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MICROPROCESSOR CONTROLLED EJECTION SEAT.(U)
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LEVEL IV

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MICROPROCESSOR CONTROLLED EJECTION SEAT

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COMPUTER SCIENCES CORPORATION
101 Masons Hill Business Park
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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) → The operation of an ejection seat depends on a number of devices on the seat performing certain tasks at specific times. Traditionally, the timing and sequencing of these tasks have been controlled by fuses, gas lines and mechanical linkages, with marginal accuracy and limited logic. This effort was undertaken to demonstrate the feasibility of using a microprocessor to control these functions with increased accuracy and more sophisticated logic. The microprocessor provides timing by electronic clock, → next page		

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cont 20 event sequencing via electrical signals, and sophisticated logic based on environmental inputs. In addition, the microprocessor, in conjunction with a gimballed rocket motor, provides the capability of performing a Vertical Seeking Maneuver in the event of an adverse attitude ejection. This report contains the software required to complement all these functions.

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FOREWORD

This final report describes the work accomplished by Computer Sciences Corporation for the Aircraft and Crew Systems Technology Directorate of the Naval Air Development Center, Warminster, Pennsylvania, in accordance with the requirements defined by Task Order 7, "Escape System Trajectory Simulation and Micro-processor Control System" issued under Contract N62269-78-0191. This work was sponsored by the Naval Air Systems Command (AIR-340B) under AirTask A03V-0000/001B/8F41400000 and was monitored by Mr. Louis D'Aulerio and Mr. John Tyburski of NADC.

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SUMMARY

Computer Sciences Corporation (CSC) Bryn Athyn, Pennsylvania conducted an effort for the Crew Systems Engineering Division (603), Naval Air Development Center. The purpose of this effort was to examine and demonstrate the feasibility of using a microprocessor based system to control the functions of a vertical seeking ejection seat.

In November 1977, CSC issued a report containing the results of an initial study which found the concept to be feasible and recommended further analysis. To this end, NADC initiated the purchase of the IMSAI PCS 80/30 microprocessor based software development system.

In July 1978, CSC issued a second report containing the results of an effort which consisted of the following activities:

1. Define the functional requirements of an ejection seat system.
2. Develop software to demonstrate that the INTEL 8085 microprocessor possesses the capabilities required to perform the desired functions.
3. Examine the reliability and maintainability aspects of the INTEL 8085 to determine whether it meets the requirements defined for military use.

Of these, the primary task was the software development. Although the program had been designed, and much of it coded, complete development was postponed by delays in the shipment of the IMSAI PCS 80/30. In September, CSC completed the development and testing of the program, thus demonstrating the feasibility of the microprocessor controlled ejection seat concept.

The material presented herein assumes that the reader has some familiarity with the IMSAI PCS 80/30 and its operating system (IMDOS).

1. INTRODUCTION

This document describes the program that was developed and tested to demonstrate the capability of the INTEL 8085 microprocessor to control the functions of a vertical seeking ejection seat. The main subroutines are discussed in some detail, with special emphasis given to the implementation of the vertical seeking maneuver, the major function in the ejection sequence. A listing of the program is included, along with flow diagrams, a definition of each program variable and a map of the area of memory containing the program data buffers and variables.

The microcomputer system purchased for the development of this program is the IMSAI PCS 80/30, an integrated I/O terminal based on the INTEL 8085 microprocessor. It includes an intelligent, programmable keyboard for direct data input, a 5-inch CRT for data output, 3 programmable memory-mapped timers for real time control and 32K bytes of Random Access Memory for program loading and execution. A single density dual floppy disk system provides mass storage.

It should be noted that because of its nature as a software development system, the IMSAI PCS 80/30 lacks the specialized hardware interfaces and "peripheral devices" that would be found on a true ejection seat system. Therefore, although the program was written for implementation on this system, it would have to be modified slightly before being used in a real system. The program, however was designed and coded in such a way as to minimize this transition.

2. PROGRAM DESCRIPTION

The program consist of two parts. The first is a lengthy initialization process, most of which is necessitated by the fact that the program is implemented on a software development system as opposed to a real ejection seat system. The second controls the timing, sequencing and simulated execution of the ejection functions. The following discussion describes each part in detail.

2.1 Initialization

The initialization process is accomplished through a series of CALLs to the subroutines executing the appropriate initialization functions. Each of these subroutines, its function, and an explanation is given below.

2.1.1 INZRST75: Initialize Timer Interrupt Handler

Each timer interrupt received causes the execution of the instruction "RST 7.5", which is essentially a "CALL 003C". Thus, code for handling the interrupt must begin at memory location 3CH; however, the operating system under which the program is run (IMDOS) will not load object code into any memory location below 100H. If code is required in that area of memory, it must be loaded by the program itself. This subroutine loads the object code for the instruction "JMP SEQSR1" (the timer interrupt handling routine) into memory locations 3CH, 3DH, 3EH.

2.1.2 INZTMRS: Initialize System Timers

Because the system timers have no power-on reset, each is programmed to count to a short termination (.5 μ s) and stop. Any timer interrupts that may be present are cleared.

2.1.3 INZDSP: Initialize Display

The CRT is first initialized by CALLing the INITIALIZATION ENTRY POINT of the VIO firmware driver. This accomplishes the following:

1. Clears the screen
2. Positions the cursor in the upper left corner
3. Selects an 80x24 screen format
4. Selects UPPER CASE display mode
5. Activates screen scroll mode

INZDSP then selects the alternate 40x24 screen format and upper and lower case display mode.

2.1.4 CHOICE: Initialize Test to be Run

The demonstration program can execute the vertical seeking maneuver from an initial orientation of a 90° roll or a 180° roll. This subroutine displays the message shown in Figure 2.1, then waits for the user to make a selection. Upon receiving a valid input (1 or 2), CHOICE defines the initial orientation of the seat/occupant system, sets up the 'INITIAL ORIENTATION' message to be displayed upon completion of the ejection sequence, and selects the appropriate rate data file.

2.1.4.1 Define Initial Orientation of Seat/Occupant System

The program keeps track of the orientation of the seat/occupant system by maintaining the direction cosines of the angles from each of the axes of the seat/occupant coordinate system to the vertical (see Figure 2.2). Within the program, the direction cosines are maintained in double precision (16 bit), two's complement form, according to the following scheme:

Value of Direction Cosine	Value in Program
1	4000H
0	0000
-1	C000H

Thus, D31, D32 and D33, (the memory locations in which the three direction cosines are stored) are initialized as follows:

Test selected	$\alpha 31$	D31	$\alpha 32$	D32	$\alpha 33$	D33
1	90	0000	0	4000H	90	0000
2	90	0000	-90	0000H	0	4000H

2.1.4.2 Set Up 'INITIAL ORIENTATION' Message

After completing the execution of the ejection seat functions, the demonstration program displays the initial and final orientation of the seat/occupant system. CHOICE writes the ASCII code for the decimal equivalent of the above initial direction cosines into the message to be displayed.

2.1.4.3 Select Appropriate Rate Data File

For each test, there exists a disk file containing the rate data interpolating points (see Section 2.1.7). CHOICE initializes the File Control Block FCBRD1 to access either file RDATA1.DAT or RDATA2.DAT for test 1 or test 2 respectively.

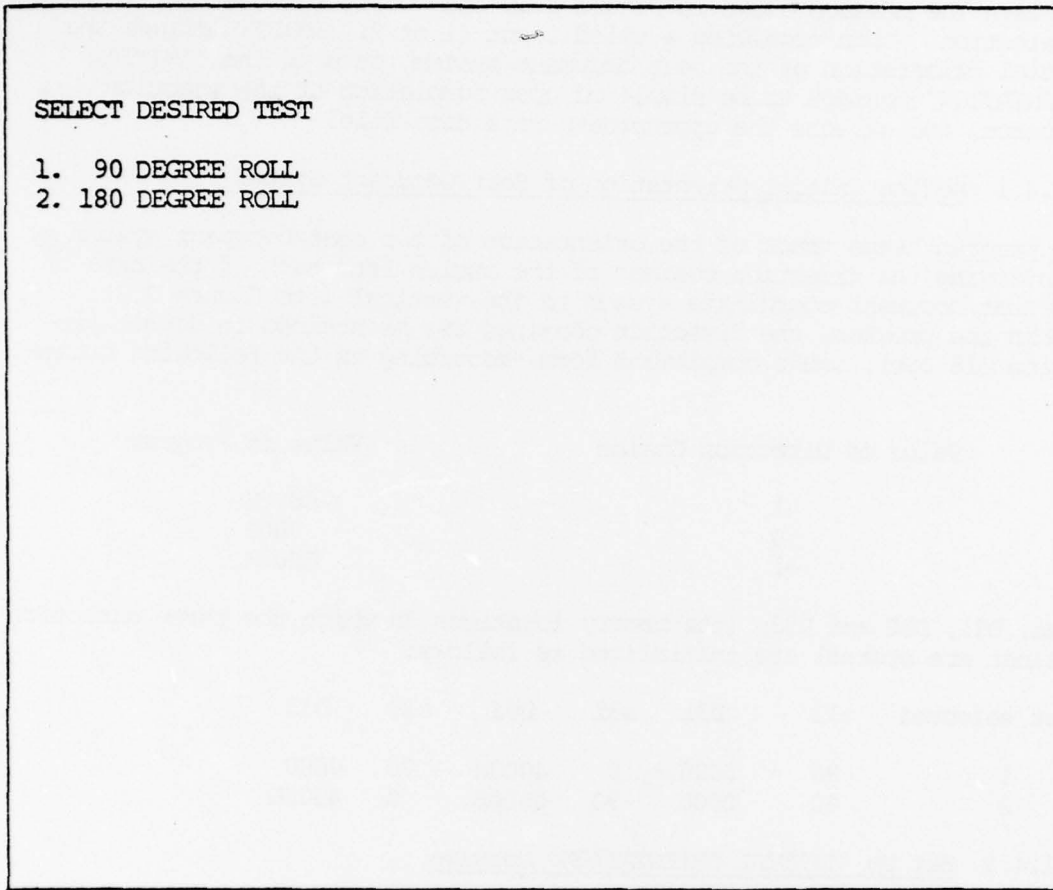
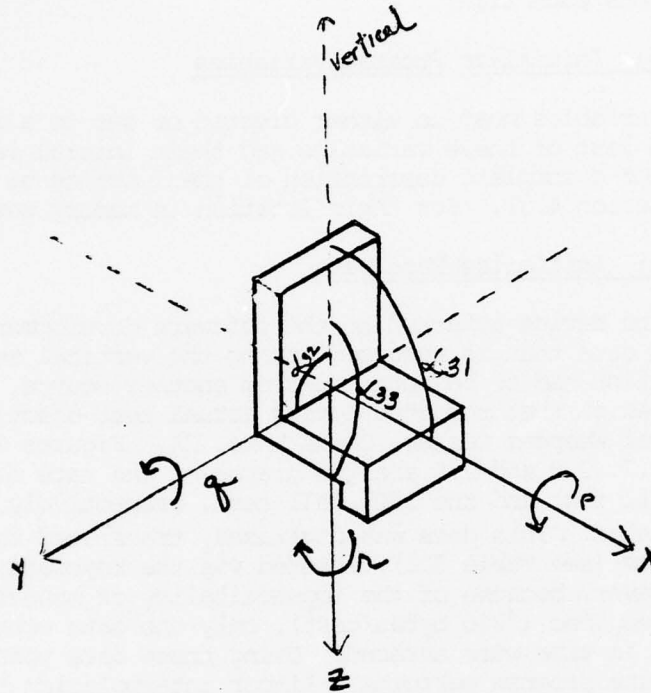


Figure 2.1 CRT Display for Test Initialization



$D_{31} = \text{dir. cos. } \alpha_{31}$

$D_{32} = \text{dir. cos } \alpha_{32}$

$D_{33} = \text{dir. cos. } \alpha_{33}$

p = rate of rotation
around the X-axis
(roll rate)

q = rate of rotation
around the y-axis
(pitch rate)

r = rate of rotation
around the z-axis
(yaw rate)

Figure 2.2 Seat/Occupant Coordinate System Definition

2.1.5 INZDSK: Initialize Disk

All disk I/O is handled through IMDOS and this requires that a File Control Block (FCB) be set up for each file to be accessed by the program. This subroutine initializes the FCB s for each of four files used by the program. It then opens each file.

2.1.6 INZVRBLS: Initialize Program Variables

Certain program variables must be either cleared or set to a predefined initial value. A list of these variables and their initial value is given in Figure 2.3. For a complete description of the function of each of these variables (see Section 4.3). For their location in memory see Section 4.4.

2.1.7 INZRDATA: Initialize Rate Data

Because there is no device attached to the software development system to generate the rate data that is required during the vertical seeking maneuver, this information had to be obtained from another source. The input data used was based on that recorded during actual test ejections performed at the Naval Weapons Center, China Lake, CA. Figures 2.4, 2.5 and 2.6 and Figures 2.7, 2.8 and 2.9 are the graphs of the rate data recorded during the 90° roll test and the 180° roll test, respectively, of the vertical seeking seat. This data was digitized, translated to the form used in the program (see Table 3.1), entered via the keyboard, and stored on the disk. However, because of the impracticality of manually entering each data point required (7200 bytes/test), only the data corresponding to certain points in time were entered. Using these data points as interpolating points, the program performs a linear interpolation to generate the rest of the data. This data is then stored in memory and read as required during the vertical seeking maneuver.

2.1.7.1 LINF: Linear Interpolation

According to the report in which the test data was issued, microprocessor control is initiated at .389 seconds. Since the rocket motor burns for a nominal 1.5 seconds, the data between $T=.389$ and $T=1.889$ was assumed to have been used in the test to perform the vertical seeking maneuver. Accordingly, it is from this portion of each graph that the interpolating points were read. The total elapsed times differ in the demonstration program as indicated on the graphs and defined as follows:

$T=.389$	=	$T=.55$ in demo program
$T=1.889$	=	$T=2.05$ in demo program

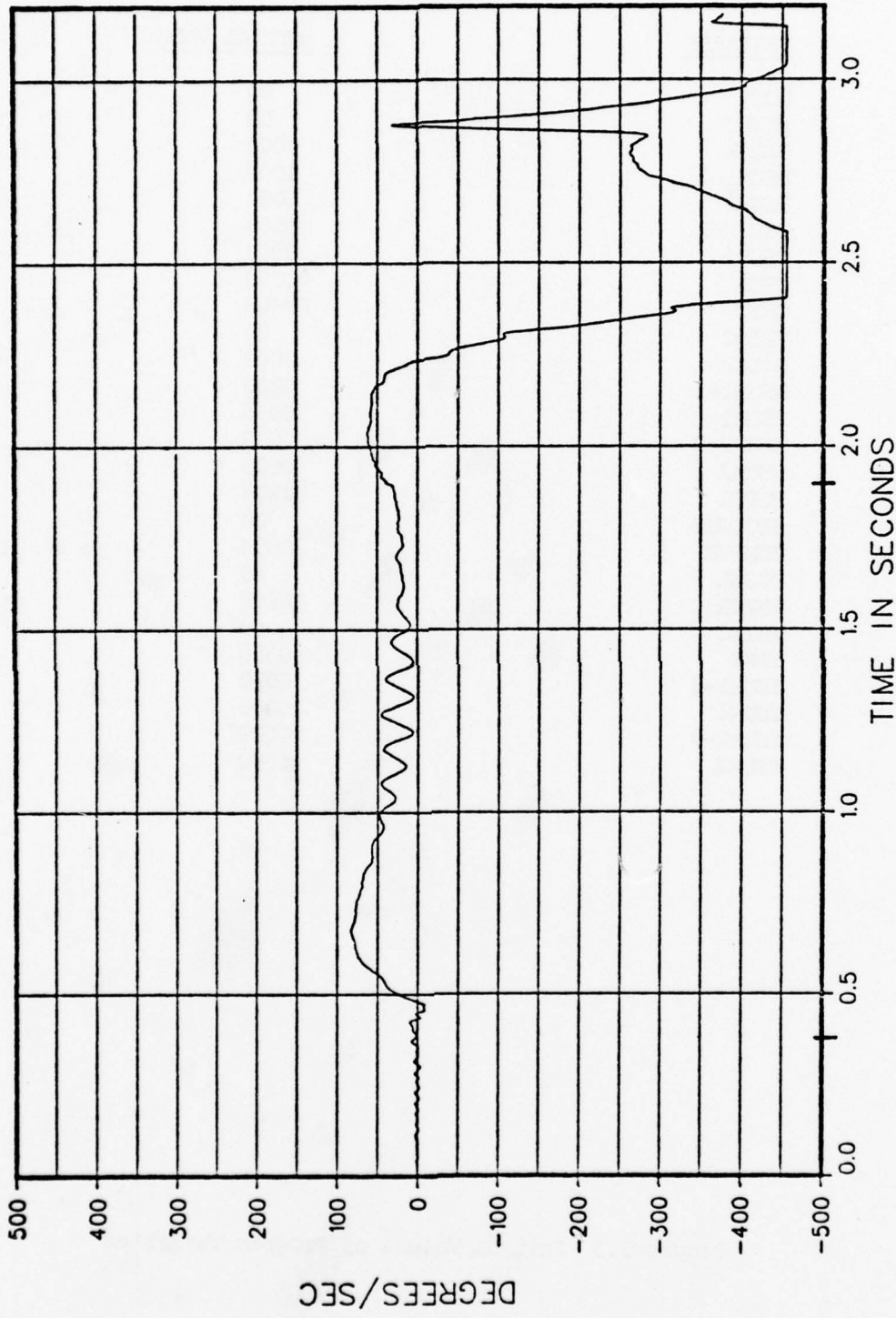
In the vertical seeking algorithm, these times in turn correspond to $t=0$ and $t=1500$ (where t = number of ms after the beginning of the maneuver) and are also indicated on the graph. For consistency with the discussion of the vertical seeking algorithm (see Section 3) it is these times that are used below.

