PRINT
5115 PRINT "     SOL       TIME       CYC.    CMD.  CAM.  PRE  POST  STOW   RE- DUST
5120 PRINT "            HR:MIN:SEC.            NO.   NO.  CAL   CAL         SCAN"
5125 PRINT
5130 J1=0
5135 J=1
5140 FOR I=1 TO C[101,6]
5145 IF C[I,6]<7000 THEN 5175
5150 IF INT((C[I,6]-7000)/1000)=J1 THEN 5160
5155 GOTO 5175
5160 F[J,1]=I
5165 F[J,2]=0
5170 J=J+1
5175 NEXT I
5180 IF J=1 THEN 5410
5185 T=F[1,1]
5190 M1=1
5195 G1=C[T,1]
5200 FOR L=1 TO J-1
5205 G4=C[T,2]
5210 FOR I=1 TO J-1
5215 IF F[I,2]>0.5 THEN 5260
5220 IF G1=C[F[I,1],1] THEN 5235
5225 IF G1<C[F[I,1],1] THEN 5260
5230 GOTO 5240
5235 IF G4<C[F[I,1],2] THEN 5260
5240 T=F[I,1]
5245 G1=C[T,1]
5250 G4=C[T,2]
5255 M1=I
5260 NEXT I
5265 F[M1,2]=1
5270 M1=INT(G1/100)
5275 M2=G1-100*M1
5290 G=G4
5295 GOSUB 6105
5300 M3=G2
5305 M4=G3
5310 G=C[T,3]
5315 GOSUB 6105
5320 M5=G1
5325 M6=G2
5330 M7=G3
5335 G=C[T,5]
5340 GOSUB 6105
5345 M8=G2
5350 K1=G3
5355 G=C[T,4]
5360 GOSUB 6105
5365 IF J1=1 THEN 5390
5370 OUTPUT (15,5375)"ADD:"¦M1+200¦M2¦":"¦M3¦":"¦M4¦M5¦M6¦M7¦G1¦G2¦G3¦M8¦K1
5375 FORMAT F4.0,F4.0,2F3.0,8F6.0
5385 GOTO 5395
5390 OUTPUT (15,5375)"DEL:"M1+200¦M2¦":"¦M3¦":"¦M4¦M5¦M6¦M7¦G1¦G2¦G3¦M8¦K1
5395 G1=35000
5400 D9=D9+2
5405 NEXT L
5410 IF J1=1 THEN 5440
5415 J1=1
5420 M7=4
5425 GOSUB 6175
5430 G5=J
5435 GOTO 5135
5440 M7=55-G5-J
5445 GOSUB 6175
5450 GOSUB 8000
5455 M7=4
```

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5460 GOSUB 6160
5465 J1=0
5470 K1=0
5475 IF J1=1 THEN 5535
5480 IF K1=1 THEN 5550
5485 PRINT "CHANGES TO THE DCS PARAMETER TABLE:"
5490 PRINT
5495 PRINT "       TAB.  OPT.  CMD.    TIME   CAM.   STOW"
5500 PRINT "                               SEC."
5505 Q=0
5525 Q=1
5530 GOTO 5590
5535 IF K1=1 THEN 5580
5540 PRINT "CHANGES TO THE RCE PARAMETER TABLE:"
5545 GOTO 5490
5550 PRINT "CHANGES TO THE DCS MSET IMAGING PARAMETERS:"
5555 PRINT
5560 PRINT "    SOL     TIME      PAR.   OPTIONS"
5565 PRINT "         HR.:MIN:SEC."
5570 PRINT
5575 GOTO 5590
5580 PRINT "CHANGES TO THE RCE MSET IMAGING PARAMETERS:"
5585 GOTO 5555
5590 FOR K2=0 TO 1
5595 J=1
5600 G1=2000+J1*1000+K1*3000+500*K2
5605 G2=G1+499
5610 IF K1=1 THEN 5660
5615 FOR I=1 TO C[101,6]
5620 IF C[I,6]<G1 THEN 5645
5625 IF C[I,6]>G2 THEN 5645
5630 F[J,1]=C[I,6]-G1
5635 F[J,2]=I
5640 J=J+1
5645 NEXT I
5650 IF J=1 THEN 5870
5655 GOTO 5700
5660 FOR I=1 TO C[101,6]
5665 IF C[I,6]<G1 THEN 5690
5670 IF C[I,6]>G2 THEN 5690
5675 F[J,1]=INT(C[I,1]/100)
5680 F[J,2]=I
5685 J=J+1
5690 NEXT I
5695 IF J=1 THEN 5870
5700 J=J-1
5705 FOR L=1 TO J
5710 T=329
5715 M1=1
5720 FOR I=1 TO J
5725 IF F[I,1]>T THEN 5745
5730 T=F[I,1]
5735 G4=F[I,2]
5740 M1=I
5745 NEXT I
5750 IF K1=1 THEN 5800
5755 IF Q=1 THEN 5935
5760 G2=C[G4,2]+C[G4,3]/10
5765 M2=C[G4,6]-2156-J1*1012
5770 M3=INT(M2/6)
5775 M2=M2-6*M3+1
5780 OUTPUT (15,5790)"  TO ";M3;M2;C[G4,1];G2;C[G4,4];C[G4,5]
5784 IF M7=G2 THEN 5786
5785 D9=D9+1
5786 IF C[G4,4]=C[G4,10] THEN 5790
5787 D9=D9+1
5790 FORMAT F4.0,2F6.0,F9.1,2F6.0
5791 IF C[G4,1]=C[G4,7] AND C[G4,4]=C[G4,10] AND C[G4,5]=C[G4,11] THEN 5795
5792 D9=D9+1
5795 GOTO 5850
5800 G=C[G4,1]
5805 M2=INT(G/100)
5810 M3=G-100*M2
5820 G=C[G4,2]
5825 GOSUB 6105
5830 M5=21+K2*3
5835 OUTPUT (15,5845)O$[M5,M5+2];M2+200;M3;G2;G3;C[G4,3];C[G4,4];",";C[G4,5]
5840 D9=D9+2
5845 FORMAT F4.0,F5.0,2F3.0,2F6.0,F5.0
5850 F[M1,1]=330
5855 NEXT L
5860 PRINT
5865 PRINT
5870 NEXT K2
5875 IF K1=1 THEN 5900
5880 PRINT
5885 PRINT
5890 K1=1
5895 GOTO 5475
5900 M7=8
5910 GOSUB 6175
5915 GOSUB 8000
5920 IF J1=1 THEN 5960
5925 J1=1
5930 GOTO 5470
5935 G2=C[G4,8]+C[G4,9]/10
5940 PRINT
5945 OUTPUT (15,5950)"FROM              ";C[G4,7];G2;C[G4,10];C[G4,11]
5947 M7=G2
5950 FORMAT F4.0,F9.1,2F6.0
5955 GOTO 5760
5960 M7=7
5965 GOSUB 6160
5970 PRINT "IMAGING DATA BASE PARAMETER CHANGES:"
5975 PRINT
5980 FOR I=1 TO 100
5985 IF C[101-I,6]=4100 THEN 6004
5990 NEXT I
5995 PRINT "NO CHANGES MADE"
6000 GOTO 6055
6004 M1=101-I
6005 OUTPUT (15,6050)"WAS:          ";C[M1,7]+C[M1,8]/10
6010 OUTPUT (15,6050)"NOW: RSCN.DT";C[M1,1]+C[M1,2]/10
6020 IF ABS(C[M1,1]+C[M1,2]/10-C[M1,7]-C[M1,8]/10)<0.05 THEN 6030
6025 D9=D9+1
6030 PRINT
6035 OUTPUT (15,6050)"WAS:              ";C[M1,9]/100
6036 OUTPUT (15,6050)"NOW: RUNUP.RESCAN";C[M1,3]/100
6040 IF ABS(C[M1,3]-C[M1,9])<0.5 THEN 6050
6045 D9=D9+1
6050 FORMAT 2F8.2
6055 M7=10
6060 GOSUB 6175
6065 PRINT "---"
6070 PRINT
6075 PRINT "***APPROXIMATE U/L COMMAND WORD COUNT IS:";D9;" ***"
6080 M7=44
6085 GOSUB 6175
6090 GOSUB 8000
6095 IF Z(7)>0.5 THEN 1750
6100 GOTO 40
6105 G1=INT(G/10↑4)
6110 G2=INT(G/10↑2)-G1*10↑2
6115 G3=G-G1*10↑4-G2*10↑2
6120 RETURN
6125 PRINT
6130 OUTPUT (15,6135)"SIP NO: VL";P[186,10];"-";P[186,6];" U/L-CAM-REV";P[186,7]
6135 FORMAT F2.0,F4.0,F3.0