<u>VARIABLE</u>	<u>INITIAL VALUE</u>
DOCT	00
PCINC	00
PICHR	0000
PSUM1-2	0000
PSUM1	0000
PSUM2-2	0000
PSUM2	0000
QPOS	0000H
QNEG	F340H
RLINC	00
ROLLR	0000
RSUM1-2	0000
RSUM1	0000
RSUM2-2	0000
RSUM2	0000
SCPTR	3800H
SEQINDX	00
TLMPTR	3CB0H
TOGGL	00
VSPTR	4AE0H
YAINC	00
YAWR	0000
YSUM1-2	0000
YSUM1	0000
YSUM2-2	0000
YSUM2	0000

Figure 2.3 Initial Values of Program Variables

STEERABLE SEAT EJECTION TEST OF 2/15/78, ZERO TIME IS 20:16:22.936

R BODY RATE -- CHANNEL 53



Demonstration Program Time .5
Corresponding VS Time (MS) 0

2.05
1500

Figure 2.4 R Body Rate Graph - 90° Roll Test

STEERABLE SEAT EJECTION TEST OF 2/15/78, ZERO TIME IS 20:16:22.936
Q BODY RATE -- CHANNEL 52

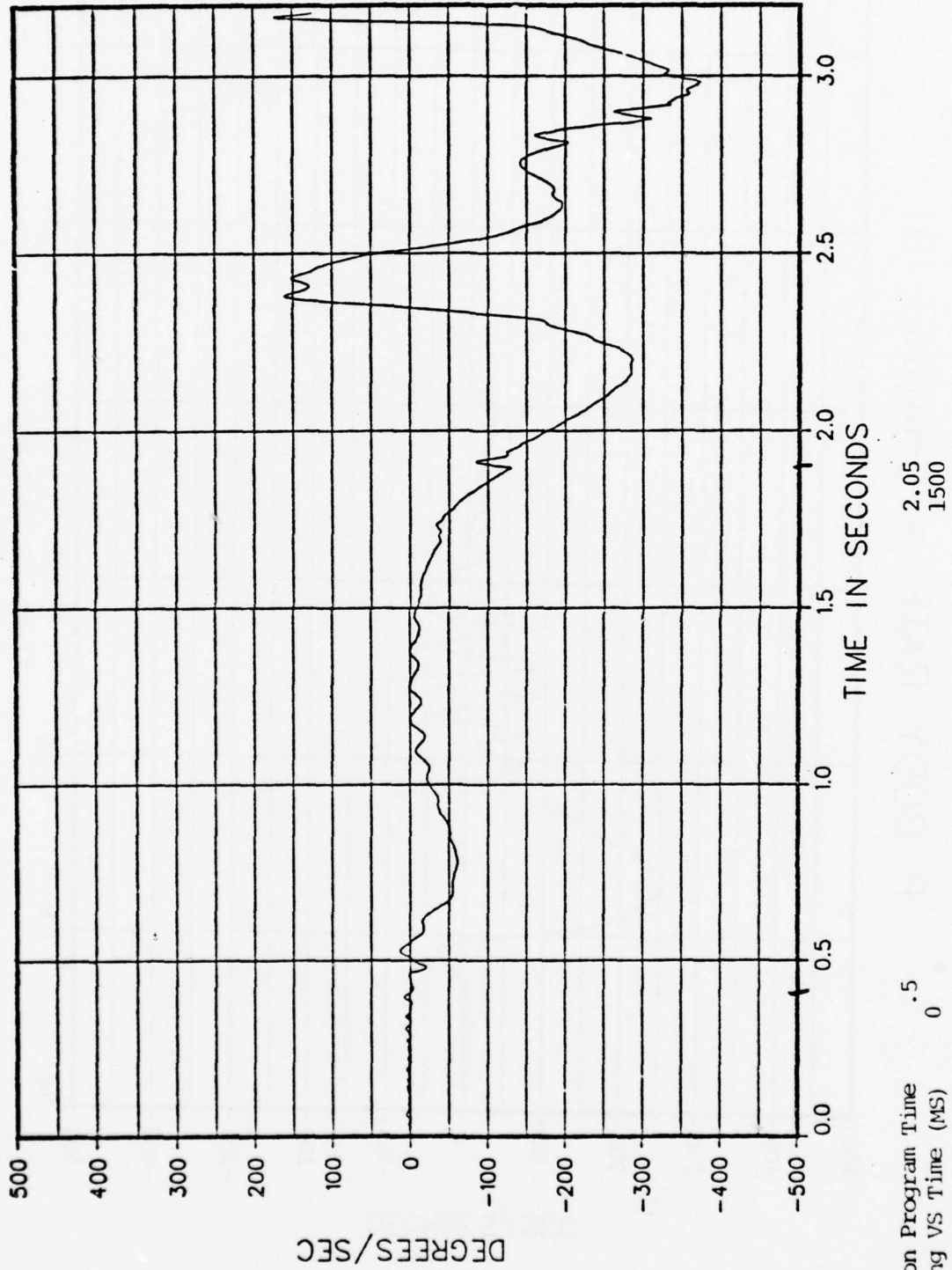


Figure 2.5 Q Body Rate Graph - 90° Roll Test

STEERABLE SEAT EJECTION TEST OF 2/15/78, ZERO TIME IS 20:16:22.936
P BODY RATE - CHANNEL 51

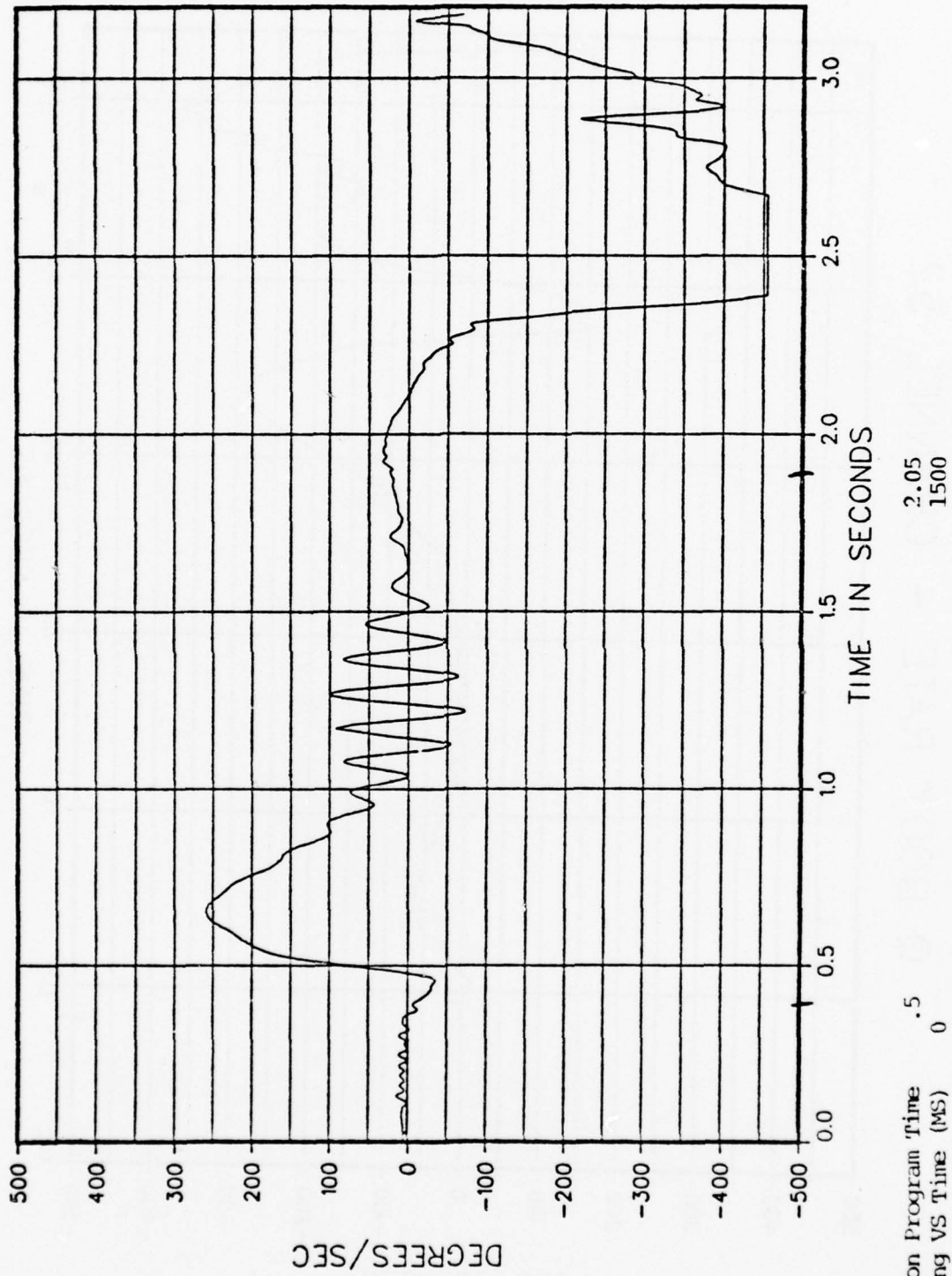
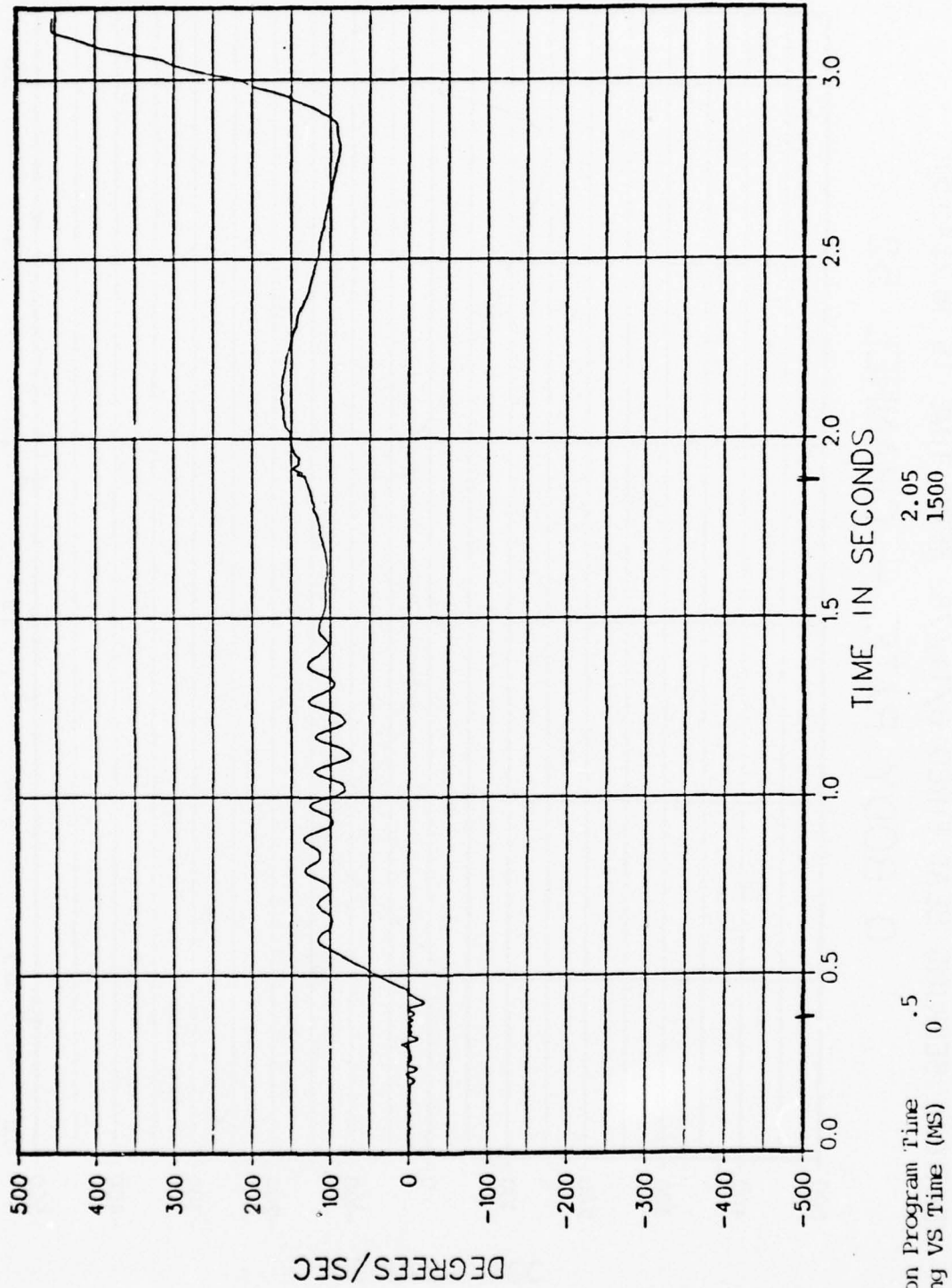