6140 IF P[186,9]=1 THEN 6175
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6145 PRINT "        WARNING UNROLLED REVISION"
6150 GOTO 6175
6160 OUTPUT (15,6135)"SIP NO: VL";C[101,7];"-";C[101,5];" U/L-CAM-REV"C[101,4]
6165 IF Z[9]=0 THEN 6175
6170 PRINT "WARNING CHANGE IS NOT  FINAL"
6175 FOR I1=1 TO M7
6180 PRINT
6185 NEXT I1
6190 RETURN
6500 Z[9]=0
6505 DISP "ENTER A BOOKEEPING COMMAND";
6510 INPUT B$
6515 IF B$[1,5]="CLEAN" THEN 6710
6520 IF B$[1,4]="TAPE" THEN 6545
6525 IF B$[1,5]="CARRY" THEN 6535
6530 GOTO 40
6535 Z[7]=1
6540 GOTO 6550
6545 Z[7]=0
6550 IF Z[9]=0 AND P[186,9]=1 THEN 6565
6555 PRINT "CHANGE IN WORK OR INVALID MISSION. TAPE INIT NOT AVAILABLE."
6560 GOTO 6505
6565 DISP "LOAD BLANK TAPE AND PRESS CONT/EXEC.";
6570 STOP
6575 IF Z[7]>0.5 THEN 6625
6585 REWIND
6590 WAIT 10000
6595 MARK 1,300
6600 MARK 1,2000
6605 MARK 21,1150
6610 REWIND
6615 WAIT 2000
6620 IF Z[7]>0.5 THEN 6685
6625 MAT C=ZER
6630 MAT A=ZER
6635 A[1]=1
6640 C[101,1]=P[186,10]
6645 C[101,5]=P[186,6]
6650 C[101,4]=P[186,7]
6651 C[101,7]=P[186,10]
6655 DISP "ENTER OP. NO.,AND DATE AS MO.DAY,YR.";
6660 INPUT A[2],A[3],A[4],A[5]
6665 A[6]=0
6670 DISP "ENTER SOL THIS TAPE";
6675 INPUT A[7]
6680 IF Z[7]>0.5 THEN 6710
6685 STORE  DATA 0,A
6690 STORE  DATA 1,P
6695 STORE  DATA 2,C
6700 REWIND
6702 Z[7]=0
6705 GOTO 40
6710 DISP "ENTER CLEANUP SOL";
6715 INPUT M4
6720 DISP "ENTER #(SOLS.HR MN SC)/ BUMP";
6725 INPUT 03,02,01,00
6726 I6=P[186,8]
6727 I4=6
6728 I3=161
6730 M4=M4-200
6731 I2=1
6732 IF I6#161 THEN 6735
6733 I6=I6-1
6734 GOSUB 6820
6735 FOR I2=1 TO I6
6740 IF INT(P[I2,6]/100)>M4 THEN 6760
6745 IF INT(P[I2,8]/10000)=1 THEN 6750
6746 GOSUB 6820
6747 I6=I6-1*(P[I2,8]#0)
6749 GOTO 6753
6750 GOSUB 6805
6753 I2=I2-1
6754 IF I2=I6 THEN 6761
6760 NEXT I2
6761 I3=144
6762 I4=1
6765 FOR I2=103 TO 144
6770 IF INT(P[I2,1]/100)>M4 THEN 6780'
6772 IF INT(P[I2,3])=0 THEN 6780
6775 GOSUB 7000
6780 NEXT I2
6781 I3=186
6782 I4=1
6785 FOR I2=145 TO 186
6790 IF INT(P[I2,1]/100)>M4 THEN 6800
6792 IF INT(P[I2,3])=0 THEN 6800
6795 GOSUB 7000
6800 NEXT I2
6801 P[186,8]=I6
6802 GOTO 40
6805 SEND P[I2,6] TO E[1]
6808 O4=00+INT(100*(FRAC(E[2]/100)))
6810 O5=01+INT(E[2]/100)+(O4>59)
6812 O4=O4-60*(O4>59)
6814 O6=02+INT(100*(FRAC(E[1]/100)))+(O5>59)
6815 O5=O5-60*(O5>59)
6816 O7=03+INT(E[1]/100)+(O6>23)
6817 O6=O6-24*(O6>23)
6818 E[1]=100*O7+O6
6819 E[2]=100*O5+O4
6820 SEND E[1] TO P[I6+1,6]
6821 FOR I7=I2 TO I6+1
6825 SEND P[I7+1,6] TO E[1]
6826 SEND E[1] TO P[I7,6]
6830 NEXT I7
6840 RETURN
7000 FOR I7=I2 TO I3-1
7005 SEND P[I7+1,1] TO E[1]
7010 SEND E[1] TO P[I7,1]
7015 NEXT I7
7017 I2=I2-1
7020 RETURN
8000 PRINT "--------------------------------------------------------------------------------"
8010 PRINT "                                                                    "A$
8020 RETURN
10 COM P[186,10],C[101,11],Z[9],A[242],V[33]
15 DIM B$[60],D$[80],E$[80],F[99,11],R[101,11],U[12],Q$[26],A$[15]
20 REWIND #5
25 TRANSFER V[1] TO A$
30 IF Z[7]>0.5 THEN 7000
35 Z[7]=0
40 DISP "PLAN";
45 INPUT B$
50 IF B$[1,3]="SKY" THEN 75
55 IF B$[1,4]="LSE@" THEN 3000
56 IF B$[1,4]="FORM" THEN 6500
60 IF B$[1,3]="USE" THEN 1710
65 IF B$[1,4]="CONT" THEN 1570
66 IF B$[1,4]="STOP" THEN 2800
67 IF B$[1,2]="RE" THEN 7000
70 GOTO 40
75 E$="ALLRECDCSRCECLR IRBB NNCSURMDNDCSRCE     CYC PRE PST"
76 B$="BB2BLUGRNREDSUNBB4UNDUNDBB1IR3IR2IR1UNDBB3SURCLR IRNNC"
77 Z[7]=0
80 F5=0
91 DISP "REASON";
92 INPUT Q$[1,1]
110 REM
118 DISP "SOL START, STOP";
119 INPUT V1,V2
120 V1=V1-200
121 V2=V2-200
122 FOR V=145 TO 185
123 T1=INT(P[V,1]/100)
124 T3=INT(P[V+1,1]/100)
125 IF (T1)V2 OR T3<V1) THEN 1560
126 D$="RCE"
140 FOR I=3 TO 4
145 G1=3*I-2
150 IF D$[1,3]=E$[G1,G1+2] THEN 185
155 NEXT I
160 F2=0
165 T3=T3+24
170 T2=1
175 T4=2100
180 GOTO 285
185 IF T3>T1 THEN 187
186 T3=T3+100
187 IF I=4 THEN 205
190 F2=1
195 K1=102
200 GOTO 215
205 K1=144
210 F2=2
215 T=T1/100
255 T1=P[V,1]
260 T2=P[V,2]
275 T3=P[V+1,1]
280 T4=P[V+1,2]
285 IF Z[7]>0.5 THEN 390
287 DISP "TRANS. MODE";
290 INPUT D$
295 FOR L=0 TO 3
300 G1=1+L*3
305 IF D$[1,3]=E$[G1,G1+2] THEN 320
310 NEXT L
315 GOTO 285
320 F3=L
325 DISP "PICT. CLASS";
330 INPUT D$
335 FOR L=0 TO 4
340 F4=(POS(E$,D$)-10)/3
345 IF F4<-3 THEN 325
350 IF F4>0 THEN 365
355 F4=0
365 F1=0
370 DISP "PLOT?";
375 INPUT D$
380 IF D$[1,1]="N" THEN 390
385 F1=1
390 IF F5<0.5 THEN 420
395 I3=INT((T3-T1+2)/100)
396 IF (60*(T3-T3)+INT((T4-T2)/100))/I3>6000 THEN 401
397 T5=T1
398 T4=T2
399 T2=T2+300
400 GOTO 405
401 T2=T4
402 T5=T3-I3*100
403 T4=T4+300
405 FOR I4=1 TO I3
410 T1=T5+100*(I4-1)
415 T3=T1+100
420 IF F1=0 THEN 515
425 DISP "PLOTTER";
430 STOP
435 SCALE 0,360,-60,220
440 LABEL (*,1.3,1,0,0.6)
445 G1=F2*3+28
```

```
450 G2=F3*3+1
455 G3=F4*3+1+(F4>0)*9
460 PLOT 5,82,1
465 LABEL (*)E$[G3,G3+2]$" IMAGES BY "$E$[G2,G2+2]$" MODE OF TRANS."$
470 LABEL (*)" FROM "$E$[G1,G1+2]$" SOL"$INT(T1/100)+200
475 PLOT 5,74,1
480 LABEL (*)"TO "$E$[G1,G1+2]$" SOL"$INT(T3/100)+200$
490 LABEL (*)" PER VL"$P[186,10]$" U/L"$P[186,6]$" REV."$P[186,7]
495 IF P[186,9]=1 THEN 505
500 LABEL (*)"WARNING UNROLLED REVISION IN MISSION"
505 PLOT 0,-60,-2
508 PLOT 0,-60,1
510 PLOT 360,219,-2
512 PEN
515 GOSUB 8000
520 M7=4
525 GOSUB 1690
530 D9=11
535 G1=F2+3+28
540 G2=F3*3+1
545 G3=F4*3+1+(F4>0)*9
550 OUTPUT (15,565)"LIST OF "$E$[G3,G3+2]$" IMAGES BY "$E$[G2,G2+2]$" MODE OF"
555 OUTPUT (15,565)"TRANSMISSION FROM "$E$[G1,G1+2]$" ON SOL"$INT(T1/100)+200
560 OUTPUT (15,565)"TO "$E$[G1,G1+2]$" SOL"$INT(T3/100)+200$" PER VL"$P[186,10]$
565 FORMAT F4.0,F2.0
566 FORMAT F4.0,F3.0
570 OUTPUT (15,566)" U/L-"$P[186,6]$" REV."$P[186,7]
575 PRINT
580 IF P[186,9]=1 THEN 590
585 PRINT "WARNING UNROLLED REVISION IN MISSION"
590 PRINT
595 N=0
600 S2=INT(T1/100)
605 J1=5
610 IF F3>1 THEN 1420
615 J2=1
620 J3=P[186,8]
625 PRINT "RECORDED IMAGING"
630 PRINT
635 S1=0
640 B2=0
645 S3=S2-1
650 D3=0
655 D9=D9+2
657 S4=0
665 FOR L=J2 TO J3
670 IF P[L,1+J1]<T1 THEN 1360
675 IF P[L,1+J1]>T1 THEN 685
680 IF P[L,2+J1] <= T2 THEN 1360
685 IF P[L,1+J1]>T3 THEN 1360
690 IF P[L,1+J1]<T3 THEN 700
695 IF P[L,2+J1]>T4 THEN 1360
700 IF S4=1 THEN 725
705 PRINT " LIST  TYPE  CAM. START    END   EPA      TIME     CMD.  BITS   DUR."
710 D9=D9+2
715 PRINT "  NO.  PIC.          AZ.    AZ.           HR.:MIN        X10↑6"
720 B3=0
725 G=P[L,1+J1]
730 M1=INT(G/100)
735 M2=G-100*M1
745 G=P[L,2+J1]
750 GOSUB 1670
755 M3=G2
760 M4=G3
765 IF J1=0 THEN 835
770 G=P[L,8]
775 GOSUB 1670
780 M5=G2
785 M6=G3
790 G=P[L,9]
795 GOSUB 1670
800 M7=G1+G2
805 M8=G3
810 G=P[L,10]
815 GOSUB 1670
820 H1=G2
825 H2=G3
830 GOTO 900
835 M7=0
840 H1=0
845 H2=0
850 G5=P[L,4]*10↑5+P[L,5]
855 FOR I5=1 TO 10
860 G6=INT(G5/10↑(I5-1))
865 G6=G6-10*INT(G6/10)
870 IF G6=0 THEN 1350
875 G6=G6+12*J4+P[L,3]*6+155
880 M5=P[G6,6]
885 M6=P[G6,9]
890 M8=P[G6,10]
895 B1=(P[G6,7]+P[G6,8]/10)*(250+15750*J4)
900 G=P[M5,1]
905 GOSUB 1670
910 H3=G1
915 H4=G3
920 G=P[M5,2]
925 GOSUB 1670
930 H5=G3
935 H6=P[M5,3]/10
940 H7=P[M5,4]/10
945 H8=P[M5,5]
950 IF F4=0 THEN 1035
955 IF F4=1 AND H4=1 AND H5=1 THEN 995
960 IF F4=2 AND H4=9 AND H5=1 THEN 1005
965 S9=(H4=0 OR H4=5 OR H4=8 OR H4=13)
970 IF F4=3 AND S9=1 AND H5#1 THEN 1025
975 IF F4=5 AND S9=0 AND H5#1 THEN 1025
980 S9=(H4=1 OR H4=9)
985 IF F4=4 AND S9=0 AND H5=1 THEN 1015
990 GOTO 1345
995 H9=15
1000 GOTO 1085
1005 H9=16
1010 GOTO 1085
1015 H9=17
1020 GOTO 1085
1025 H9=H4
1030 GOTO 1085
1035 IF H5=1 THEN 1050
1040 H9=H4
1045 GOTO 1085
1050 IF H4=1 THEN 1070
1055 IF H4=9 THEN 1080
1060 H9=17
1065 GOTO 1085
1070 H9=15
1075 GOTO 1085
1080 H9=16
1085 K1=0.04
1090 IF H5<3 THEN 1100
1095 K1=0.12
1100 IF H4=0 OR H4=5 OR H4=8 OR H4=13 THEN 1120
1105 IF H5#2 AND H5#0 THEN 1130
1110 H8=H8-5.6
1115 GOTO 1130
1120 IF H5=2 OR H5=0 THEN 1130
1125 H8=H8+5.6
1130 IF J1=0 THEN 1145
1135 B1=(H7-H6)*3413/K1+(250+15750*H3)*(H1*(P[100,1]+P[100,2]/10)+P[100,3]/100)