Figure 2.6 P Body Rate Graph - 90° Roll Test

VERTICAL SEEKING SEAT FIRED 6/14/78, ZERO TIME IS 18:21:45.518

R BODY RATE - CHANNEL 53



Demonstration Program Time .5
Corresponding VS Time (MS) 0

2.05
1500

Figure 2.7 R Body Rate Graph - 180° Roll Test

VERTICAL SEEKING SEAT FIRED 6/14/78, ZERO TIME IS 18:21:45.518
Q BODY RATE - CHANNEL 52

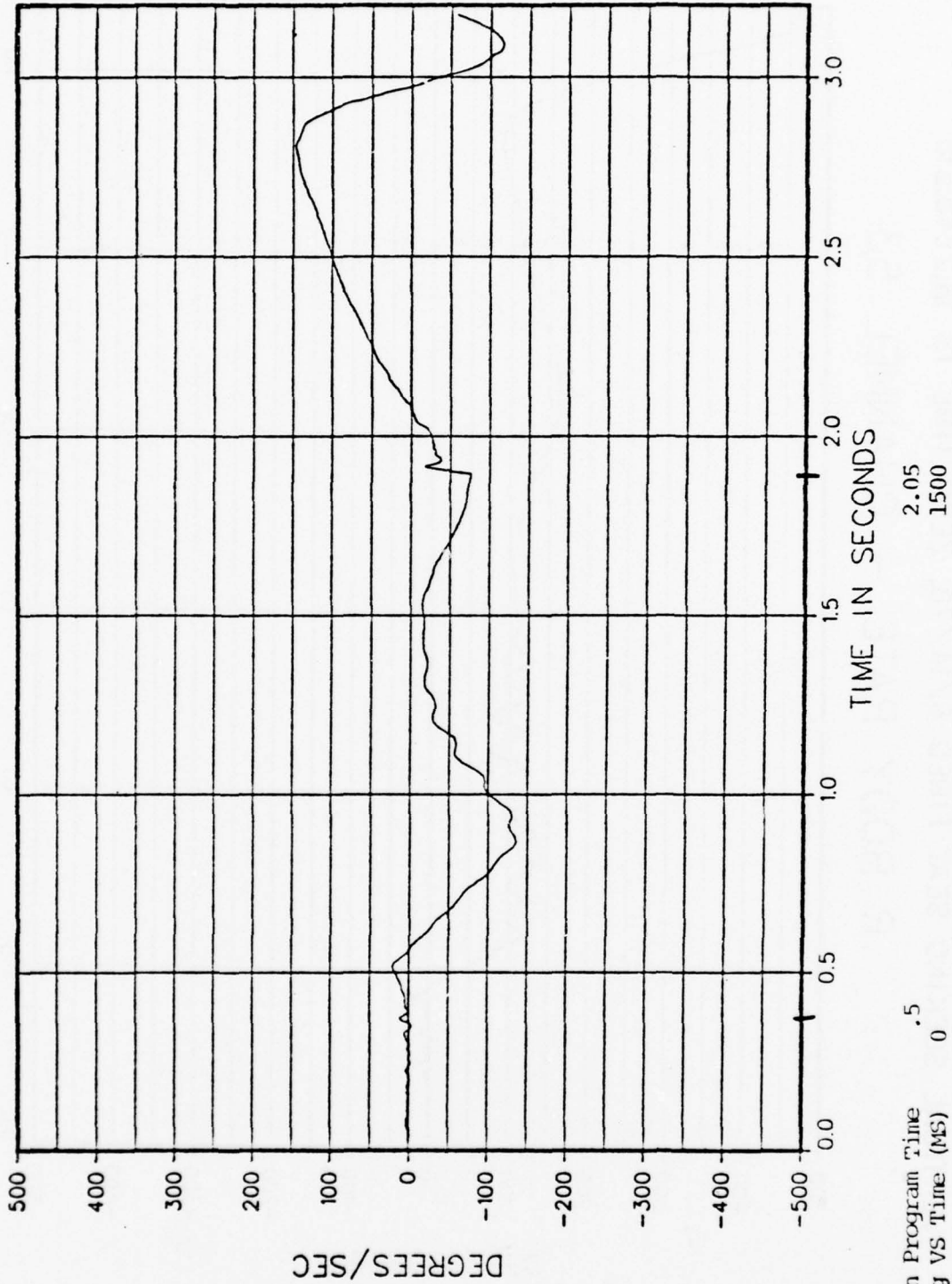


Figure 2.8 Q Body Rate Graph - 180° Roll Test

VERTICAL SEEKING SEAT FIRED 6/14/78, ZERO TIME IS 18:21:45.518
P BODY RATE - CHANNEL 51

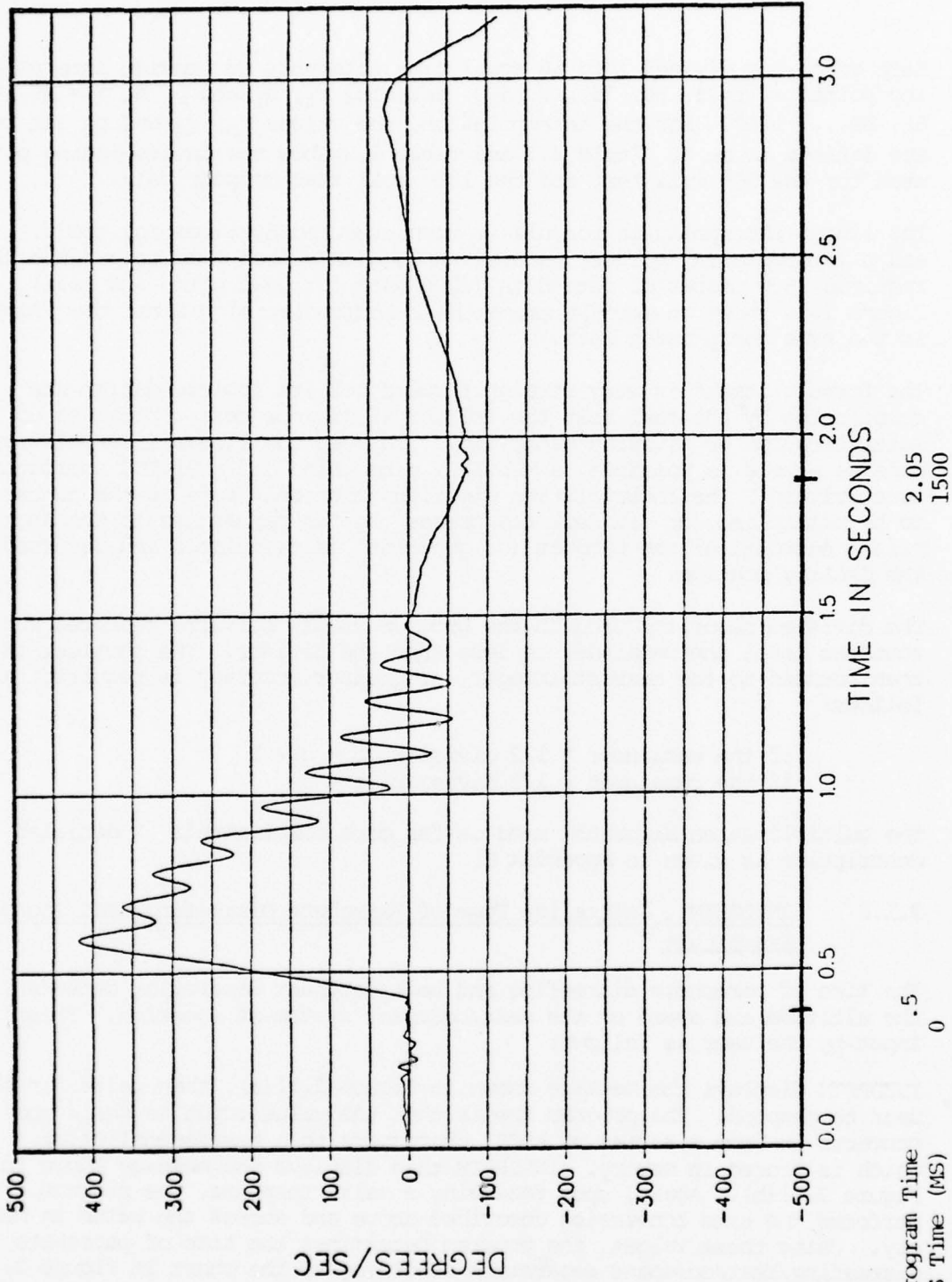


Figure 2.9 P Body Rate Graph - 180° Roll Test

Each graph was divided into 60 equal time intervals to provide interpolating points at $t=25, 50, 75, \dots, 1500$, defining r_i, q_i and p_i at $i = 20, 40, 60, 80, \dots, 1200$. For the interpolation, the values r_0, q_0 and p_0 (at $t=0$) are defined to be 0. Table 2.1 and Table 2.2 show the interpolating points used for the 90° roll test and the 180° roll test respectively.

The linear interpolation formula is then executed 60 times for the r, q , and p interpolating points, generating 20 points each time to produce the required 3600 pieces of rate data (1200 each for yaw, pitch and roll). Figure 2.10 shows an example using the r interpolating points; the process is the same for p and q data.

The formula itself is very straightforward but its implementation was complicated by the fact that the INTEL 8085 microprocessor provides no multiplication or division capability. To keep the linear interpolation code as simple as possible, a MULTIPLY subroutine and a DIVIDE subroutine were written. The interpolation algorithm then only sets up the numbers to be multiplied (or divided) and passes them as parameters to the appropriate subroutine; the product (or quotient) is calculated and returned to the CALLING routine.

The division algorithm used in the program simply performs repeated subroutines until the remainder is less than the divisor. The quotient is then rounded to the nearest integer (no greater accuracy is required) as follows:

if the remainder \geq 1/2 divisor, $q = q + 1$
if the remainder $<$ 1/2 divisor, $q = q$

The multiplication algorithm used is far more complicated. A detailed description is given in Appendix B.

2.1.8 INZDRFTM: Initialize Time of Parachute Disreefing/Seat/Occupant Separation

The time of parachute disreefing and seat/occupant separation depends upon the altitude and speed of the seat/occupant system at ejection. These are input by the user as follows:

INZDRFTM displays the message shown in Figure 2.11(a), then waits for the user to respond. The program checks that the value input is valid and converts it from a series of ASCII characters to a hexadecimal value, which is stored in memory. INZDRFTM then displays the message shown in Figure 2.11(b). Again, upon receiving a valid response, the program performs the same conversion described above and stores the value in memory. Using these values, the program determines the time of parachute disreefing/seat/occupant separation according to the chart in Figure 2.12, as defined by NADC personnel.

INTERPOLATING POINTS FOR 90° ROLL TEST

i	R(i)		Q(i)		P(i)	
	Deg/Sec	Hex Equiv	Deg/Sec	Hex Equiv	Deg/Sec	Hex Equiv
0	0	0000	0	0000	0	0000
20	9	0024	2	0008	-14	FFC7
40	4	0010	-5	FFEC	-25	FF9A
60	-2	FFF8	-14	FFC7	-17	FFBB
80	14	0039	-15	FFC3	51	00D1
100	36	0093	4	0010	131	0218
120	46	00BC	8	0020	186	02F9
140	57	00E9	-8	FFE0	209	0357
160	70	011E	-18	FFB7	226	039D
180	73	012A	-18	FFB7	246	03EF
200	78	013F	-30	FF86	255	0414
220	81	014B	-44	FF4C	254	0410
240	82	014F	-53	FF28	242	03DE
260	79	0143	-54	FF23	230	03AD
280	78	013F	-56	FF1B	210	035C
300	74	012E	-58	FF13	183	02ED
320	73	012A	-58	FF13	166	02A7
340	69	011A	-55	FF1F	153	0272
360	67	0112	-52	FF2C	132	021C
380	60	00F5	-50	FF34	109	016E
400	60	00F5	-49	FF38	103	01A5
420	56	00E5	-40	FF5D	96	0189
440	50	00CC	-34	FF75	66	010E
460	44	00B4	-32	FF7D	50	00CC
480	46	00BC	-27	FF92	68	0116
500	40	00A3	-22	FFA6	41	00A7
520	32	0083	-23	FFA2	9	0024
540	38	009B	-18	FFB7	62	00FD
560	42	00AB	-11	FFD3	40	00A3
580	25	0066	-12	FFCF	-25	FF9A
600	22	005A	-19	FFB3	-9	FFDC
620	37	0097	-8	FFE0	62	00FD
640	32	0083	-1	FFFC	26	006A
660	13	0035	-7	FFE4	-52	FF2C
680	22	005A	-10	FFD8	0	0000
700	40	00A3	-4	FFF0	82	014F
720	30	007A	-2	FFF8	30	007A
740	12	0031	-5	FFEC	-44	FF4C
760	22	005A	-8	FFE0	4	0010
780	36	0093	-2	FFF8	68	0116
800	27	006E	-1	FFFC	21	0055
820	11	002D	-6	FFE8	-35	FF71
840	17	0045	-11	FFD3	3	000C
860	28	0072	-7	FFE4	47	00C0
880	21	0055	-6	FFE8	11	002D
900	11	002D	-9	FFDC	-19	FFB3

TABLE 2.1

INTERPOLATING POINTS FOR 90° ROLL TEST

i	R(i)		Q(i)		P(i)	
	Deg/Sec	Hex Equiv	Deg/Sec	Hex Equiv	Deg/Sec	Hex Equiv
920	18	0049	-12	FFCF	-2	FFF8
940	24	0062	-11	FFD3	14	0039
960	24	0062	-16	FFBF	15	003D
980	21	0055	-21	FFAB	4	0010
1000	21	0055	-27	FF92	3	000C
1020	20	0051	-32	FF7D	5	0014
1040	24	0062	-38	FF65	10	0028
1060	25	0066	-37	FF69	22	005A
1080	21	0055	-33	FF79	18	0049
1100	23	005E	-43	FF50	11	002D
1120	27	006E	-54	FF23	17	0045
1140	28	0072	-72	FEDA	18	0049
1160	30	007A	-89	FE94	20	0051
1180	30	007A	-103	FESB	22	005A
1200	32	0083	-118	FELD	24	0062

TABLE 2.1 (Continued)

INTERPOLATING POINTS FOR 180° ROLL TEST

i	R(i)		Q(i)		P(i)	
	Deg/Sec	Hex Equiv	Deg/Sec	Hex Equiv	Deg/Sec	Hex Equiv
0	0	0000	0	0000	0	0000
20	-7	FFE4	4	0010	2	0008
40	-7	FFE4	8	0020	30	007A
60	12	0031	11	002D	91	0174
80	32	0083	15	003D	153	0272
100	52	00D4	18	0049	217	0378
120	72	0126	9	0024	298	04C8
140	92	0178	-2	FFF8	364	05D2
160	112	01CA	-12	FFCF	417	06AB
180	108	01BA	-22	FFA6	378	060B
200	101	019D	-33	FF79	338	0567
220	100	0199	-44	FF4C	342	0578
240	110	01C2	-56	FF1B	355	05AD
260	108	01BA	-66	FEF2	318	0515
280	100	0199	-81	FEB5	281	047E
300	109	01BE	-97	FE73	309	04F1
320	132	021C	-108	FE46	306	04E4
340	117	01DE	-115	FE2A	257	041C
360	112	01CA	-126	FDFC	236	03C2
380	123	01F7	-135	FDD8	259	0424
400	122	01F3	-132	FDE3	215	0370
420	103	01A5	-130	FDEC	152	026E
440	99	0195	-130	FDEC	138	0234
460	116	01DA	-118	FELD	174	02C8
480	110	01C2	-107	FE4F	112	01CA
500	87	0164	-96	FE77	40	00A3
520	94	0180	-96	FE77	78	013F
540	114	01D2	-84	FEA9	114	01D2
560	100	0199	-69	FEE6	41	00A7
580	78	013F	-59	FF0F	-15	FFC3
600	87	0164	-60	FF0B	30	007A
620	110	01C2	-52	FF2C	71	0122
640	100	0199	-39	FF61	12	002D
660	85	015B	-31	FF82	-44	FF4C
680	104	01A9	-31	FF82	1	0004
700	121	01EF	-28	FF8E	42	00AB
720	110	01C2	-22	FFA2	-6	FFE8
740	97	018D	-22	FFA2	-46	FF44
760	111	01C6	-22	FFA2	-5	FFEC
780	125	01FF	-22	FFA2	27	006E
800	122	01F3	-19	FFB3	5	0014
820	108	01BA	-18	FFB7	-22	FFA6
840	105	01AD	-18	FFB7	-18	FFB7
860	111	01C6	-18	FFB7	-4	FFF0
880	109	01BE	-16	FFBF	-2	FFF8
900	106	01B1	-15	FFC3	-6	FFE8

TABLE 2.2

INTERPOLATING POINTS FOR 180° ROLL TEST

i	R(i)		Q(i)		P(i)	
	Deg/Sec	Hex Equiv	Deg/Sec	Hex Equiv	Deg/Sec	Hex Equiv
920	103	01A5	-17	FFBB	-10	FFD8
940	104	01A9	-21	FFAB	-12	FFCE
960	104	01A9	-25	FF9A	-14	FFC7
980	103	01A5	-29	FF8A	-16	FFBF
1000	101	019D	-34	FF75	-18	FFB7
1020	104	01A9	-39	FF61	-22	FFA6
1040	106	01B1	-45	FF48	-27	FF92
1060	109	01BE	-53	FF28	-32	FF7D
1080	112	01CA	-58	FF13	-37	FF68
1100	115	01D6	-63	FEFF	-42	FF55
1120	118	01E3	-68	FEEA	-48	FF36
1140	120	01EB	-70	FEE2	-54	FF23
1160	123	01F7	-73	FED6	-59	FF0F
1180	126	0203	-75	FECD	-64	FEFA
1200	131	0218	-78	FEC5	-69	FEE6

TABLE 2.2 (Continued)

The Linear Interpolation Formula is

$$f(x_i) = \frac{(f_0 x_1 - f_1 x_0) + ((f_1 - f_0)(x_i))}{(x_1 - x_0)}$$

where f_0, f_1, x_0, x_1, x_i are defined at each of the 60 passes as follows:

<u>Pass</u>	<u>f_0</u>	<u>f_1</u>	<u>x_0</u>	<u>x_1</u>	<u>$x_i = i$</u>	<u>Points Generated</u>
1	r_0	r_{20}	0	20	1 - 20	$r_1 - r_{20}$
2	r_{20}	r_{40}	20	40	21 - 40	$r_{21} - r_{40}$
3	r_{40}	r_{60}	40	60	41 - 60	$r_{40} - r_{60}$
⋮						⋮
60	r_{1180}	r_{1200}	1180	1200	1181 - 1200	$r_{1181} - r_{1200}$

Figure 2.10 Linear Interpolation

SELECT DESIRED TEST

1. 90 DEGREE ROLL
2. 180 DEGREE ROLL

ENTER ALTITUDE AT EJECTION (0-18,000 FT)

(a)

SELECT DESIRED TEST

1. 90 DEGREE ROLL
2. 180 DEGREE ROLL

ENTER ALTITUDE AT EJECTION (0-18,000 FT)

ENTER SPEED AT EJECTION (0-600 KEAS)

(b)

Figure 2.11 Altitude/Speed Initialization Display

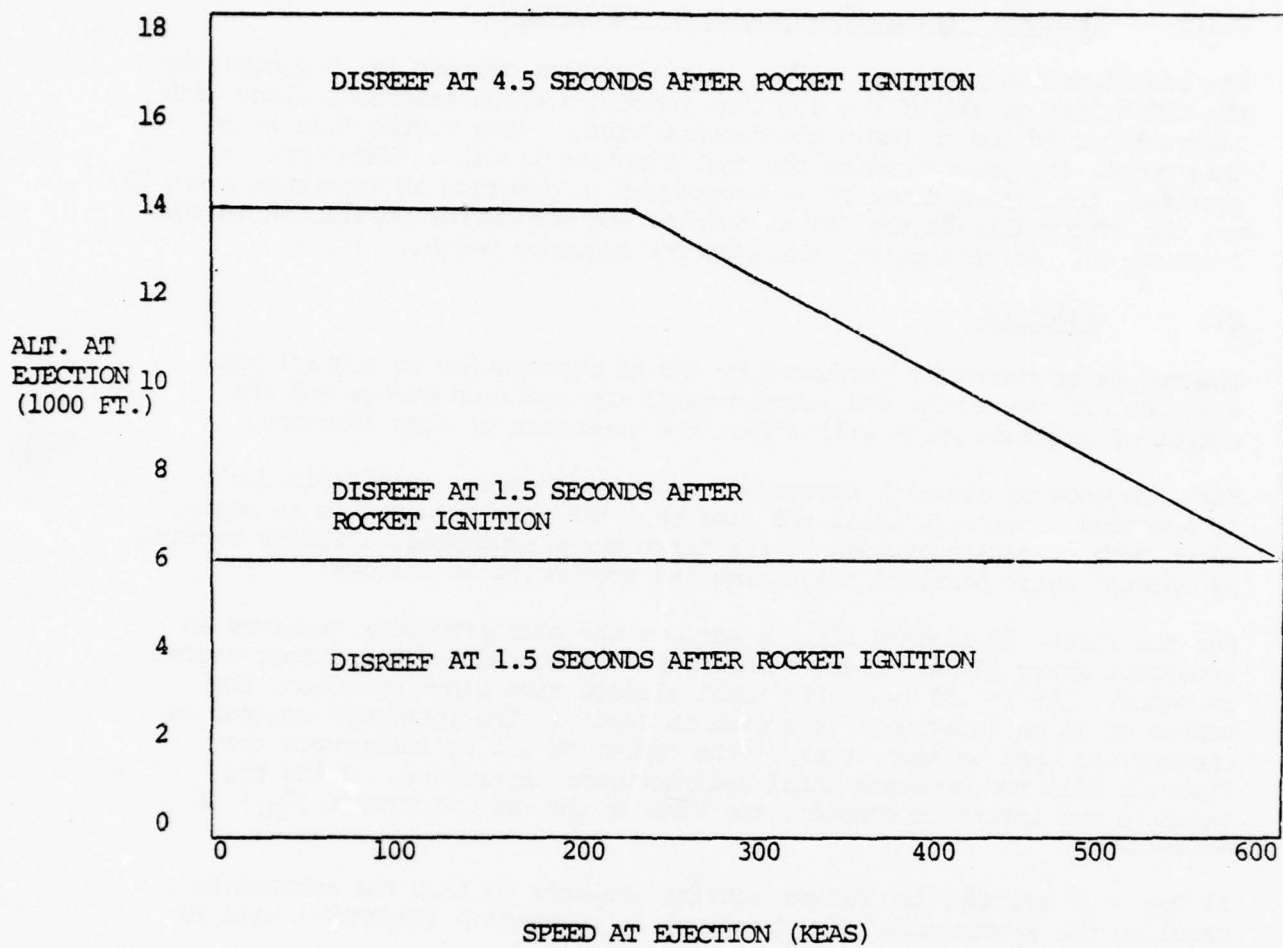


Figure 2.12 Parachute Deployment Chart

2.1.9 INZDEMO: Initialize Demonstration Display

The last function performed in the initialization process is to display on the CRT a list of all of the ejection functions to be executed, along with instructions on how to begin the demonstration. (See Figure 2.13.) At this point, the program waits for the 'ejection signal'. When this is received, the system timer T1 is programmed to generate an interrupt every 25 ms, the bottom line on the CRT is deleted and the cursor positioned at row 2 column 40. At this point, the ejection sequence begins.