1137 IF H3>0 THEN 1140
1138 B1=(2.5E+05)*(1+INT(B1/1.92E+05))
1139 GOTO 1145
1140 B1=B1+M7*275200
1145 B2=B2+B1
1149 D1=M7*17.5
1150 D1=(H7-H6)*3413/((250+15750*H3)*K1)+H1*(P[100,1]+P[100,2]/10)+P[100,3]/100
1151 IF J1>1 THEN 1155
1152 D1=B1/(250+H3*15750)
1155 B3=B3+B1
1160 IF M1=S3 THEN 1230
1165 IF S1=1 THEN 1185
1170 S4=1
1175 S1=1
1180 GOTO 1210
1185 PRINT "                                    TOTAL BITS THIS MODE/SOL:";
1190 OUTPUT (15,1195)(B3-B1)/10↑6
1195 FORMAT F7.2
1200 PRINT
1205 B3=B1
1210 PRINT "IMAGES ON SOL"$M1+200
1215 D9=D9+4
1220 PRINT
1225 S3=M1
1230 N=N+1
1235 H9=3*H9+1
1237 PRT-ALL 0
1238 G4=P[M5,1]
1239 OUTPUT (15,1250)N$"    "$B$[H9,H9+2]$M6$H6$H7$H8$M2$":"$M3$M5$B1/10↑6$D1
1240 IF Q$[1,1]#"Y" THEN 1244
1241 DISP "CMD:"M5"REASON"$
1242 INPUT Q$[2,25]
1243 PRINT "       GAIN:"INT(G4/100)-INT(G4/10↑4)*100"        REASON:  "Q$[2,25]
1244 PRT-ALL 1
1245 D9=D9+1
1250 FORMAT F4.0,F6.0,2F7.1,F7.1,F6.0,F3.0,F6.0,F8.2,F8.2
1255 IF J1=0 THEN 1295
1260 IF H3>0 THEN 1270
1265 PRINT "NOTICE: RECORDED IMAGING WITH LOW DATA RATE; DSN MODE ONLY."
1270 D2=P[L,6]*10↑4+P[L,7]
1275 IF D2>D3 THEN 1285
1280 PRINT "WARNING: RECORDED IMAGES WITH OVERLAPING TIMES."
1285 D3=D2+40*INT((D1+40)/60)+D1+40
1286 J9=0
1290 GOTO 1335
1295 J9=0
1296 IF J4=0.AND H3=1 THEN 1310
1300 IF J4=1 AND H3=0 THEN 1320
1305 GOTO 1325
1310 PRINT "WARNING: DCS IMAGE WITH HIGH DATA RATE CMD."
1315 GOTO 1325
1320 PRINT "WARNING: RCE IMAGE WITH LOW DATA RATE CMD."
1325 IF B1>(H7-H6)*3413/K1 THEN 1335
1327 J9=1
1330 PRINT "NOTICE: DCS/RCE IMAGE WITH DUR.<AZ. SCAN TIME"
1335 IF F1=0 THEN 1345
1337 IF J1>1 OR J9<0.5 THEN 1340
1338 H7=H6+B1*K1/3413
1340 GOSUB 1585
1345 IF J1=5 THEN 1355
1350 NEXT I5
1355 S4=1
1360 NEXT L
1365 IF S1=1 THEN 1390
1370 PRINT "NO PICTURES FOUND WITH DESIRED CHARACTERISTICS."
1375 D9=D9+2
1380 PRINT
1385 PRINT
1390 PRINT
1395 D9=D9+2
1400 PRINT "                                    TOTAL BITS THIS MODE:";
1405 OUTPUT (15,1195)B2/10↑6
1410 M7=4
1415 GOSUB 1690
1420 IF F3=1 THEN 1535
1425 IF F3=3 THEN 1485
1430 IF F3=0 THEN 1475
1435 IF J1=0 THEN 1535
1440 J1=0
1445 J4=0
1450 J3=144
1455 J2=103
1460 PRINT "DCS IMAGING"
1465 PRINT
1470 GOTO 635
1475 IF J1=0 THEN 1525
1480 GOTO 1440
1485 IF J1=0 THEN 1535
1490 J1=0
1495 J4=1
1500 J2=145
1505 J3=185
1510 PRINT "RCE IMAGING"
1515 PRINT
1520 GOTO 635
1525 IF J4=1 THEN 1535
1530 GOTO 1490
1535 M7=55-D9
1540 GOSUB 1690
1545 GOSUB 8000
1550 IF F5<0.5 THEN 1560
1555 NEXT I4
1560 NEXT V
1565 GOTO 35
1570 REM
1580 LOAD #5,0
1585 SCALE -5.5,354.5,0,219.6
1590 LABEL (*,1.5,1,0,0.6)
1595 OFFSET 0,60.75
1600 IF M6>1.1 THEN 1610
1605 OFFSET 4,178.82
1610 S4=10.18
1615 IF H5=2 THEN 1625
1620 S4=30.72
1625 PLOT H6,H8+S4,1
1630 PLOT H6,H8+S4,2
1635 PLOT H7,H8+S4,2
1640 PLOT H7,H8-S4,2
1645 PLOT H6,H8-S4,2
1650 PLOT H6,H8+S4,2
1655 CPLOT 0.12,-1.1
1660 LABEL (*)M5
1665 RETURN
1670 G1=INT(G/10000)
1675 G2=INT(G/100)-100*G1
1680 G3=G-G1*10000-G2*100
1685 RETURN
1690 FOR K=1 TO M7
1695 PRINT
1700 NEXT K
1705 RETURN
1710 MAT F=ZER
1712 M4=P[186,8]
1715 FOR J=1 TO 3
1720 FOR I=1 TO 54
1725 M5=I+(J-1)*54
1730 IF M5>M4 THEN 1760
1735 G=P[M5,8]
1740 GOSUB 1670
```