2.2 Ejection

The two major functions performed by the microprocessor to control the ejection are the timing and sequencing of the ejection events and the output of commands which will effect the execution of each function.

Each sequence of ejection functions, except sequence D (see Table 2.3), is executed repeatedly until the time that the next sequence is to begin. After each execution of each of the first three sequences, a driver routine is entered which performs the timing and sequencing as follows:

For the first .55 seconds after ejection, the microprocessor receives an interrupt every 25 ms. These interrupts are counted and the number stored in memory. At $T = .55$ (where $T =$ total elapsed time since ejection) the number of 25 ms interrupts is stored in memory. The interrupt counter is cleared and used to keep track of the number of 2.5 ms interrupts that Timer T1 will now generate until seat/occupant separation. Using the value in the interrupt counter, the time of the next interrupt (T_{NI}) is determined.

If $T_{NI} < .3$ seconds, the driver routine prepares so that the subroutine enabling the execution of the functions in sequence A (EJCTRIN:) will be indexed when the next interrupt is received.

If $.3 \text{ seconds} \leq T_{NI} < .55$ seconds, the driver routine prepares so that the subroutine enabling the execution of the functions in sequence B (CTPLTRIN:) will be indexed when the next interrupt is received.

If $T_{NI} = .55$ seconds, the driver routine programs the timer T1 to generate an interrupt every 2.5 ms after the next (and last 25 ms) interrupt is received and sets up so that the subroutine enabling the execution of the functions in sequence C (RKTSEQ:) will be indexed upon receiving that interrupt. Since the only function in sequence C to be executed at this time is to ignite the rocket, (this is the only time this function is executed), the driver routine also sets a flag, indicating this to RKTSEQ. If $.55 \text{ seconds} \leq T_{NI} \leq 2.05$ seconds, RKTSEQ is indexed. At $T = 2.05$, sequence C is executed for the last time and control is passed immediately to the subroutine controlling sequence D (PARSEP:). If the time of parachute disreefing/seat/occupant separation is $T = 2.05$ seconds, these two functions

UP EJECTION SEAT FEASIBILITY DEMO

Emergency O2 Generation
Inertial Reel Firing
Neck Bladder Inflation
Hip Thruster Firing
Canopy Removal
Gyro Spinup
Seat Release
Catapult Initiation
Rocket Initiation
Rocket Gimbaling Initiated
PCEM Fired
Rocket Gimbaling Completed
Parachute Disreefed
Seat/Occupant Separated

TO BEGIN DEMONSTRATION, PRESS 'E'

Figure 2.13 Feasibility Demonstration Display

TIMING/SEQUENCING OF EJECTION SEAT FUNCTIONS

<u>Sequence</u>	<u>Function</u>	<u>Time Initiated</u>
A - Ejection Sequence	1. Emergency O ₂ Generation	t_0
	2. Inertial Reel Firing	
	3. Neck Bladder Inflation	
	4. Hip Thruster Firing	
	5. Canopy Removal	
	6. Gyro Spin-Up	
B - Catapult Sequence	1. Seat Release	$t_0 + .3$
	2. Catapult Initiation	
C - Rocket Sequence	1. Rocket Initiation	$t_0 + .55$
	2. Rocket Motor Gimballing	$t_0 + 1.85$
	3. PCEM Firing	
D - Descent Sequence	1. Parachute Disreefing	$t_0 + 2.05/t_0 + 5.05$
	2. Seat/Occupant Separation	

Table 2.3 Timing/Sequencing of Ejection Seat Functions

are executed and the ejection is complete. Otherwise, as each 2.5 ms interrupt is received and counted, control is passed directly to PARSEP which waits until $T = 5.05$ seconds to execute the final sequence to complete the ejection.

To effect the execution of each of the ejection functions on an actual ejection seat system, the microprocessor would output a command word to a specific port. This port would interface with specially designed hardware that would convert the digital data to an analog signal which in turn would enable the desired event. This process is simulated in the demonstration program (subroutine SQUIB:) as follows:

The microprocessor outputs the three character ASCII sequence 00001000_2 (backspace), 00001010_2 (line feed), 00101010_2 (*) to the CRT. This causes the '*' character to be displayed next to the function being extracted indicating its successful completion.

3. THE VERTICAL SEEKING MANEUVER

The implementation of the vertical seeking maneuver, the most critical of the ejection seat functions to be controlled by the microprocessor, is based to a great extent on the work done previously by personnel at the Naval Weapons Center, China Lake, CA. The following discussion describes the vertical seeking seat program as designed, coded and tested at NWC, and indicates where modifications had to be made for implementation in the demonstration program.

Simply stated, the purpose of the vertical seeking maneuver is to insure that the seat/occupant system is in an upright position and traveling in a vertical direction. The microprocessor accomplishes this by properly gimbaling the rocket motor according to information describing the initial orientation of the seat/occupant system and by continuously monitoring the angular rates of the system about all three axes. For testing purposes, the initial orientation of the seat/occupant system is predetermined and essentially hardwired in the memory of the microprocessor by storing the direction cosine of the angle of each of the axes of the seat/occupant coordinate system to the vertical. These are updated continuously throughout the maneuver using the rotational rates, and the direction cosines are then used to calculate the rocket gimbaling commands. Gimbaling the rocket modifies the orientation of the system and the rotational rates, which in turn cause the microprocessor to modify the direction cosines and, ultimately, the rocket gimbaling. By this circular process, the system is stabilized as it approaches the desired orientation.

3.1 The Vertical Seeking Algorithm

There are five basic steps comprising the vertical seeking algorithm:

1. Input Rate Data
2. Integrate Rate Data
3. Update Direction Cosines
4. Calculate Rocket Gimbaling Commands
5. Output Rocket Gimbaling Commands

3.1.1 Input Rate Data

Attached to the ejection seat are gyroscopes which sense the rate of rotation of the seat/occupant around the yaw, pitch and roll axes of the seat/occupant coordinate system. A voltage level proportional to the rotational rate is sent from the gyroscope to an A/D converter which outputs complementary twos complement (CTC) digital data to the microprocessor. This data is then converted to obtain the twos complement form used in the program. Three examples of this conversion process for a typical system are shown in Table 3.1. As presently implemented, rate data is sampled every 1.25 ms; every 2.5 ms an interrupt is generated to the microprocessor, at which time the previous two samples (which have been buffered) are read and processed. Thus, every 2.5 ms, six words of rate data are input by the

Assume the following gyro characteristics:

range: ± 500 deg/sec (8.72 rad/sec)

full scale deflection: ± 10 v

Rate	Gyro	Analog Data	A/D	CTC Data	μP	Twos Comp
500 ^o /sec (8.72 rad/sec)			10v	F800H		07FFH
0 ^o /sec (0 rad/sec)			0v	FFFFH		0000H
-500 ^o /sec (-8.72 rad/sec)			-10v	07FEH		F801H

Table 3.1 Angular Rate - Digital Data Conversion

microprocessor - 2 each for yaw rate (r), pitch rate (q) and roll rate (p).

3.1.2 Integrate Rate Data

Integration of the rate data with respect to time allows the microprocessor to keep track of the rotation of the seat/occupant system about each of the axes. (Note that three separate integrations are required.) The integration scheme is based on the following formula for the trapezoidal rule:

$$A = \frac{1}{2} \Delta h (y_1 + 2y_2 + 2y_3 + \dots + y_n) \quad (1)$$

The above was modified slightly to give the following formula:

$$2A/\Delta h = (0+y_1) + (0+y_2) + (y_1+y_3) + (y_2+y_4) + (y_3+y_5) + (y_4+y_6) + \dots \quad (2)$$

where y_i corresponds to r_i , q_i , or p_i for a particular time t given by:

$$i = 1, 1200$$

$$t \text{ (number of ms after beginning of maneuver)} = 1.25 (i)$$

Since data is sampled approximately every 1.25 ms, $\Delta h = 1.25$.

To perform the next step of the algorithm (update direction cosines), the program does not actually need to know the amount of rotation about each of the seat/occupant axes but only when the rotation has exceeded a predefined angle. Thus the A in eq. (2) is not calculated in the program but has been predetermined to insure that the left side of the equation becomes a constant against which the right side is tested. A is defined as the maximum angle that could be generated in one sampling period if rotating at the maximum rate that can be sensed by the gyroscope. In this case, the maximum rate is 8.72 rad/sec and the sampling period is 1.25 ms; therefore $A = .0109$ radians. Given the scaling used in the program, the left side of the equation is determined as follows:

$$A = .0109 \text{ radians} = 07FF_{16} = 2047_{10}$$

$$\frac{2A}{\Delta h} = \frac{2(2047)}{1.25} = \frac{4094}{1.25} = 3275 \cong CC0_{16}$$

If however, the seat/occupant system is rotating at the maximum rate in a negative direction (-8.72 rad/sec):

$$A = -.0109 \text{ rad such that}$$

$$\frac{2A}{\Delta h} = -CC0_{16} = F34B_{16}$$

Thus, the following three equations define the three integrations performed in the program:

$$\pm \text{CCO} = (0+r_1)+(0+r_2)+(r_1+r_3)+(r_2+r_4)+(r_3+r_5)+(r_4+r_6)+\dots \quad (3)$$

$$\pm \text{CCO} = (0+q_1)+(0+q_2)+(q_1+q_3)+(q_2+q_4)+(q_3+q_5)+(q_4+q_6)+\dots \quad (4)$$

$$\pm \text{CCO} = (0+p_1)+(0+p_2)+(p_1+p_3)+(p_2+p_4)+(p_3+p_5)+(p_4+p_6)+\dots \quad (5)$$

When the system has rotated at least .0109 radians in either a positive or negative direction around any of the 3 axes the appropriate direction cosines are updated and the corresponding test value ($\pm \text{CCO}$) is subtracted from the sum; the integration then continues as before.

3.1.3 Update Direction Cosines

Implementation of this part of the vertical seeking algorithm is based on the Crowder Hession Direction Cosine Updating Algorithm as follows:

$$C_{31,a} = C_{31,K}$$

$$C_{32,a} = C_{32,K} - \Delta\theta_z C_{31,K}$$

$$C_{33,a} = C_{33,K} + \Delta\theta_y C_{31,K}$$

$$C_{31,b} = C_{31,a} + \Delta\theta_z C_{32,a}$$

$$C_{32,b} = C_{32,a}$$

$$C_{33,b} = C_{33,a} - \Delta\theta_x C_{32,a}$$

$$C_{31,K+1} = C_{31,b} - \Delta\theta_y C_{33,b}$$

$$C_{32,K+1} = C_{32,b} + \Delta\theta_x C_{33,b}$$

$$C_{33,K+1} = C_{33,b}$$

where:

C_{31}, C_{32}, C_{33} are the three direction cosines D_{31}, D_{32}, D_{33} , shown in Figure 2.2.

$K, K+1$ designate points in time;

a, b are values for intermediate calculations used in arriving at the next point in time, and

$\Delta\theta_x, \Delta\theta_y$ and $\Delta\theta_z$ are the angular displacements of the gyros.

The displacements are represented by a quantum pulse weight $\Delta\theta$ which has the general form 2^{-n} , where n is determined by the sample time and the maximum value of the angular rates.

To maximize the resolution of this quantity the size of the quantum weight is required to be as small as possible but must be larger than the maximum rotation over one sample period. Given a maximum angular velocity of 8.72 radians/sec and a sample time of 1.25×10^{-3} seconds, the smallest quantum size that would be larger than the maximum angular displacement of the gyros (.0109 rad.) is 2^{-6} radians (= .0156 rad.). The quantum size used in the program is 2^{-7} (= .0078 rad.).

Every 2.5 ms (with each interrupt) this algorithm is processed twice, once for each of the two samples of input data. In processing the algorithm, $\Delta\theta_x$, $\Delta\theta_y$, $\Delta\theta_z$ are determined by the integration of the rotational rates around the x, y and z axes respectively, as follows:

For each axis,

if the system has rotated less than .0109 radians in either a positive or negative direction, the corresponding $\Delta\theta_j=0$;

if the system has rotated at least .0109 radians in a positive direction, the corresponding $\Delta\theta_j=2^{-7}$;

if the system has rotated at least .0109 radians in a negative direction, the corresponding $\Delta\theta_j=-2^{-7}$.

In the program, there are three bytes of memory used as flag words (RLINC, PCINC, YARIC), each of which is set to one of three values (00, 01 or FF) when the rate data is integrated. The program then uses the value of the flag to determine which of the above three values (00, 2^{-7} , -2^{-7}) will be used (see Figure 3.1).

3.1.4 Generate Rocket Gimbaling Commands

Two commands, a roll command and a pitch command, are output to gimbal the rocket and are calculated very straightforwardly as follows: Since, by their definition, the direction cosines are sinusoidal, a control law based on them would not be strictly linear. There are two distinct regions of seat attitude where different control aspects are to take place. First, in an inverted attitude ($-90^\circ < \alpha_{33} < 90^\circ$) a large command is needed to bring the seat upright. In this region, D33 is always positive, whereas D31 and D32 will vary from zero when $\alpha_{33} = 0^\circ$ to ± 1 when $\alpha_{33} = 90^\circ$. Second, in the upright attitude ($90^\circ < \alpha_{33} < 270^\circ$), D33 is always negative while D31 and D32 again vary between ± 1 . The control law is shown in Figure 3.2.