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1745 F[I,J]=G2
1750 NEXT I
1755 NEXT J
1760 FOR J=4 TO 5
1761 FOR I=0 TO 20
1762 M5=J*21+I+19
1763 IF M5>144 THEN 1775
1764 FOR K=4 TO 5
1765 IF P[M5,K]=0 THEN 1769
1766 M4=155+6*P[M5,3]+P[M5,K]
1767 K1=I*2+K-3
1768 F[K1,J]=P[M4,6]
1769 NEXT K
1770 NEXT I
1771 NEXT J
1775 FOR J=6 TO 11
1780 FOR I=0 TO 7
1785 M5=J*8+I+97
1790 IF M5>186 THEN 1860
1795 H1=P[M5,4]*10+5+P[M5,5]
1800 IF H1=0 THEN 1850
1805 K1=0
1810 FOR K=0 TO 9
1815 G6=INT(H1/10^K)
1820 G6=G6-INT(G6/10)*10
1825 IF G6=0 THEN 1845
1830 K1=K1+1
1835 M4=167+6*P[M5,3]+G6
1840 F[6*I+K1,J]=P[M4,6]
1845 NEXT K
1850 NEXT I
1855 NEXT J
1860 N=0
1862 E$="ALLRECDCSRCEALLCLR IRBB NNCMDNDCSRCE     CYC PRE PST"
1865 GOSUB 2160
1870 FOR L=1 TO 99
1871 H9=P[L,2]-10*INT(P[L,2]/10)
1872 H7=(P[L,4]-P[L,3])/(10*(1+2*(H9=3)))
1875 FOR J=1 TO 3
1880 FOR I=1 TO 54
1885 IF L#F[I,J] THEN 1915
1890 H1=I+54*(J-1)
1895 H2=6
1900 H3=4
1905 H4=4*INT(P[H1,8]/10000)+37
1910 GOSUB 2225
1915 NEXT I
1920 NEXT J
1925 H2=1
1930 FOR I=162 TO 169
1935 IF L=P[I,6] THEN 1950
1940 NEXT I
1945 GOTO 2030
1950 H3=7
1952 M5=I
1955 H4=45
1960 IF I=162 OR I=168 THEN 1970
1965 H4=49
1970 FOR J=4 TO 5
1975 FOR I=1 TO 42
1980 IF L#F[I,J] THEN 2020
1985 H1=J*2+INT((I-1)/2)+95
1990 IF H1>144 THEN 2030
2015 GOSUB 2222
2020 NEXT I
2025 NEXT J
2030 H3=10
2035 FOR I=174 TO 185
2040 IF L=P[I,6] THEN 2055
2045 NEXT I
2050 GOTO 2135
2055 H4=49
2056 M5=I
2060 IF I>176 AND I<180 THEN 2075
2065 IF I>182 THEN 2075
2070 H4=45
2075 FOR J=6 TO 11
2080 FOR I=1 TO 48
2085 IF L#F[I,J] THEN 2125
2090 H1=97+INT((I-1)/6)+J*8
2095 IF H1>186 THEN 2135
2120 GOSUB 2222
2125 NEXT I
2130 NEXT J
2135 GOSUB 2275
2140 PRINT
2145 NEXT L
2146 IF N>50 OR N<4 THEN 2150
2147 M7=54-N
2148 GOSUB 1690
2150 IF Z[7]>0.5 THEN 3000
2155 GOTO 35
2160 GOSUB 8000
2165 M7=4
2170 GOSUB 1690
2175 OUTPUT (15,2185)"LIST OF THE ORDER OF USE OF EACH COMMAND IN MISSION";
2180 OUTPUT (15,2185)" VL"$P[186,10]$" U/L"$P[186,6]$", REV."$P[186,7]
2185 FORMAT F2.0,F4.0,F3.0
2190 IF P[186,9]=1 THEN 2200
2195 PRINT "WARNING: UNROLLED REVISION IN MISSION."
2200 PRINT
2205 PRINT
2210 PRINT " CMD.    MODE     CAM.  SOL    HR.:MIN.  **AZ."
2215 PRINT
2220 RETURN
2222 M4=P[M5,9]
2225 G=P[H1,H2]
2230 M1=INT(G/100)
2235 M2=G-100*M1
2245 G=P[H1,H2+1]
2250 GOSUB 1670
2255 IF H2<5 THEN 2265
2260 M4=P[H1,8]-10*INT(P[H1,8]/10)
2265 OUTPUT (15,2270)L$"      "$E$[H3,H3+2]$E$[H4,H4+3]$M4$M1+200$M2$":"$G2$H7
2270 FORMAT F3.0,F5.0,F6.0,F7.0,F3.0,F9.2
2275 N=N+1
2280 IF N<54 THEN 2305
2285 N=0
2290 M7=4
2295 GOSUB 1690
2300 GOSUB 2160
2305 RETURN
2800 STOP
3000 D$[1,66]="TBL.CMD,  IMGRT,DCS,RCE,IMG,  *DLPAR,  *RLPAR,RUNUP.RESCAN,RSCN.D
3005 D$[67,76]=",
3010 E$="0123456789ADDDEL"
3015 IF Z[9]<0.5 THEN 3030
3020 PRINT "CHANGE IN WORK. LSEQ IS NOT AVAILABLE."
3025 GOTO 35
3030 IF Z[7]>0.5 THEN 3065
3035 DISP "PRESENT CHANGE";
3040 INPUT B$
3045 IF B$="Y" THEN 3065
3050 DISP "DESTINATION REV";
3055 INPUT G
3060 LOAD  DATA G+2,C
3065 MAT R=ZER
3066 R[101,5]=C[101,5]
3070 IF Z[7]<0.5 THEN 3090
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3075 IF Z[7]<1.5 THEN 3120
3080 G=Z[7]-1
3085 GOTO 3115
3090 DISP "SOURCE?";
3095 INPUT B$
3100 IF B$[1,1]="N" THEN 3120
3105 DISP "REV. OF SOURCE";
3110 INPUT G
3115 LOAD  DATA G+2,R
3120 GOSUB 8000
3125 M7=4
3130 GOSUB 5485
3135 D9=7
3140 FOR I=1 TO 4
3145 G1=I*1000
3150 G2=G1+600
3155 J=0
3160 FOR L=1 TO C[101,6]
3165 IF C[L,6]<G1 OR C[L,6]>G2 THEN 3185
3170 J=J+1
3175 F[J,1]=C[L,6]
3180 F[J,2]=L
3185 NEXT L
3190 IF J=0 THEN 3340
3195 FOR L=1 TO J
3200 FOR K=1 TO R[101,6]
3205 IF F[L,1]=R[K,6] THEN 3240
3210 NEXT K
3215 H2=0
3220 H1=0
3225 H3=F[L,2]
3230 GOSUB I OF 3445,3720,3770,4140
3235 GOTO 3300
3240 M1=0
3245 FOR J=1 TO 5
3250 IF C[F[L,2],J]=R[K,J] THEN 3260
3255 M1=1
3260 NEXT J
3265 IF M1=0 THEN 3295
3270 H1=1
3275 H2=0
3280 H3=F[L,2]
3285 H4=K
3290 GOSUB I OF 3445,3720,3770,4140
3295 R[K,6]=0
3300 NEXT L
3305 D9=D9+4
3310 M7=4
3315 GOSUB 5525
3320 IF D9<65 THEN 3340
3325 D9=7
3330 GOSUB 8000
3335 GOSUB 5485
3340 NEXT I
3345 M7=65-D9
3350 GOSUB 5525
3355 GOSUB 8000
3360 GOSUB 5410
3365 D9=7
3370 FOR I=1 TO 4
3375 M5=I*1000
3380 M6=M5+600
3385 FOR K=1 TO R[101,6]
3390 IF R[K,6]<M5 OR R[K,6]>M6 THEN 3415
3395 H1=1
3400 H2=1
3405 H4=K
3410 GOSUB I OF 3445,3720,3770,4140
3415 NEXT K
3420 NEXT I
3425 M7=65-D9
3430 GOSUB 5525
3435 GOSUB 8000
3440 GOTO 4405
3445 IF H1>0.5 THEN 3605
3450 M1=0
3455 FOR K1=1 TO 5
3460 IF C[H3,K1]=C[H3,K1+6] THEN 3470
3465 M1=1
3470 NEXT K1
3475 IF M1>0.5 THEN 3485
3480 RETURN
3485 H7=10
3490 D9=D9+1
3495 G=C[H3,1]
3500 GOSUB 5545
3505 U[1]=C[H3,6]-1000
3510 U[2]=G2
3515 U[3]=G1
3520 U[4]=G3
3525 G=C[H3,2]
3530 GOSUB 5545
3535 U[5]=G3
3540 U[6]=G2
3545 U[7]=G1
3550 U[8]=C[H3,3]/10
3555 U[9]=C[H3,4]/10
3560 U[10]=C[H3,5]
3565 GOSUB 3980
3570 IF H1>0.5 THEN 3585
3575 PRINT "      "$D$[1,8]$B$[1,Y1]
3580 RETURN
3585 PRINT "  TO "$D$[1,8]$B$[1,Y1]
3590 PRINT
3595 D9=D9+1
3600 RETURN
3605 H7=10
3610 D9=D9+1
3615 G=R[H4,1]
3620 GOSUB 5545
3625 U[1]=R[H4,6]-1000
3630 U[2]=G2
3635 U[3]=G1
3640 U[4]=G3
3645 G=R[H4,2]
3650 GOSUB 5545
3655 U[5]=G3
3660 U[6]=G2
3665 U[7]=G1
3670 U[8]=R[H4,3]/10
3675 U[9]=R[H4,4]/10
3680 U[10]=R[H4,5]
3685 GOSUB 3980
3690 IF H2<0.5 THEN 3705
3695 PRINT "    "$D$[1,8]$B$[1,Y1]
3700 RETURN
3705 PRINT
3710 PRINT "FROM "$D$[1,8]$B$[1,Y1]
3715 GOTO 3485
3720 IF H2>0.5 THEN 3760
3725 G1=C[H3,6]-2156
3730 U[1]=INT(G1/6)
3735 H7=1
3740 GOSUB 3980
3745 H7=7
3750 PRINT "     "$D$[29,37]$B$[1,Y1]
3755 GOTO 3820
3760 G1=R[H4,6]-2156
3765 GOTO 3730
3770 IF H2>0.5 THEN 3810
3775 G1=C[H3,6]-3168
3780 U[1]=INT(G1/6)
3785 H7=1
3790 GOSUB 3980
3795 H7=6
3800 PRINT "     "$D$[38,46]$B$[1,Y1]
3805 GOTO 3820
3810 G1=R[H4,6]-3168
3815 GOTO 3780
3820 U[1]=G1-6*U[1]+1
3825 IF H1>0.5 THEN 3920
3830 U[2]=C[H3,1]
3835 U[3]=C[H3,2]+C[H3,3]/10
3840 U[4]=C[H3,4]
3845 U[5]=C[H3,5]
3855 G=1
3860 U[6]=12+U[4]+5*G*(3-I)
3865 U[7]=5*U[4]-4
3870 GOSUB 3980
3872 IF H7=6 THEN 3875
3873 B$[Y1,Y1]="*"
3875 IF H1>0.5 THEN 3900
3880 PRINT "     "$D$[9,16]$B$[1,Y1]
3885 PRINT
3890 D9=D9+3
3895 RETURN
3900 PRINT "  TO "$D$[9,16]$B$[1,Y1]
3905 PRINT
3910 D9=D9+4
3915 RETURN
3920 U[2]=R[H4,1]
3925 U[3]=R[H4,2]+R[H4,3]/10
3930 U[4]=R[H4,4]
3935 U[5]=R[H4,5]
3945 G=1
3950 U[6]=12+U[4]+5*G*(3-I)
3955 U[7]=5*U[4]-4
3960 GOSUB 3980
3962 IF H7=6 THEN 3965
3963 B$[Y1,Y1]="*"
3965 IF H2>0.5 THEN 3880
3970 PRINT "FROM "$D$[9,16]$B$[1,Y1]
3975 GOTO 3830
3980 Y1=0
3985 FOR I1=1 TO H7
3990 Y1=Y1+1
3995 IF U[I1]>-0.05 THEN 4010
4000 B$[Y1,Y1]="-"
4005 Y1=Y1+1
4010 M1=0
4015 M8=ABS(U[I1])+200*(I1=1 AND (H7=1 OR H7=7) AND (G1=0 OR G1=1))
4020 IF M8<0.05 THEN 4125
4025 M2=0
4030 IF 10*M8-INT(M8)*10<0.05 THEN 4040
4035 M2=1
4040 FOR K1=1 TO 5
4045 IF M2<0.5 AND K1>4 THEN 4105
4050 G=INT(M8/10↑(4-K1))
4055 G=G-10*INT(G/10)
4060 IF M2<0.5 OR K1<5 THEN 4075
4065 B$[Y1,Y1]="."
4070 Y1=Y1+1
4075 IF G<0.5 AND M1<1 AND K1<4.5 THEN 4100
4080 G=G+1
4085 B$[Y1,Y1]=E$[G,G]
4090 M1=1
4095 Y1=Y1+1
```

```
4100 NEXT K1
4105 B$[Y1,Y1]=","
4110 NEXT I1
4115 Y1=Y1-1