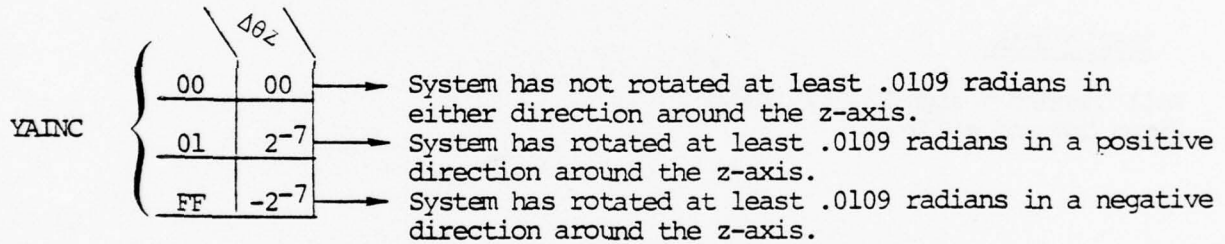
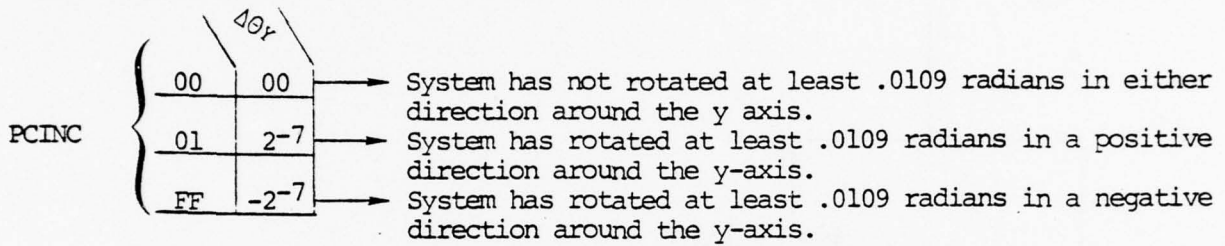
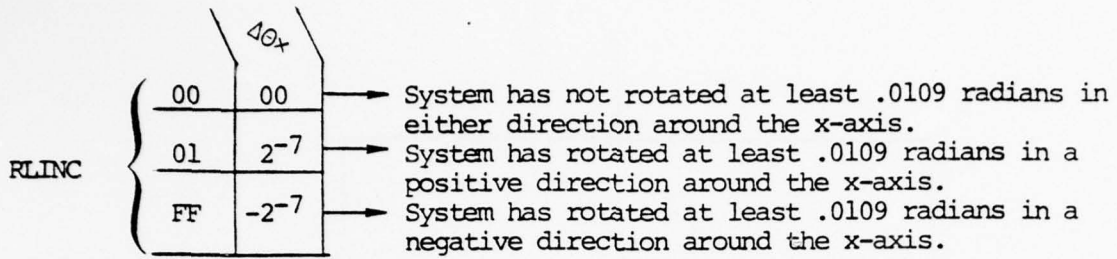


Figure 3.1 Quantum Control Chart

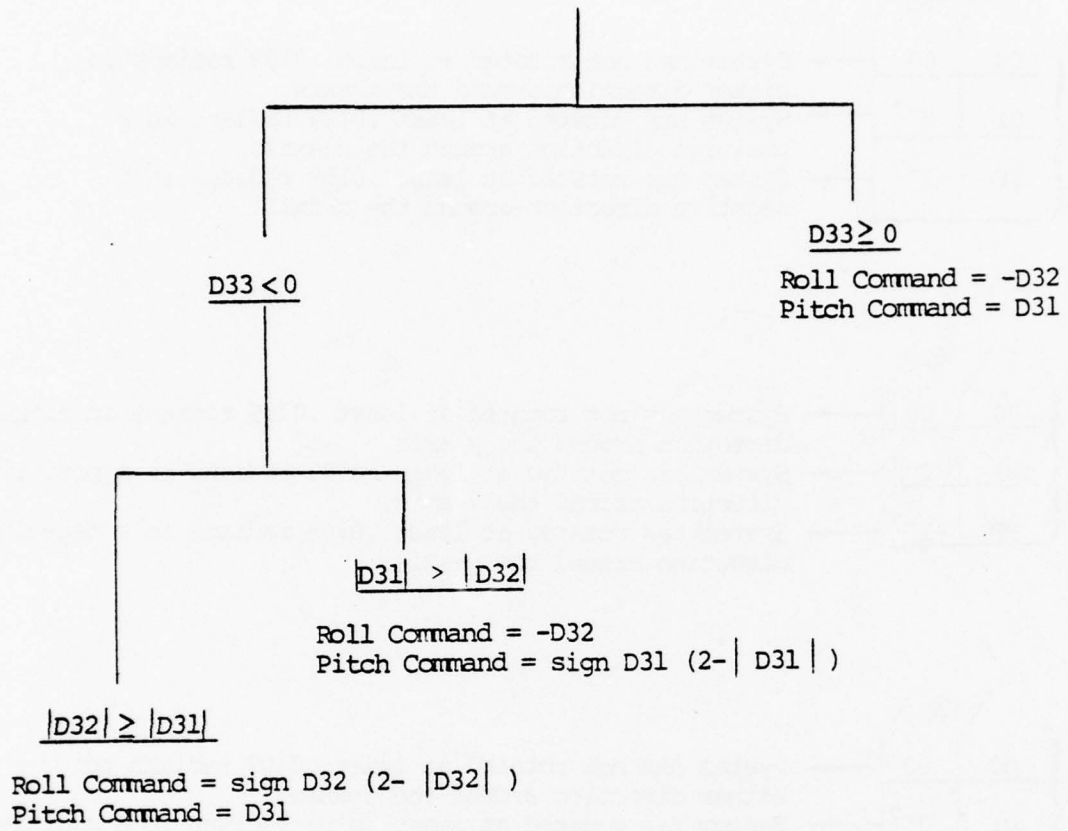


Figure 3.2 Control Law

3.1.5 Output Rocket Gimbaling Commands

The seat-rocket motor arrangement as implemented at NWC is shown in Figure 3.3. It can be seen that the rocket motor can be gimballed $\pm 16^\circ$ in two directions.

The two commands are output to a D/A converter, which in turn outputs a signal causing the rocket to move a certain angle. That angle is measured not from the current position of the rocket but from the neutral position.

3.2 Summary

Viewing the vertical seeking maneuver as a closed loop process as discussed in Section 3, it can be seen that the primary problem in implementing it in the feasibility demonstration program is that, although it is possible to simulate the input of the rate data, perform the required calculations to generate the rocket motor gimbaling commands and display the outcome of these commands, the feedback effect of the rocket gimbaling on the orientation of the seat/occupant system and on subsequent rate data is missing. It is not possible then to determine on the software development system whether the commands generated would produce the desired trajectory. However, using the rate data recorded at NWC, China Lake, it was possible to verify to a reasonable extent, the accuracy of the vertical seeking maneuver by inspecting the direction cosines of the final orientation. These are shown for both the 90° roll test and the 180° roll test in Figure 3.4. As stated in Section 2.1.7, some inaccuracy is expected due to the way in which the rate data was generated.

SEAT MOTOR ARRANGEMENT

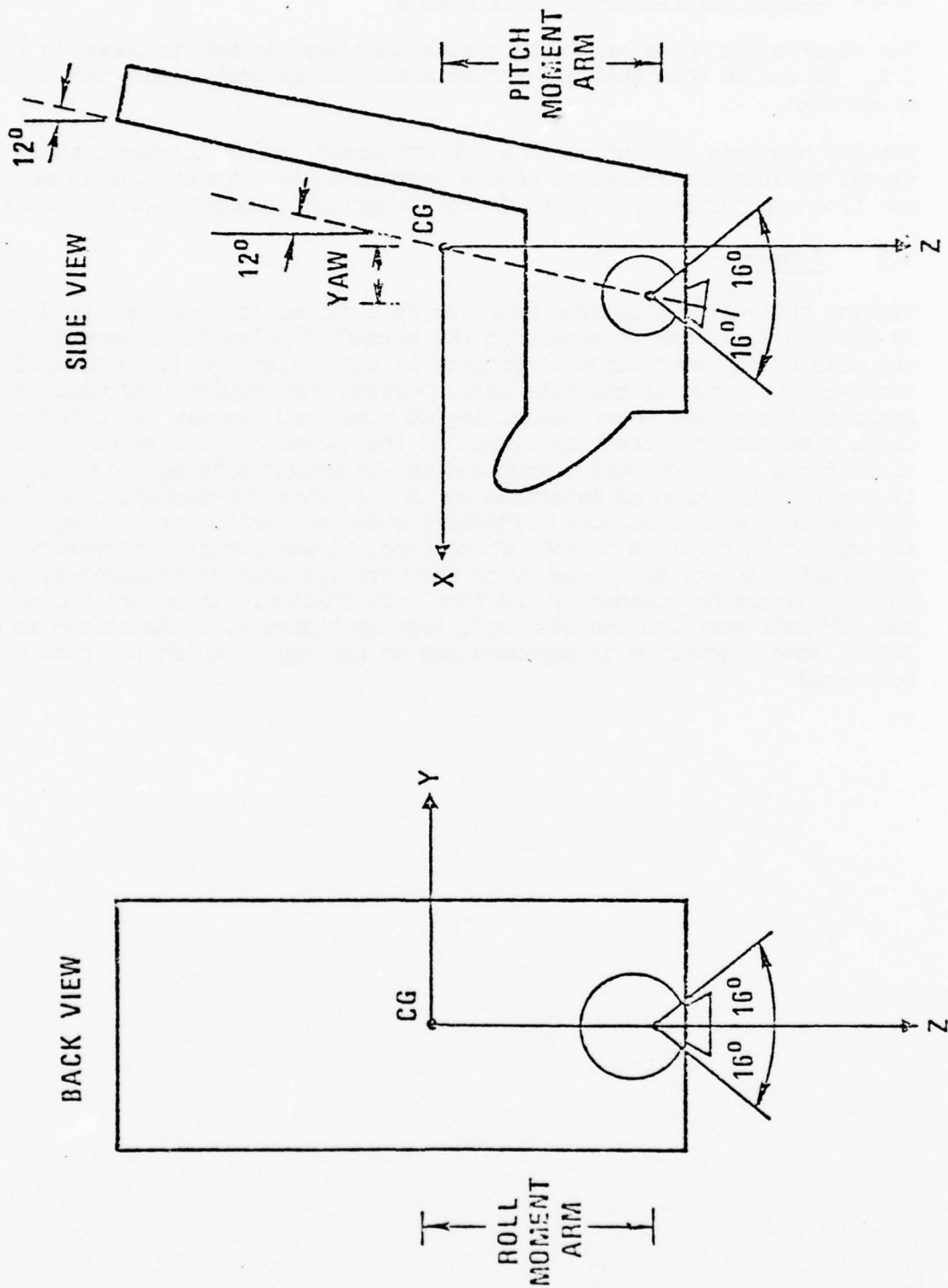


Figure 3.3 Seat/Motor Arrangement

90° Roll Test Final Orientation

D31 = -.184	→ $\alpha_{31} = 100.6^\circ$
D32 = .004	→ $\alpha_{32} = 89.77^\circ$
D33 = -.969	→ $\alpha_{33} = 165.69^\circ$

180° Roll Test Final Orientation

D31 = .164	→ $\alpha_{31} = 80.56^\circ$
D32 = .089	→ $\alpha_{32} = 84.89^\circ$
D33 = -.970	→ $\alpha_{33} = -165.93^\circ$

Figure 3.4 Results

4. DEMONSTRATION PROGRAM

4.1 PROGRAM LISTING

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```

0100          ORG 100H
0100 00          NOP
0101 F3          DI
0102 318F37      LXI SP,NEED30
0105 CD2601      CALL INZRST75
0108 CD3201      CALL INZTMRS
010B CD5401      CALL INZDSP
010E CD3C08      CALL CHOICE
0111 CD6C01      CALL INZDSK
0114 CD9C01      CALL INZVRBLS
0117 CDFF01      CALL INZRDATA
011A CD9D05      CALL INZDRFTM
011D CD5401      CALL INZDSP
0120 CD2F07      CALL INZDEMO
0123 C34607      JMP EJKEY

```

INZRST75:

```

;
;SET UP RST 7.5
;(CANNOT LOAD PRGM INTO LOC 3C)
;

```

```

0126 213C00      LXI H,3CH
0129 36C3        MVI M,0C3H
012B 215C07      LXI H,SEQSRT
012E 223DC0      SHLD 3DH
0131 C9          RET

```

INZTMRS:

```

0132 3E40        MVI A,40H
0134 D3F3        OUT OF3H
0136 2103D1      LXI H,OD103H ;MODE SET
0139 3630        MVI M,30H ;TO,MO
013B 3670        MVI M,70H ;T1,MO
013D 3680        MVI M,0B0H ;T2,MO
013F 2B          DCX H ;T2 LOC
0140 3601        MVI M,1 ;1/2 US
0142 3600        MVI M,0
0144 2B          DCX H ;T1 LOC
0145 3601        MVI M,1 ;1/2 US
0147 3600        MVI M,0
0149 2B          DCX H ;TO LOC
014A 3601        MVI M,1 ;1/2 US
014C 3600        MVI M,0

```

```

;
;CLEAR UNWANTED INTERRUPTS
;

```

```

014E 3E1B        MVI A,1BH
0150 CDD307      CALL SIM
0153 C9          RET

```

INZDSP:

```

;CLEAR SCREEN, USE 40 CLMNS.,
;USE UPPER AND LOWER CASE

```

```

0154 CD00F8      CALL OF800H
0157 3E1B        MVI A,1BH
0159 CD03F8      CALL OF803H ;40 COLMNS
015C 3E43        MVI A,43H
015E CD03F8      CALL OF803H
0161 3E1B        MVI A,1BH
0163 CD03F8      CALL OF803H
0166 3E55        MVI A,55H

```

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0168 CD03F8
016B C9CALL OF803H
RET

INZDSK:

;
; INITIALIZE FILE CONTROL BLOCKS
; AND OPEN ALL FILES
;016C 210042
016F 3600
0171 010C00
0174 1E03
0176 1616LXI H,FCBRDI
MVI M,0
LXI B,12
MVI E,3
MVI D,22

LPM:

0178 09

DAD B

LPS:

0179 3600
017B 23
017C 15
017D C27901
0180 1616
0182 2B
0183 1D
0184 C27801
0187 0E0F
0189 110042
018C CE0500
018F 112142
0192 CE0500
0195 114242
0198 CD0500
019B C9MVI M,0
INX H
DCR D
JNZ LPS
MVI D,22
DCX H
DCR E
JNZ LPM
MVI C,OPEN
LXI D,FCBRDI
CALL BDOS
LXI D,FCBDRFTM
CALL BDOS
LXI D,FCBDEMO
CALL BDOS
RET

INZVRBLS:

019C AF
019D 210000
01A0 32F841
01A3 32F441
01A6 22EA41
01A9 22EC41
01AC 22EE41
01AF 22C441
01B2 22D041
01B5 22C841
01B8 22D441
01BB 22CC41
01BE 22D841
01C1 22C641
01C4 22D241
01C7 22CA41
01CA 22D641
01CD 22CE41
01D0 22DA41
01D3 32DD41
01D6 32DE41
01D9 32DF41
01DC 32F541
01DF 210038
01E2 22FA41
01E5 21B03CXRA A
LXI H,0
STA DCCT
STA SEQINDX
SHLD YAWR
SHLD PICHR
SHLD ROLLR
SHLD YSUM1-2
SHLD YSUM2-2
SHLD PSUM1-2
SHLD PSUM2-2
SHLD RSUM1-2
SHLD RSUM2-2
SHLD YSUM1
SHLD YSUM2
SHLD PSUM1
SHLD PSUM2
SHLD RSUM1
SHLD RSUM2
STA YAINC
STA PCINC
STA RLINC
STA TOGGL
LXI H,3800H
SHLD SCPTR
LXI H,3CBOH

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```

01E8 22FC41      SHLD TLMPTR
01EB 21E04A      LXI H,4AE0H
01EE 22B241      SHLD VSPIR
01F1 21C00C      LXI H,0CC0H
01F4 22F041      SHLD QPOS
01F7 2140F3      LXI H,0F340H
01FA 22F241      SHLD QNEG
01FD C9          RET

```

INZRDATA:

```

;
;READ FILE WITH END POINTS
;AND INTERPOLATE TO GET
;1200 PIECES OF DATA EACH FOR
;YAW,PITCH AND ROLL RATES
;

```

```

01FE 210036      LXI H,3600H
0201 22E237      SHLD MOVPTR
0204 0603        MVI B,3

```

SETUPIPS:

```

0206 0E14        MVI C,READ
0208 110042      LXI D,FCBRD1
020B CD0500      CALL BDOS

```

```

;
;MOVE 80H BYTES TO INT PTS.STORAGE
;

```

```

020E 2AE237      LHLD MOVPTR
0211 118000      LXI D,80H

```

MOVLOOP:

```

0214 1A          LDAX D
0215 77          MOV M,A
0216 13          INX D
0217 23          INX H
0218 AF          XRA A
0219 BA          CMP D
021A CA1402      JZ MOVLOOP
021D 22E237      SHLD MOVPTR
0220 05          DCR B
0221 C20602      JNZ SETUPIPS

```

```

;
;SET UP TO INTERPOLATE YAW RATE DATA
;

```

```

0224 210036      LXI H,BEGYIP
0227 22EA37      SHLD STRTPT
022A 21E04A      LXI H,YRDATA
022D 22E837      SHLD STRLOC
0230 CD5202      CALL LINT

```

```

;
;SET UP TO INTERPOLATE PITCH RATE DATA
;

```

```

0233 217A36      LXI H,BEGPIP
0236 22EA37      SHLD STRIPT
0239 21E24A      LXI H,PRDATA
023C 22E837      SHLD STRLOC
023F CD5202      CALL LINT

```

```

;
;SET UP TO INTERPOLATE ROLL RATE DATA
;

```

```

0242 21F436      LXI H,BEGRIP

```

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```

0245 22EA37      SHLD STRIPT
0248 21E44A      LXI H,RRDATA
024B 22E837      SHLD STRLOC
024E CD5202      CALL LINT
0251 C9          RET

```

LINT:

```

;
;F(XI)=[FOX1-FIXO + (F1-FO)*XI]/[XI-XO]
;

```

```

0252 210000      LXI H,0
0255 39          DAD SP
0256 22F637      SHLD LISVSP
0259 31F637      LXI SP,LIJUNK
025C 010000      LXI B,0000
025F 1!0100      LXI D,1
0262 C5          PUSH B
0263 D5          PUSH D
0264 C5          PUSH B
0265 2AEA37      LHL STRIPT
0268 F9          SPHL

```

LILLOOP:

```

0269 E1          POP H ;FO
026A 22C137      SHLD MLTP2
026D 22F837      SHLD FZERO ;FOR LATER
0270 2AF437      LHL XZERO
0273 3E14        MVI A,20
0275 85          ADD L
0276 6F          MOV L,A ;GET X1
0277 7C          MOV A,H
0278 CE00        ACI 0
027A 67          MOV H,A
027B 22C737      SHLD MLTP1 ;FO X X1
027E 210000      LXI H,0
0281 39          DAD SP
0282 22E637      SHLD TMPSP

```

```

;
;SAVE STACK PTR BEFORE CALL MULT
;

```

```

0285 31CF37      LXI SP,SCRATCH
0288 CD9403      CALL MULT

```

```

;
;PRODUCT OF MULT = FO X X1
;

```

```

028B 2AC137      LHL ANSL
028E 22FC37      SHLD FOX1L
0291 2AC337      LHL ANSM
0294 22FE37      SHLD FOX1M
0297 2AE637      LHL TMPSP
029A F9          SPHL
029B E1          POP H ;GET F1
029C 3B          DCX SP
029D 3B          DCX SP ;=NXT FO
029E 22C137      SHLD MLTP2
02A1 22FA37      SHLD FONE
02A4 2AF437      LHL XZERO
02A7 22C737      SHLD MLTP1

```

```

;
;NEXT XO = CURRENT XO + 20

```

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```

;
02AA 111400      LXI D,20
02AD 19          DAD D
02AE 22F437     SHLD XZERO
02B1 210000     LXI H,0
02B4 39         DAD SP
02B5 22E637     SHLD TMPSP
02B8 31CF37     LXI SP,SCRATCH
02B9 CD9403     CALL MULT

```

```

;
;PRODUCT FROM MULT = F1 X XO
;

```

```

;NOW COMPUTE FOXI - FIXO
;

```

```

02BE 2AFC37     LHLD FOXIL
02C1 EB        XCHG
02C2 2AFE37     LHLD FOXIM
02C5 4D        MOV C,L
02C6 44        MOV B,H

```

```

;
;BCDE - FOXI
;

```

```

02C7 2AC137     LHLD ANSL
02CA 7D        MOV A,L
02CB 2F        CMA
02CC C601      ADI 1
02CE 6F        MOV L,A
02CF 7C        MOV A,H
02D0 2F        CMA
02D1 CE00      ACI 0
02D3 67        MOV H,A
02D4 22C137     SHLD ANSL
02D7 2AC337     LHLD ANSM
02DA 7D        MOV A,L
02DB 2F        CMA
02DC CE00      ACI 0
02DE 6F        MOV L,A
02DF 7C        MOV A,H
02E0 2F        CMA
02E1 CE00      ACI 0
02E3 67        MOV H,A
02E4 22C337     SHLD ANSM

```

```

;
;ANSM/L = -FIXO
;

```

```

02E7 2AC137     LHLD ANSL
02EA 19        DAD D
02EB 22EC37     SHLD ALST
02EE 2AC337     LHLD ANSM
02F1 D2F502     JNC LICNI
02F4 23        INX H

```

```

LICNI:

```

```

02F5 09        DAD B
02F6 22EE37     SHLD AMST

```

```

;
;COMPUTE F1 - FO
;

```

```

02F9 2AF837     LHLD FZERO -42-

```

```

02FC 7D      MOV A,L
02FD 2F      CMA
02FE 4F      MOV C,A
02FF 7C      MOV A,H
0300 2F      CMA
0301 47      MOV B,A
0302 03      INX B
0303 2AFA37  LHLD FONE
0306 09      DAD B
0307 22E437  SHLD FIMFO

```

```

LISUBLP:
;
;

```

```

; COMPUTE (F1-F0) X X(I)
;

```

```

030A 2AE437  LHLD FIMFO
030D 22C737  SHLD MLTP1
0310 2AF237  LHLD IVAL
0313 22C137  SHLD MLTP2
0316 23      INX H
0317 22F237  SHLD IVAL
031A CD9403  CALL MULT

```

```

;
; COMP. (FOX1-FIX0)+(F1-F0)X X(I)
;

```

```

031D 2AEC37  LHLD ALST
0320 EB      XCHG
0321 2AC137  LHLD ANSL
0324 19      DAD D
0325 22D037  SHLD DVNDL
0328 2AEE37  LHLD AMST
032B EB      XCHG
032C 2AC337  LHLD ANSM
032F D23303  JNC LICN2
0332 23      INX H

```

```

LICN2:

```

```

0333 19      DAD D
0334 22D237  SHLD DVNDM
0337 211400  LXI H,20
033A 22D437  SHLD DVSRL
033D 210000  LXI H,0
0340 22D637  SHLD DVSRM
0343 CD7E04  CALL DIVIDE

```

```

;
; QUOT. = (FOX1-FIX0)+(F1-F0)X X(I) / 20
; WHERE 20 = X1-X0
;

```

```

0346 2AD837  LHLD QUOTL
0349 EB      XCHG

```

```

;
; STORE INTERPOLATED DATA POINT
;

```

```

034A 2AE837  LHLD STRLOC
034D 73      MOV M,E
034E 23      INX H
034F 72      MOV M,D

```

```

;
; INX BY 5 TO STORE NEXT DATA POINT
;

```

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```

0350 110500      LXI D,5
0353 19          DAD D
0354 22E837      SHLD STRLOC

```

;19 PTS?

```

0357 3AF037      LDA CTR20
035A 3C          INR A
035B 32F037      STA CTR20
035E FE13        CPI 19
0360 C20A03      JNZ LISUBLP
0363 AF          XRA A
0364 32F037      STA CTR20
0367 2AFA37      LHL D FONE
036A EB          XCHG
036B 2AE837      LHL STRLOC

```

```

;
;STORE F1 AS 20TH POINT
;

```

```

036E 73          MOV M,E
036F 23          INX H
0370 72          MOV M,D
0371 110500      LXI D,5
0374 19          DAD D
0375 22E837      SHLD STRLOC

```

```

;
;RESTORE STACK PTR TO GET NEW
;END POINTS
;

```

```

0378 2AE637      LHL TMPSP
037B F9          SPHL
037C 2AF237      LHL IVAL
037F 23          INX H
0380 22F237      SHLD IVAL

```

```

;
;HAVE 60X20 PTS BEEN GENERATED?
;

```

```

0383 3AF137      LDA CTR60
0386 3C          INR A
0387 32F137      STA CTR60
038A FE3C        CPI 60
038C C26902      JNZ LIL00P
038F 2AF637      LHL LISVSP
0392 F9          SPHL
0393 C9          RET

```

MULT:

```

;
;ZERO OUT MST 1/2 ANS AND CARRY SAVE
;

```

```

0394 210000      LXI H,0000
0397 22C337      SHLD ANSM
039A 22C537      SHLD CARYSV

```

```

;
;DETERMINE SIGN OF ANSWER
;

```

```

039D 2AC737      LHL MLTP1
03A0 7C          MOV A,H
03A1 2AC137      LHL MLTP2
03A4 AC          XRA H
03A5 32CF37      STA SIGN

```

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```

03A8 3E80          MVI A,80H
;
; IF MLTP2<0, MLTP2=!MLTP2!
;
03AA A4           ANA H
03AB FC6904       CM TC16
03AE CD7104       CALL CHKZERO
03B1 22C137       SHLD MLTP2
03B4 2AC737       LHL MLTP1
03B7 3E80          MVI A,80H
;
; IF MLTP1<0, MLTP1=!MLTP1!
;
03B9 A4           ANA H
03BA FC6904       CM TC16
03BD CD7104       CALL CHKZERO
03C0 22C737       SHLD MLTP1
;
; SAVE SP FOR RETURN
;
03C3 210000       LXI H,0
03C6 39           DAD SP
03C7 22C937       SHLD MSVSP
;
; SET UP BIT COUNT
;
03CA 3E11         MVI A,17
03CC 32C037       STA CNT
03CF 31C137       LXI SP,MLTP2
MLTLP:
03D2 21FFFF       LXI H,OFFFHH
03D5 39           DAD SP
03D6 35           DCR M
03D7 CA4604       JZ MLPDONE
;
; PUT TEST BIT INTO CARRY
;
03DA F1           POP PSW
03DB D22E04       JNC BIT0
BIT1:
03DE D1           POP D
03DF C1           POP B
03E0 E1           POP H
;D=MST 1/2 ANS
;B=CARRY SAVE
;H=1ST MULTIPLIER
;
; GET SUM WITHOUT CARRIES
;
03E1 78           MOV A,B
03E2 AA           XRA D
03E3 AC           XRA H
03E4 47           MOV B,A
03E5 79           MOV A,C
03E6 AB           XRA E
03E7 AD           XRA L
03E8 4F           MOV C,A
03E9 21FAFF       LXI H,OFFFAH

```

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03EC 39
03ED F9DAD SP
SPHL;
; COMPUTE NEW CARRY SAVE
;03EE E1
03EF 7C
03F0 E1
03F1 A4
03F2 57
03F3 7C
03F4 E1
03F5 A4
03F6 B2
03F7 57
03F8 7C
03F9 21FAFF
03FC 39
03FD F9
03FE E1
03FF A4
0400 B2
0401 57
0402 7D
0403 E1
0404 A5
0405 5F
0406 7D
0407 E1
0408 A5
0409 B3
040A 5F
040B 7D
040C 21FAFF
040F 39
0410 F9
0411 E1
0412 A5
0413 B3
0414 5F
0415 E1POP H
MOV A,H
POP H
ANA H
MOV D,A
MOV A,H
POP H
ANA H
ORA D
MOV D,A
MOV A,H
LXI H,OFFFAH
DAD SP
SPHL
POP H
ANA H
ORA D
MOV D,A
MOV A,L
POP H
ANA L
MOV E,A
MOV A,L
POP H
ANA L
ORA E
MOV E,A
MOV A,L
LXI H,OFFFAH
DAD SP
SPHL
POP H
ANA L
ORA E
MOV E,A
POP H

MSTR:

;
; STORE NEW PS(I)
; STORE NEW CS(I)
;0416 D5
0417 C5
0418 3B
0419 3B
041A D1
041B C1PUSH D
PUSH B
DCX SP
DCX SP
POP D
POP B;
; BCDE=PS(I)--MUST BE SHIFTED RIGHT
; BY 1
;
SHFT:

041C AF

XRA A

```

041D 78      MOV A,B
041E 1F      RAR
041F 47      MOV B,A
0420 79      MOV A,C
0421 1F      RAR
0422 4F      MOV C,A
0423 7A      MOV A,D
0424 1F      RAR
0425 57      MOV D,A
0426 7B      MOV A,E
0427 1F      RAR
0428 5F      MOV E,A
0429 C5      PUSH B
042A D5      PUSH D
042B C3D203  JMP MLTLP

```

BITO:

```

;
; COMPUTE PS(I)
;

```

```

042E D1      POP D
042F C1      POP B
0430 78      MOV A,B
0431 AA      XRA D
0432 47      MOV B,A
0433 79      MOV A,C
0434 AB      XRA E
0435 4F      MOV C,A
0436 3B      DCX SP
0437 3B      DCX SP
0438 3B      DCX SP
0439 3B      DCX SP

```

```

;
; COMPUTE CS(I)
;

```

```

043A E1      POP H
043B 7C      MOV A,H
043C 5D      MOV E,L
043D E1      POP H
043E A4      ANA H
043F 57      MOV D,A
0440 7B      MOV A,E
0441 A5      ANA L
0442 5F      MOV E,A
0443 C31604  JMP MSTR

```

MLPDONE:

```

;
; COMPUTE PS(N) + CS(N)
;

```

```

0446 33      INX SP
0447 33      INX SP
0448 E1      POP H
0449 C1      POP B
044A 09      DAD B
044B C5      PUSH B
044C E5      PUSH H
044D 2AC937  LHL D MSVSP
0450 F9      SPHL

```

```

; DETERMINE PROPER SIGN OF PRODUCT
;

```

```

0451 3ACF37          LDA SIGN
0454 E680            ANI 80H
0456 F0              RP
0457 2AC337          LHLD ANSM
045A EB              XCHG
045B 2AC137          LHLD ANSL
045E CD0205          CALL TWOSCOMP
0461 22C137          SHLD ANSL
0464 EB              XCHG
0465 22C337          SHLD ANSM
0468 C9              RET

```

```

TC16:
;

```

```

; SUBROUTINE TO TAKE TWOS COMPLEMENT
; OF 16 BIT WORD HL
;

```

```

0469 7D              MOV A,L
046A 2F              CMA
046B 6F              MOV L,A
046C 7C              MOV A,H
046D 2F              CMA
046E 67              MOV H,A
046F 23              INX H
0470 C9              RET

```

```

CHKZERO:

```

```

0471 AF              XRA A
0472 BC              CMP H
0473 C0              RNZ
0474 BD              CMP L
0475 C0              RNZ
0476 210000          LXI H,0
0479 22C137          SHLD ANSL
047C C1              POP B
047D C9              RET

```

```

DIVIDE:
;

```

```

; DIVIDE BY REPEATED SUBTRACTIONS
; THEN ROUND QUOTIENT TO NEAREST
; INTEGER
;

```

```

047E 21FFFF          LXI H,OFFFHH
0481 22DR37          SHLD QUOTL
0484 22DA37          SHLD QUOTM

```

```

; DETERMINE SIGN OF QUOTIENT
;

```

```

0487 2AD637          LHLD DVSRM
048A 7C              MOV A,H
048B 2AD237          LHLD DVNDM
048F AC              XRA H
048F 32CF37          STA SIGN

```

```

; IF DVND<0, DVND=|DVND|
;

```

```

0492 7C              MOV A,H
0493 E680            ANI 80H

```

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```

0495 F2A604      JP CKDVSR
0498 EB          XCHG
0499 2AD037      LHL D DVNDL
049C CD0205      CALL TWOSCOMP
049F 22D037      SHLD DVNDL
04A2 EB          XCHG
04A3 22D237      SHLD DVNDM

```

CKDVSR:

```

;
; IF DVSR<0, DVSR=:DVSR:
;

```

```

04A6 2AD637      LHL D DVSRM
04A9 7C          MOV A,H
04AA E680        ANI 80H
04AC F2BD04      JP DOCKS
04AF EB          XCHG
04E0 2AD437      LHL D VSRM
04E3 CD0205      CALL TWOSCOMP
04E6 22D437      SHLD VSRM
04E9 EB          XCHG
04EA 22D637      SHLD DVSRM

```

DOCKS:

```

;
; IS DVSR 0 OR 1?
;

```

```

04BD EB          XCHG
04BE 2AD437      LHL D VSRM
04C1 EB          XCHG
04C2 AF          XRA A
04C3 B4          ORA H
04C4 B5          ORA L
04C5 B2          ORA D
04C6 C2D204      JNZ CKDNO
04C9 B3          ORA E
04CA CA0105      JZ DIVZERO
04CD FE01        CPI 1
04CF CAEB04      JZ DIVONE

```

CKDNO:

```

;
; IV DVND=0, QUOT = 0
;

```

```

04D2 AF          XRA A
04D3 2AD237      LHL D DVNDM
04D6 EB          XCHG
04D7 2AD037      LHL D DVNDL
04DA B2          ORA D
04DB B3          ORA E
04DC B4          ORA H
04DD B5          ORA L
04DE C23405      JNZ SETUP

```

QUOTO:

```

04E1 210000      LXI H,0
04E4 22DA37      SHLD QUOTM
04E7 22DB37      SHLD QUOTL
04EA C9          RET

```

DIVONE:

```

;
; IF DVSR=1, QUOT=DVND

```

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```

04EB 2AD237      LHLD DVNDM
04EE EB          XCHG
04EF 2AD037      LHLD DVNDL
04F2 3ACF37      LDA SIGN
04F5 AA          XRA D
04F6 FC0205      CM TWOSCOMP
04F9 22D837      SHLD QUOTL
04FC EB          XCHG
04FD 22DA37      SHLD QUOTM
0500 C9          RET

```

DIVZERO:

0501 76 HLT

TWOSSCOMP:

```

;
;SUBROUTINE TAKES 2'S COMP.
;OF 32 BITS IN DEHL
;

```

```

0502 7D          MOV A,L
0503 2F          CMA
0504 C601        ADI 1
0506 6F          MOV L,A
0507 7C          MOV A,H
0508 2F          CMA
0509 CE00        ACI 0
050B 67          MOV H,A
050C 7B          MOV A,E
050D 2F          CMA
050E CE00        ACI 0
0510 5F          MOV E,A
0511 7A          MOV A,D
0512 2F          CMA
0513 CE00        ACI 0
0515 57          MOV D,A
0516 C9          RET

```

INCQUOT:

```

;
;INCR. QUOT WITH EACH SUCCESSFUL
;SUBTRACTION
;

```

```

0517 2AD837      LHLD QUOTL
051A 7D          MOV A,L
051B C601        ADI 1
051D 6F          MOV L,A
051E 7C          MOV A,H
051F CE00        ACI 0
0521 67          MOV H,A
0522 22D837      SHLD QUOTL
0525 2ADA37      LHLD QUOTM
0528 7D          MOV A,L
0529 CE00        ACI 0
052B 6F          MOV L,A
052C 7C          MOV A,H
052D CE00        ACI 0
052F 67          MOV H,A
0530 22DA37      SHLD QUOTM
0533 C9          RET

```

SETUP:

```

;
;SET DVSR= -DVSR TO DO SUBTRACTION
;

```

```

0534 2AD637      LHL D DVSRM
0537 EB          XCHG
0538 2AD437      LHL D DVSR L
053B CD0205      CALL TWOSCOMP
053E 44          MOV B,H
053F 4D          MOV C,L