4120 RETURN
4125 B$[Y1,Y1+1]="0,"
4130 Y1=Y1+1
4135 GOTO 4110
4140 H7=1
4145 IF H1=1 AND H2=1 THEN 4210
4150 IF H1=1 AND H2=0 THEN 4270
4155 IF C[H3,1]+C[H3,2]/10=C[H3,7]+C[H3,8]/10 THEN 4275
4160 U[1]=C[H3,1]+C[H3,2]/10
4165 GOSUB 3980
4170 IF H1>0.5 THEN 4195
4175 PRINT "      "$D$[60,67]$B$[1,Y1]
4180 D9=D9+2
4185 PRINT
4190 GOTO 4275
4195 PRINT "  TO "$D$[60,67]$B$[1,Y1]
4200 PRINT
4205 GOTO 4275
4210 IF R[H4,1]+R[H4,2]/10=R[H4,7]+R[H4,8]/10 THEN 4275
4215 U[1]=R[H4,1]+R[H4,2]/10
4220 GOSUB 3980
4225 IF H1>0.5 THEN 4250
4230 PRINT "      "$D$[60,67]$B$[1,Y1]
4235 D9=D9+2
4240 PRINT
4245 GOTO 4275
4250 PRINT "FROM "$D$[60,67]$B$[1,Y1]
4255 PRINT
4260 D9=D9+3
4265 GOTO 4160
4270 IF C[H3,1]+C[H3,2]/10#R[H4,1]+R[H4,2]/10 THEN 4215
4275 IF H1=1 AND H2=1 THEN 4340
4280 IF H1=1 AND H2=0 THEN 4395
4285 IF C[H3,3]=C[H3,9] THEN 4400
4290 U[1]=C[H3,3]/100
4295 GOSUB 3980
4300 IF H1>0.5 THEN 4320
4305 PRINT "      "$D$[47,59]$B$[1,Y1]
4310 D9=D9+1
4315 GOTO 4400
4320 PRINT "  TO "$D$[47,59]$B$[1,Y1]
4325 PRINT
4330 D9=D9+3
4335 GOTO 4400
4340 IF R[H4,3]=R[H4,9] THEN 4400
4345 U[1]=R[H4,3]/100
4350 GOSUB 3980
4355 IF H1>0.5 THEN 4375
4360 PRINT "      "$D$[47,59]$B$[1,Y1]
4365 D9=D9+1
4370 GOTO 4400
4375 PRINT "FROM "$D$[47,59]$B$[1,Y1]
4380 PRINT
4385 D9=D9+3
4390 GOTO 4290
4395 IF C[H3,3]#R[H4,3] THEN 4345
4400 RETURN
4405 D9=7
4410 GOSUB 5460
4415 FOR I=1 TO 3
4420 M5=3999+I*1000
4425 M6=500+(I>2)*500
4430 FOR K=0 TO 1
4435 M3=M5+K*M6
4440 M4=M3+10
4445 J=0
4450 FOR L=1 TO C[101,6]
4455 IF C[L,6]<M3 OR C[L,6]>M4 THEN 4475
4460 J=J+1
4465 F[J,1]=C[L,6]
4470 F[J,2]=L
4475 NEXT L
4480 IF J=0 THEN 4720
4485 FOR L=1 TO J
4490 H3=F[L,2]
4495 IF K>0.5 THEN 4605
4500 FOR L1=1 TO R[101,6]
4505 IF R[L1,6]<M5 OR R[L1,6]>M5+10 THEN 4515
4510 IF R[L1,1]=C[H3,1] AND R[L1,2]=C[H3,2] THEN 4555
4515 NEXT L1
4520 IF K<0.5 THEN 4605
4525 H1=I*4+13
4530 D9=D9+1
4535 H2=K*3+11
4540 GOSUB 4925
4545 PRINT E$[H2,H2+2]$"   "$D$[H1,H1+3]$B$[1,Y1]
4550 GOTO 4670
4555 FOR L2=3 TO 5
4560 IF R[L1,L2]#C[H3,L2] THEN 4525
4565 NEXT L2
4575 IF K>0.5 THEN 4590
4580 R[L1,6]=0
4585 GOTO 4670
4590 PRINT "POSSIBLE BAD DATA"$C[L,6]$C[L,1]$C[L,2]$C[L,3]$C[L,4]$C[L,5]
4595 D9=D9+1
4600 GOTO 4670
4605 M3=M5+M6
4610 M4=M3+10
4615 FOR L1=1 TO R[101,6]
4620 IF R[L1,6]<M3 OR R[L1,6]>M4 THEN 4630
4625 IF R[L1,1]=C[H3,1] AND R[L1,2]=C[H3,2] THEN 4645
4630 NEXT L1
4635 IF K>0.5 THEN 4500
4640 GOTO 4525
4645 FOR L2=3 TO 5
4650 IF R[L1,L2]#C[H3,L2] THEN 4525
4655 NEXT L2
4660 IF K<0.5 THEN 4590
4665 R[L1,6]=0
4670 NEXT L
4675 M7=4
4680 GOSUB 5525
4685 D9=D9+4
4690 IF D9<58 THEN 4720
4695 D9=7
4700 M7=4
4705 GOSUB 5525
4710 GOSUB 8000
4715 GOSUB 5460
4720 NEXT K
4725 NEXT I
4730 M7=61-D9
4735 GOSUB 5525
4740 GOSUB 8000
4745 D9=7
4750 GOSUB 5435
4755 FOR I=1 TO 3
4760 M3=500
4765 IF I<3 THEN 4775
4770 M3=1000
4775 FOR K=0 TO 1
4780 M5=3999+I*1000+K*M3
4785 M6=M5+10
4790 J=0
4795 H1=I*4+13
4800 H2=K*3+11
4805 FOR L=1 TO R[101,6]
4810 IF R[L,6]<M5 OR R[L,6]>M6 THEN 4835
4815 GOSUB 5215
4820 PRINT E$[H2,H2+2]$"   "$D$[H1,H1+3]$B$[1,Y1]
4825 D9=D9+1
4830 J=J+1
4835 NEXT L
4840 IF J=0 THEN 4860
4845 D9=D9+4
4850 M7=4
4855 GOSUB 5525
4860 NEXT K
4865 NEXT I
4870 M7=61-D9
4875 GOSUB 5525
4880 GOSUB 8000
4885 IF Z[7]<0.5 THEN 35
4890 F5=1
4895 F4=0
4900 F3=0
4905 F1=1
4910 I=4
4912 T1=100*P[148,6]
4914 T2=1
4916 T3=T1+800
4918 T4=0
4920 GOTO 75
4925 G=C[H3,1]
4930 U[1]=INT(G/100)
4935 U[2]=G-100*U[1]
4945 G=C[H3,2]
4950 GOSUB 5545
4955 U[3]=G2
4960 U[4]=G3
4965 IF C[H3,6]<6999 THEN 5115
4970 G=C[H3,3]