```

```

DIVLP:

```

```

0540 CD1705      CALL INCQUOT
0543 2AD037      LHL D DVNDL
0546 22DC37      SHLD REML
0549 09          DAD B
054A 22D037      SHLD DVNDL
054D 2AD237      LHL D DVNDM
0550 22DE37      SHLD REMM
0553 7D          MOV A,L
0554 8B          ADC E
0555 6F          MOV L,A
0556 7C          MOV A,H
0557 8A          ADC D
0558 67          MOV H,A
0559 22D237      SHLD DVNDM
055C DA4005      JC DIVLP
055F 2ADC37      LHL D REML
0562 7D          MOV A,L
0563 17          RAL
0564 6F          MOV L,A
0565 7C          MOV A,H
0566 17          RAL
0567 67          MOV H,A
0568 22DC37      SHLD REML
056B 2ADE37      LHL D REMM
056E 7D          MOV A,L
056F 17          RAL
0570 6F          MOV L,A
0571 7C          MOV A,H
0572 17          RAL
0573 67          MOV H,A
0574 22DE37      SHLD REMM
0577 2ADC37      LHL D REML
057A 09          DAD B
057B 2ADE37      LHL D REMM
057E 7D          MOV A,L
057F 8B          ADC E
0580 7C          MOV A,H
0581 8A          ADC D
0582 DC1705      CC INCQUOT
0585 3ACF37      LDA SIGN
0588 E620        ANI 80H
058A F0          RP
058B 2ADA37      LHL D QUOTM
058E EB          XCHG
058F 2AD837      LHL D QUOTL
0592 CD0205      CALL TWOSCOMP
0595 22D837      SHLD QUOTL
0598 EB          XCHG

```

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```

0599 22DA37          SHLD QUOTM
059C C9              RET
                    INZDRFTM:
                    ;
                    ;GET INITIAL ALTITUDE AND SPEED
                    ;FROM CRT AND DETERMINE
                    ;PARACHUTE DISREEFING TIME
059D 0E14            MVI C,READ
059F 112142          LXI D,FCBDRFTM
05A2 CD0500          CALL BDOS
                    GETALT:
05A5 118000          LXI D,80H
05A8 0E09            MVI C,PRINT
05AA CD0500          CALL BDOS
                    RDALT:
05AD 0E0A            MVI C,INLINE
05AF 116041          LXI D,INBUF
05B2 CD0500          CALL BDOS
05B5 216141          LXI H,INBUF+1
05B8 7E              MOV A,M
05B9 FE06            CPI 6
05BB 4F              MOV C,A
05BC D21F07          JNC AINVENT
05BF 23              INX H
05C0 CDB706          CALL ASBCD
05C3 DA1F07          JC AINVENT
05C6 116141          LXI D,INBUF+1
05C9 1A              LDAX D
05CA 13              INX D
05CB D605            SUI 5
05CD 0E05            MVI C,5
05CF 217441          LXI H,INBUF+20
05D2 CDC806          CALL PREP
05D5 217441          LXI H,INBUF+20
05D8 110000          LXI D,0
05DB CDDF06          CALL TNTHOUS
05DE 22B641          SHLD ALT
05E1 01AFB9          LXI B,-18001
05E4 09              DAD B
05E5 DA1F07          JC AINVENT
                    ;GET SPEED
05E8 0E09            MVI C,PRINT
05EA 11AE00          LXI D,0A5H
05ED CD0500          CALL BDOS
                    RDSPEED:
05F0 116041          LXI D,INBUF
05F3 0E0A            MVI C,INLINE
05F5 CD0500          CALL BDOS
05F8 216141          LXI H,INBUF+1
05FB 7E              MOV A,M
05FC FE04            CPI 4
05FE 4F              MOV C,A
05FF D22707          JNC SINVENT
0602 23              INX H
0603 CDB706          CALL ASBCD
0606 DA2707          JC SINVENT
0609 116141          LXI D,INBUF+1
060C 1A              LDAX D

```

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060D 13	INX D
060E D603	SUI 3
0610 0E03	MVI C,3
0612 217441	LXI H,INBUF+20
0615 CDC806	CALL PREP
0618 217441	LXI H,INBUF+20
061B 110000	LXI D,0
061E CDFB06	CALL HUNDS
0621 22B841	SHLD SPEED
0624 01A7FD	LXI B,-601
0627 09	DAD B
0628 DA2707	JC SINVENT
062B 2AB641	LHLD ALT
062E 0150C9	LXI B,-14000
0631 09	DAD B
0632 DAB006	JC T4PT5
0635 2AB641	LHLD ALT
0638 0190E8	LXI B,-6000
063B 09	DAD B
063C D2A906	JNC T1PT5
063F 2AB841	LHLD SPEED
0642 0110FF	LXI B,-240
0645 09	DAD B
0646 D2A906	JNC T1PT5
0649 211600	LXI H,22
064C 22C737	SHLD MLTP1
064F 2AB841	LHLD SPEED
0652 22C137	SHLD MLTP2
0655 CD9403	CALL MULT
0658 2AB841	LHLD SPEED
065B 29	DAD H ; 2X S
065C 22D037	SHLD DVNDL
065F 210000	LXI H,0
0662 22D237	SHLD DVNDM
0665 22D637	SHLD DVSRM
0668 210A00	LXI H,10
066B 22D437	SHLD DVSRL
066E CD7E04	CALL DIVIDE
	;QUOT = .2XS
	;CALC. 22.2XS
0671 2AD837	LHLD QUOTL
0674 EB	XCHG
0675 2AC137	LHLD ANSL
0678 19	DAD D
0679 22C137	SHLD ANSL
067C 2AB841	LHLD SPEED
067F 29	DAD H
0680 22D037	SHLD DVNDL
0683 210000	LXI H,0
0686 22D237	SHLD DVNDM
0689 22D637	SHLD DVSRM
068C 216400	LXI H,100
068F 22D437	SHLD DVSRL
0692 CD7E04	CALL DIVIDE
0695 2AD837	LHLD QUOTL
0698 EB	XCHG
0699 2AC137	LHLD ANSL
069C 19	DAD D

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```

;HL = 22.22XSPEED
069D .117BB4 LXI D,-19333
06A0 19 DAD D
06A1 EB XCHG
06A2 2AB641 LHLD ALT
06A5 19 DAD D
06A6 DAB006 JC T4PT5

T1PT5:
06A9 215802 LXI H,600
06AC 22B441 SHLD PDRFTM
06AF C9 RET

T4PT5:
06B0 210807 LXI H,1800
06B3 22B441 SHLD PDRFTM
06B6 C9 RET

;CONVERT ASCII-8 BIT BCD
ASBCD:
06B7 7E MOV A,M
06B8 FE30 CPI 30H
06BA D8 RC
06BB FE3A CPI 3AH
06BD 3F CMC
06BE D8 RC

;OK IF BETWEEN 0,9
06BF D630 SUI 30H
06C1 .77 MOV M,A
06C2 23 INX H
06C3 0D DCR C
06C4 C2B706 JNZ ASBCD
06C7 C9 RET

PREP:
06C8 FE00 CPI 0
06CA CAD606 JZ PREP2
06CD 3600 MVI M,0
06CF 23 INX H
06D0 3C INR A
06D1 0D DCR C
06D2 C2C806 JNZ PREP
06D5 C9 RET

PREP2:
06D6 1A LDAX D
06D7 77 MOV M,A
06D8 13 INX D
06D9 23 INX H
06DA 0D DCR C
06DB C2D606 JNZ PREP2
06DE C9 RET

;
;CONVERT 8 BIT BCD TO HEX
;
INTHOUS:
06DF 7E MOV A,M
06E0 23 INX H
06E1 FE02 CPI 2
06E3 DALA06 JC TINTCNT
06E6 E1 POP H
06E7 C31F07 JMP AINVENT

TINTCNT:

```

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```

06EA FE01      CPI 1
06EC C2F206    JNZ THOUS
06EF 111027    LXI D,10000

THOUS:
06F2 7E        MOV A,M
06F3 23        INX H
06F4 01E803    LXI B,1000
06F7 CD1607    CALL BCDHEX
06FA EB        XCHG

HUNDS:
06FB 7E        MOV A,M
06FC 23        INX H
06FD 016400    LXI B,100
0700 CD1607    CALL BCDHEX
0703 EB        XCHG

TENS:
0704 7E        MOV A,M
0705 23        INX H
0706 010A00    LXI B,10
0709 CD1607    CALL BCDHEX
070C EB        XCHG

UNITS:
070D 7E        MOV A,M
070E 23        INX H
070F 010100    LXI B,1
0712 CD1607    CALL BCDHEX
0715 C9        RET

BCDHEX:
0716 EB        XCHG

BHLP:
0717 FE00      CPI 0
0719 C8        RZ
071A 09        DAD B
071B 3D        DCR A
071C C31707    JMP BHLP

AINVENT:
;
; INVALID ALTITUDE ENTERED
;

071F 3E04      MVI A,4
0721 CD03F8    CALL OF803H
0724 C3AD05    JMP RDALT

SINVENT:
;
; INVALID SPEED ENTERED
;

0727 3E04      MVI A,4
0729 CD03F8    CALL OF803H
072C C3F005    JMP RDSPEED

INZDEMO:
072F 0604      MVI B,4

INZDMLP:
0731 0E14      MVI C,READ
0733 114242    LXI D,FCBDEMO
0736 CD0500    CALL BDOS
0739 0E09      MVI C,PRINT
073B 118000    LXI D,801
073E CD0500    CALL BDOS

```

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```

0741 05          DCR B
0742 C23107     JNZ INZDMLP
0745 C9         RET

EJKEY:
0746 0E01      MVI C,CONIH
0748 CD0500    CALL BDOS
074B FE45      CPI 'E'
074D CA7F07    JZ EJECT
0750 3E7F      MVI A,7FH
0752 CD03F8    CALL OF803H
0755 C34607    JMP EJKEY

WAITING:
0758 FB        EI

HERE:
0759 C35907    JMP HERE ;WAIT FOR INTERRUPT

SEQSRT:
075C 2ABA41    LHLD INTCONTR
075F 23        INX H
0760 22BA41    SHLD INTCONTR
0763 318F37    LXI SP,NEED30
0766 217307    LXI H,JMPSTRT
0769 3AF441    LDA SEQINDX
076C 4F        MOV C,A
076D 0600      MVI B,0
076F 09        DAD B
0770 09        DAD B
0771 09        DAD B
0772 E9        PCHL

JMPSTRT:
0773 C3B707    JMP EJCTRTN
0776 C3BF07    JMP CTPLIRTN
0779 C38F08    JMP RKTSEQ
077C C3450A    JMP PARSEP

EJECT:
077F 2103D1    LXI H,0D103H
0782 3674      MVI M,74H
0784 2101D1    LXI H,0D101H
0787 3650      MVI M,50H
0789 36C3      MVI M,0C3H
078B 3E1B      MVI A,1BH
078D CDD807    CALL SIM
0790 3E0B      MVI A,0BH
0792 CDD807    CALL SIM
0795 318F37    LXI SP,NEED30
0798 3E04      MVI A,4
079A CD03F8    CALL OF803H
079D 3E1B      MVI A,ESC
079F CD03F8    CALL OF803H
07A2 3E3D      MVI A,'='
07A4 CD03F8    CALL OF803H
07A7 3E21      MVI A,21H
07A9 CD03F8    CALL OF803H
07AC 3E47      MVI A,47H
07AE CD03F8    CALL OF803H
07B1 210000    LXI H,0
07B4 22BA41    SHLD INTCONTR

EJCTRTN:
07B7 0E06      MVI C,6

```

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```

07B9 CDC707      CALL SQUIB
07BC C3E207      JMP DRIVER

CTPLTRTN:
07BF 0E02        MVI C,2
07C1 CDC707      CALL SQUIB
07C4 C3E207      JMP DRIVER

SQUIB:
07C7 3E0A        MVI A,0AH
07C9 CD03F8      CALL OF803H
07CC 3E08        MVI A,BS
07CE CD03F8      CALL OF803H
07D1 3E2A        MVI A,LGT
07D3 CD03F8      CALL OF803H
07D6 0D          DCR C
07D7 C2C707      JNZ SQUIB
07DA C9          RET

SIM:
07DB 21E007      LXI H,SIM1
07DE 3630        MVI M,30H

SIM1:
07E0 00          NOP
07E1 C9          RET

DRIVER:
07E2 3AF441      LDA SEQINDX
07E5 4F          MOV C,A
07E6 0600        MVI B,0
07E8 21EF07      LXI H,DRVRCK
07EB 09          DAD B
07EC 09          DAD B
07ED 09          DAD B
07EE E9          PCHL

DRVRCK:
07EF C3F807      JMP DRCKA
07F2 C32108      JMP DRCKB
07F5 C35508      JMP DRCKC

DRCKA:
07F8 2ABA41      LHL DINTCNTR
07FB 01F5FF      LXI B,0FFF5H
07FE 09          DAD B
07FF DA1908      JC SSQB
0802 3E1B        MVI A,1BH
0804 CD03F8      CALL OF803H
0807 3E3D        MVI A,'='
0809 CD03F8      CALL OF803H
080C 3E21        MVI A,21H
080E CD03F8      CALL OF803H
0811 3E47        MVI A,47H
0813 CD03F8      CALL OF803H
0816 C35807      JMP WAITING

SSQB:
0819 3E01        MVI A,1
081B 32F441      STA SEQINDX
081E C35607      JMP WAITING

DRCKB:
0821 2ABA41      LHL DINTCNTR
0824 01EBFF      LXI B,0FFEBH
0827 09          DAD B
0828 DA4208      JC SSQB

```

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```

0828 3E1B      MVI A,1BH
082D CD03F8    CALL OF803H
0830 3E3D      MVI A,'='
0832 CD03F8    CALL OF803H
0835 3E27      MVI A,27H
0837 CD03F8    CALL OF803H
083A 3E47      MVI A,47H
083C CD03F8    CALL OF803H
083F C35807    JMP WAITING

```

SSQC:

```

0842 2101D1    LXI H,0D101H
0845 3688      MVI M,88H
0847 3613      MVI M,13H
0849 3E01      MVI A,1
084B 32BC41    STA RKTFLG
084E 3C        INR A
084F 32F441    STA SEQINDX
0952 C35807    JMP WAITING

```

DRCKC:

```

0855 3ABC41    LDA RKTFLG
0858 FE01      CPI 1
085A CA7408    JZ ADJCNTR
085D 2ABA41    LHL D INTCNTR
0860 01A8FD    LXI B,-600
0863 09        DAD B
0864 D25807    JNC WAITING

```

SSQD:

```

0867 3E03      MVI A,3
0869 32F441    STA SEQINDX
086C 0E01      MVI C,1
086E CDC707    CALL SQUIB
0871 C3450A    JMP PARSEP

```

ADJCNTR:

```

0874 2ABA41    LHL D INTCNTR
0877 22BD41    SHLD TWNTYFV
087A 210000    LXI H,0
087D 22BA41    SHLD INTCNTR
0880 AF        XRA A
0881 32BC41    STA RKTFLG
0884 C35807    JMP WAITING

```

RKFSTM:

```

0887 0E02      MVI C,2
0889 CDC707    CALL SQUIB
088C C3E207    JMP DRIVER

```

RKTSEQ:

```

088F 3ABC41    LDA RKTFLG
0892 FE01      CPI 1
0894 CA8708    JZ RKFSTM

```

CKPCEM:

```

0897 2ABA41    LHL D INTCNTR
089A 110802    LXI D,520
089D 7A        MOV A,D
089E BC        CMP H
089F C2A908    JNZ INWATDTA
08A2 0E01      MVI C,1
08A4 7B        MOV A,E
08A5 8D        CMP L
08A6 CCC707    CZ SQUIB

```

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INRATDTA:

```

08A9 3E06      MVI A,6
08AB 010000    LXI B,0
08AE 21C341    LXI H,41C3H
08B1 22B041    SHLD VSINP

```

INLOOP:

```

08B4 2AB241    LHL D VSPTR
08B7 09        DAD B
08B8 03        INX B
08B9 5E        MOV E,M
08BA 23        INX H
08BB 56        MOV D,M
08BC 2AB041    LHL D VSINP
08BF F9        SPHL
08C0 210200    LXI H,2
08C3 39        DAD SP
08C4 22B041    SHLD VSINP
08C7 2B        DCX H
08C8 2B        DCX H
08C9 09        DAD B
08CA 03        INX B
08CB F9        SPHL
08CC E3        XTHL
08CD 19        DAD D
08CE EB        XCHG
08CF E3        XTHL
08D0 23        INX H
08D1 23        INX H
08D2 73        MOV M,E
08D3 23        INX H
08D4 72        MOV M,D
08D5 3D        DCR A
08D6 C2B408    JNZ INLOOP
08D9 2AB241    LHL D VSPTR
08DC 09        DAD B
08DD 22B241    SHLD VSPTR
08E0 318F37    LXI SP,NEED30