4975 GOSUB 5545
4980 U[5]=G1
4985 U[6]=G2
4990 U[7]=G3
4995 H7=7
5000 GOSUB 3980
5005 Y1=Y1+1
5010 G=C[H3,4]
5015 GOSUB 5545
5020 IF G1<0.5 THEN 5035
5025 B$[Y1+1,Y1+5]="CAL1,"
5030 Y1=Y1+5
5035 IF G2<0.5 THEN 5050
5040 B$[Y1+1,Y1+5]="CAL2,"
5045 Y1=Y1+5
5050 IF G3<0.5 THEN 5065
5055 B$[Y1+1,Y1+5]="STOW,"
5060 Y1=Y1+5
5065 G=C[H3,5]
5070 GOSUB 5545
5075 IF G2<0.5 THEN 5090
5080 B$[Y1+1,Y1+7]="RESCAN,"
5085 Y1=Y1+7
5090 IF G3<0.5 THEN 5105
5095 B$[Y1+1,Y1+5]="DUST,"
5100 Y1=Y1+5
5105 Y1=Y1-1
5110 RETURN
5115 H7=1
5117 GOSUB 3980
5119 B$[Y1+1,Y1+10]=",**,**,**,"
5121 H7=2
5123 U[1]=0
```

```
5125 U[2]=C[H3,3]
5127 Y1=Y1+10
5129 GOSUB 3985
5135 Y1=Y1+1
5140 B$[Y1+1,Y1+3]="**,"
5145 Y1=Y1+3
5150 G=C[H3,4]*10↑5+C[H3,5]
5155 FOR K1=0 TO 10
5160 G1=INT(G/10↑(10-K1))
5165 G1=G1-10*INT(G1/10)
5170 IF G1=0 THEN 5200
5175 B$[Y1+1,Y1+3]="RTI"
5180 G1=G1+1
5185 B$[Y1+4,Y1+4]=E$[G1,G1]
5190 Y1=Y1+5
5195 B$[Y1,Y1]=","
5200 NEXT K1
5205 Y1=Y1-1
5210 RETURN
5215 G=R[L,1]
5220 U[1]=INT(G/100)
5225 U[2]=G-100*U[1]
5235 G=R[L,2]
5240 GOSUB 5545
5245 U[3]=G2
5250 U[4]=G3
5255 IF R[L,6]<6999 THEN 5365
5260 G=R[L,3]
5265 GOSUB 5545
5270 U[5]=G1
5275 U[6]=G2
5280 U[7]=G3
5285 H7=7
5290 GOSUB 3980
5295 Y1=Y1+1
5300 G=R[L,4]
5305 GOSUB 5545
5310 IF G1<0.5 THEN 5325
5315 B$[Y1+1,Y1+5]="CAL1,"
5320 Y1=Y1+5
5325 IF G2<0.5 THEN 5340
5330 B$[Y1+1,Y1+5]="CAL2,"
5335 Y1=Y1+5
5340 IF G3<0.5 THEN 5355
5345 B$[Y1+1,Y1+5]="STOW,"
5350 Y1=Y1+5
5355 G=R[L,5]
5360 GOTO 5070
5365 H7=1
5367 GOSUB 3980
5369 B$[Y1+1,Y1+10]=",**,**,**,"
5371 H7=2
5373 U[1]=0
5375 U[2]=R[L,3]
5377 Y1=Y1+10
5379 GOSUB 3985
5385 Y1=Y1+1
5390 B$[Y1+1,Y1+3]="**,"
5395 Y1=Y1+3
5400 G=R[L,4]*10↑5+R[L,5]
5405 GOTO 5155
5410 M7=4
5415 GOSUB 5525
5420 PRINT "REMOVE CARDS FOR LSEQ TABLE CHANGES."
5425 PRINT
5430 GOTO 5505
5435 M7=4
5440 GOSUB 5525
5445 PRINT "REMOVE CARDS FOR LSEQ,MSET CHANGES"
5450 PRINT
5455 GOTO 5505
5460 M7=4
5465 GOSUB 5525
5470 PRINT "INSERT CARDS FOR LSEQ MSET CHANGES"
5475 PRINT
5480 GOTO 5505
5485 M7=4
5490 GOSUB 5525
5495 PRINT "INSERT CARDS FOR LSEQ TABLE CHANGES"
5500 PRINT
5505 OUTPUT (15,5520)"IN LSEQ CHANGE BASE OF VL";C[101,7];R[101,5];" U/L-CAM-";
5510 OUTPUT (15,5521)"REV.";R[101,4];" TO MAKE"
5515 OUTPUT (15,5520)"IT THE CHANGE BASE OF VL";C[101,7];C[101,5];
5516 OUTPUT (15,5521)" U/L-CAM-REV.";C[101,4]
5520 FORMAT F2.0,F4.0,F3.0
5521 FORMAT 2F3.0
5525 FOR K3=1 TO M7
5530 PRINT
5535 NEXT K3
5540 RETURN
5545 G1=INT(G/10000)
5550 G2=INT(G/100)-100*G1
5555 G3=G-10000*G1-100*G2
5560 RETURN
6500 LOAD #5,6
7000 GOSUB 8000
7010 FOR K=1 TO 8
7020 PRINT
7030 NEXT K
7040 IF Z[8]=1 THEN 7120
7050 LOAD  DATA 0,A
7060 BEEP
7070 DISP "ENTER SOL OF THIS TAPE";
7080 INPUT M1
7090 OUTPUT (15,7100)"REVISION TABLE FOR THE SOL";M1;" TAPE:"
7100 FORMAT 2F4.0
7110 GOTO 7160
7120 PRINT "REVISION TABLE FOR THE TAPE ON WHICH"
7130 OUTPUT (15,7150)"THE CHANGE FILE FOR SOL";C[101,5];" REV.";C[101,4];
7140 OUTPUT (15,7150)" RESIDES."
7150 FORMAT F4.0,2F3.0
7160 PRINT
7170 PRINT
7180 PRINT " REV.NO.  SOL      DATE      OPERATOR"
7190 PRINT "                  MO-DAY-YEAR"
7200 PRINT
7210 FOR I=1 TO A[1]
7220 OUTPUT (15,7230)A[I*6];A[I*6+1];A[I*6-3];"-";A[I*6-2];"-";A[I*6-1];A[I*6-4]
7230 FORMAT 3F6.0,2F3.0,F7.0
7240 NEXT I
7250 M7=52-A[1]
7255 GOSUB 5525
7260 GOSUB 8000
7270 IF Z[7]>0.5 THEN 1710
7280 GOTO 35
8000 PRINT "--------------------------------------------------------------------------------
8010 PRINT "
8020 RETURN                                                                    "A$
```