```

RKTCONT:

```

08E3 CDEC08    CALL UPDAT
08E6 CDB609    CALL CNTRLAW
08E9 C3E207    JMP DRIVER

```

UPDAT:

```

08EC 210000    LXI H,0
08EF 39        DAD SP
08F0 22F641    SHLD SAVE
08F3 31C641    LXI SP,YSUM1

```

RESID:

```

08F6 D1        POP D
08F7 2AEA41    LHL D YAWR
08FA CD7B09    CALL UPLOG
08FD 22EA41    SHLD YAWR
0900 32DD41    STA YAINC
0903 D1        POP D
0904 D1        POP D
0905 2AEC41    LHL D PICHR
0908 CD7B09    CALL UPLOG
090B 22EC41    SHLD PICHR
090E 32DE41    STA PCINC

```

0911 D1	POP D
0912 D1	POP D
0913 2AEE41	LHLD ROLLR
0916 CD7B09	CALL UPLOG
0919 22EE41	SHLD ROLLR
091C 32DF41	STA RLINC
091F 31E241	LXI SP,D31
0922 C1	POP B
0923 E1	POP H
0924 3ADD41	LDA YAINC
0927 2F	CMA
0928 3C	INR A
0929 CD9D09	CALL INDIS
092C E3	XTHL
092D 3ADE41	LDA PCINC
0930 CD9D09	CALL INDIS
0933 E3	XTHL
0934 E5	PUSH H
0935 C1	POP B
0936 E1	POP H
0937 3ADF41	LDA RLINC
093A 2F	CMA
093B 3C	INR A
093C CD9D09	CALL INDIS
093F E5	PUSH H
0940 2AE241	LHLD D31
0943 3ADD41	LDA YAINC
0946 CD9D09	CALL INDIS
0949 C5	PUSH B
094A E3	XTHL
094B D1	POP D
094C C1	POP B
094D 3ADF41	LDA RLINC
0950 CD9D09	CALL INDIS
0953 C5	PUSH B
0954 3B	DCX SP
0955 3B	DCX SP
0956 E3	XTHL
0957 3ADE41	LDA PCINC
095A 2F	CMA
095B 3C	INR A
095C CD9D09	CALL INDIS
095F E5	PUSH H
0960 3AF541	LDA TOGGL
0963 FE01	CPI 1
0965 D27209	JNC UPDON
0968 3C	INR A
0969 32F541	STA TOGGL
096C 31D241	LXI SP,YSUM2
096F C3F608	JMP RESID
0972 AF	XRA A
0973 32F541	STA TOGGL
0976 2AF641	LHLD SAVE
0979 F9	SPHL
097A C9	RET
097B 19	DAD D

UPDON:

UPLOG:

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```

097C 3E80      MVI A,80H
097E A4        ANA H
097F EB        XCHG
0980 C29009    JNZ NEGRS
0983 2AF241    LHLD QNEG
0986 19        DAD D
0987 3E80      MVI A,80H
0989 A4        ANA H
098A 3E01      MVI A,1
098C C8        RZ
098D EB        XCHG
098E AF        XRA A
098F C9        RET

```

NEGRS:

```

0990 2AF041    LHLD QPOS
0993 19        DAD D
0994 3E80      MVI A,80H
0996 A4        ANA H
0997 3EFF      MVI A,OFFH
0999 C0        RNZ
099A EB        XCHG
099B AF        XRA A
099C C9        RET

```

INDIS:

```

099D FE00      CPI 0
099F C8        RZ
09A0 78        MOV A,B
09A1 F2A609    JP LABEL
09A4 2F        CMA
09A5 3C        INR A

```

LABEL:

```

09A6 5F        MOV E,A
09A7 E680      ANI 80H
09A9 F2B109    JP POSBY
09AC 16FF      MVI D,OFFH
09AE 19        DAD D
09AF 19        DAD D
09B0 C9        RET

```

POSBY:

```

09B1 1600      MVI D,0
09B3 19        DAD D
09B4 19        DAD D
09B5 C9        RET

```

CNTRLAW:

```

09B6 3AE741    LDA D33+1
09B9 17        RAL
09BA DACE09    JC D33L0
09BD 3AE341    LDA D31+1
09C0 EE7F      XRI 7FH
09C2 67        MOV H,A

```

NEGD2:

```

09C3 3AE541    LDA D32+1
09C6 2F        CMA
09C7 3C        INR A
09C8 EE7F      XRI 7FH
09CA 6F        MOV L,A
09CB C3050A    JMP OUTPUT

```

D33L0:

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```

09CE 3AE341      LDA D31+1
09D1 CD370A      CALL ABS
09D4 4F           MOV C,A
09D5 5A           MOV E,D
09D6 3AE541      LDA D32+1
09D9 CD370A      CALL ABS
09DC B9           CMP C
09DD D2F109      JNC D32G
09E0 3E7F        MVI A,7FH
09E2 91           SUB C
09E3 4F           MOV C,A
09E4 7B           MOV A,E
09E5 FE80        CPI 80H
09E7 79           MOV A,C
09E8 CC420A      CZ CHS
09EB EE7F        XRI 7FH
09ED 67           MOV H,A
09EE C3C309      JMP NEGD2

```

D32G:

```

09F1 3E7F        MVI A,7FH
09F3 90           SUB B
09F4 47           MOV B,A
09F5 7A           MOV A,D
09F6 FE80        CPI 80H
09F8 78           MOV A,B
09F9 C4420A      CNZ CHS
09FC EE7F        XRI 7FH
09FE 6F           MOV L,A
09FF 3AE341      LDA D31+1
0A02 EE7F        XRI 7FH
0A04 67           MOV H,A

```

OUTPUT:

```

0A05 EB          XCHG
0A06 2AFA41      LHLD SCPTR
0A09 73           MOV M,E
0A0A 23           INX H
0A0B 72           MOV M,D
0A0C 23           INX H
0A0D 22FA41      SHLD SCPTR
0A10 21E241      LXI H,D31
0A13 1600        MVI D,0
0A15 3AF841      LDA DCCT
0A18 5F           MOV E,A
0A19 19           DAD D
0A1A 3C           INR A
0A1B 3C           INR A
0A1C FE05        CPI 5
0A1E DA220A      JC LABEL2
0A21 AF          XRA A

```

LABEL2:

```

0A22 32F841      STA DCCT
0A25 EB          XCHG
0A26 1A          LDAX D
0A27 6F          MOV L,A
0A28 13          INX D
0A29 1A          LDAX D
0A2A 67          MOV H,A
0A2B EB          XCHG

```

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```

) 0A2C 2AFC41      LHLD TLMPTR
  0A2F 73          MOV M,E
) 0A30 23          INX H
  0A31 72          MOV M,D
  0A32 23          INX H
) 0A33 22FC41     SHLD TLMPTR
  0A36 C9          RET
                ABS:
) 0A37 47          MOV B,A
  0A38 3E80        MVI A,80H
  0A3A A0          ANA B
) 0A3B 57          MOV D,A
  0A3C 78          MOV A,B
  0A3D F0          RP
) 0A3E 2F          CMA
  0A3F 3C          INR A
  0A40 47          MOV B,A
) 0A41 C9          RET
                CHS:
  0A42 2F          CMA
) 0A43 3C          INR A
  0A44 C9          RET
                PARSEP:
) 0A45 2ABA41     LHLD INTCNTR
  0A48 EB          XCHG
  0A49 2AB441     LHLD PDRFTM
) 0A4C 7C          MOV A,H
  0A4D BA          CMP D
  0A4E C25807     JNZ WAITING
) 0A51 7D          MOV A,L
  0A52 BB          CMP E
  0A53 C25807     JNZ WAITING
) 0A56 0E02       MVI C,2
  0A58 CDC707     CALL SQUIB
                FINISHUP:
;
;DISABLE TIMERS AND
;DISPLAY INITIAL AND FINAL ORIENTATION
;
) 0A5B 3E1F       MVI A,1FH
  0A5D CDD807     CALL SIM
) 0A60 318F37     LXI SP,NEED30
  0A63 119542     LXI D,FDISP1
  0A66 0E09       MVI C,PRINT
) 0A68 CD0500     CALL BDOS
  0A6B 218442     LXI H,FCNT
  0A6E 3631       MVI M,31H
                FINLP:
) 0A70 217FOA     LXI H,ROW+1
  0A73 34          INR M
) 0A74 3E1B       MVI A,1BH
  0A76 CD03F8     CALL OF803H
  0A79 3E3D       MVI A,'='
) 0A7B CD03F8     CALL OF803H
  0A7E 3E31       ROW: MVI A,31H
  0A80 CD03F8     CALL OF803H
) 0A83 3E37       MVI A,37H
  0A85 CD03F8     CALL OF803H
;

```

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0A88 218442	LXI H,FCNT
0A8B 7E	MOV A,M
0A8C 218742	LXI H,FDISP+2
0A8F 77	MOV M,A
0A90 21E241	LXI H,D31
0A93 FE31	CPI 31H
0A95 CAA10A	JZ FCONT1
0A98 23	INX H
0A99 23	INX H
0A9A FE32	CPI 32H
0A9C CAA10A	JZ FCONT1
0A9F 23	INX H
0AA0 23	INX H
0AA1 5E	FCONT1: MOV E,M
0AA2 23	INX H
0AA3 56	MOV D,M
0AA4 3E80	MVI A,80H
0AA6 A2	ANA D
0AA7 3E20	MVI A,20
0AA9 F2B50A	JP FCONT2
0AAC 7A	MOV A,D
0AAD 2F	CMA
0AAE 57	MOV D,A
0AAF 7B	MOV A,E
0AB0 2F	CMA
0AB1 5F	MOV E,A
0AB2 13	INX D
0AB3 3E2D	MVI A,2D
	FCONT2:
0AB5 328B42	STA FDISP+6
0AB8 EB	XCHG
0AB9 22C737	SHLD MLTP1
0ABC 21E803	LXI H,1000
0ABF 22C137	SHLD MLTP2
0AC2 CD9403	CALL MULT
0AC5 2AC137	LHLD ANSL
0AC8 22D037	SHLD DVNDL
0ACB 2AC337	LHLD ANSM
0ACE 22D237	SHLD DVNDM
0AD1 210040	LXI H,4000H
0AD4 22D437	SHLD DVSRL
0AD7 210000	LXI H,0
0ADA 22D637	SHLD DVSRM
0ADD CD7E04	CALL DIVIDE
0AE0 2AD837	LHLD QUOTL
0AE3 0118FC	LXI B,-1000
0AE6 09	DAD B
0AE7 DA2C0B	JC ONEPT
0AEA 3E30	MVI A,30
0AEC 328C42	STA FDISP+7
0AEF 01E803	LXI B,1000
0AF2 09	DAD B
	FCONT3:
0AF3 115400	LXI D,100
0AF6 019CFF	LXI B,-100
0AF9 3E30	MVI A,30H
0AFB CD340B	CALL HTOA
0AFE 328C42	STA FDISP+0

OB01 110A00	LXI D,10
OB04 01F6FF	LXI B,-10
OB07 3E30	MVI A,30H
OB09 CD340B	CALL HTOA
OB0C 328F42	STA FDISP+10
OB0F 7D	MOV A,L
OB10 C630	ADI 30H
OB12 329042	STA FDISP+11
OB15 0E09	MVI C,9
OB17 118542	LXI D,FDISP
OB1A CD0500	CALL BDOS
OB1D 3A8442	LDA FCNT
OB20 3C	INR A
OB21 FE34	CPI 34H
OB23 CA0000	JZ 0
OB26 328442	STA FCNT
OB29 C3700A	JMP FINLP
OB2C 3E31	ONEPT: MVI A,'1'
OB2E 328C42	STA FDISP+7
OB31 C3F30A	JMP FCONT3
OB34 09	HTOA: DAD B
OB35 3C	INR A
OB36 DA340B	JC HTOA
OB39 19	DAD D
OB3A 3D	DCR A
OB3B C9	RET
OB3C 216342	CHOICE: LXI H,FCBMENU
OB3F 3600	MVI M,0
OB41 010C00	LXI B,12
OB44 09	DAD B
OB45 1615	MVI D,21
OB47 3600	CHLP: MVI M,0
OB49 23	INX H
OB4A 15	DCR D
OB4B C2470B	JNZ CHLP
OB4E 116342	LXI D,FCBMENU
OB51 0E0F	MVI C,OPEN
OB53 CD0500	CALL BDOS
OB56 116342	LXI D,FCBMENU
OB59 0E14	MVI C,READ
OB5B CD0500	CALL BDOS
OB5E 118000	LXI D,80H
OB61 0E09	MVI C,PRINT
OB63 CD0500	CALL BDOS
OB66 0E01	GETTSTN: MVI C,CONIN
OB68 CD0500	CALL BDOS
OB6B 320642	STA FCBRD1+6
OB6E FE31	CPI 31H
OB70 CA300B	JZ TEST1
OB73 FE32	CPI 32H
OB75 CAA50B	JZ TEST2
OB78 3E04	MVI A,4
OB7A CD03F8	CALL OF803H
OB7D C3660B	JMP GETTSTN

TEST1:

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```

OB80 210000      LXI H,0
OB83 22E241      SHLD D31
OB86 22E641      SHLD D33
OB89 210040      LXI H,4000H
OB8C 22E441      SHLD D32
OB8F 3E30        MVI A,30H
OB91 32C742      STA FDISP1+50
OB94 32C942      STA FDISP1+52
OB97 32D442      STA FDISP1+63
OB9A 32DD42      STA FDISP1+72
OB9D 32DF42      STA FDISP1+74
OBA0 3C          INR A
OBA1 32D242      STA FDISP1+61
OBA4 C9         RET

```

TEST2:

```

OBA5 210000      LXI H,0
OBA8 22E241      SHLD D31
OBAB 22E441      SHLD D32
OBAE 210040      LXI H,4000H
OBB1 22E641      SHLD D33
OBB4 3E30        MVI A,30H
OBB6 32C742      STA FDISP1+50
OBB9 32C942      STA FDISP1+52
OBBC 32D242      STA FDISP1+61
OBBF 32D442      STA FDISP1+63
OBC2 32DF42      STA FDISP1+74
OBC5 3C          INR A
OBC6 32DD42      STA FDISP1+72
OBC9 C9         RET

```

; INITIALIZE SYS. CALL PRMTRS.

```

001C =          ASSDRV: EQU 28
0005 =          BDOS: EQU 5
0010 =          CLOSE: EQU 16
0001 =          CONIN: EQU 1
0002 =          CONOUT: EQU 2
000B =          CONRDY: EQU 11
0013 =          DELETE: EQU 19
001F =          DRVIN: EQU 31
0020 =          DRVOUT: EQU 32
0021 =          ERMSG: EQU 33
001B =          GETALO: EQU 27
0019 =          GETCUR: EQU 25
0007 =          GETIOB: EQU 7
0022 =          GETVCB: EQU 34
000D =          INIT: EQU 13
000A =          INLINE: EQU 10
0005 =          LIST: EQU 5
0016 =          MAKE: EQU 22
0023 =          MOUNT: EQU 35
000F =          OPEN: EQU 15
001E =          PHYDRV: EQU 30
0009 =          PRINT: EQU 9
0014 =          READ: EQU 20
0017 =          RENAME: EQU 23
0011 =          SEARCH: EQU 17
000E =          SELECT: EQU 14
0012 =          SERCHN: EQU 13
001A =          SETBUF: EQU 26

```

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```

0008 =      SETIOB: EQU 8
001D =      UNMONT: EQU 29
0015 =      WRITE: EQU 21
           ;END SYS.PRMTRS.
378F =      NEED30: EQU 378FH
3600 =      BEGYIP: EQU 3600H
367A =      BEGPIP: EQU 367AH
36F4 =      BEGRIP: EQU 36F4H
4AE0 =      YRDATA: EQU 4AE0H
4AE2 =      PRDATA: EQU 4AE2H
4AE4 =      RRDATA: EQU 4AE4H
37F6 =      LIJUNK: EQU 37F6H
37CF =      SCRATCH: EQU 37CFH
001B =      ESC: EQU 1BH
0008 =      BS: EQU 8
002A =      LGT: EQU 2AH
37C0 =      ORG 37C0H
37C0 =      CNT: DS 1
37C1 =      ANSL: DS 2
37C1 =      ORG 37C1H
37C1 =      MLTP2: DS 2
37C3 =      ANSM: DS 2
37C5 =      CARYSV: DS 2
37C7 =      MLTP1: DS 2
37C9 =      MSVSP: DS 2
37CF =      ORG 37CFH
37CF =      SIGN: DS 1
37D0 =      DVNDL: DS 2
37D2 =      DVNDM: DS 2
37D4 =      DVSRL: DS 2
37D6 =      DVSRM: DS 2
37D8 =      QUOTL: DS 2
37DA =      QUOTM: DS 2
37DC =      REML: DS 2
37DE =      REMM: DS 2
37E2 =      ORG 37E2H
37E2 =      MOVPTR: DS 2
37E4 =      F1MFO: DS 2
37E6 =      TMPSP: DS 2
37E8 =      STRLOC: DS 2
37EA =      STRTPT: DS 2
37EC =      ALST: DS 2
37EE =      AMST: DS 2
37F0 =      CTR20: DS 1
37F1 =      CTR60: DS 1
37F2 =      IVAL: DS 2
37F4 =      XZERO: DS 2
37F6 =      LISVSP: DS 2
37F8 =      FZERO: DS 2
37FA =      FONE: DS 2
37FC =      FOXIL: DS 2
37FE =      FOXIM: DS 2
4160 =      ORG 4160H
4160 50 =    INBUF: DS 80
4161 =      DS 1
4162 =      DS 80
41B0 =      ORG 41B0H
41B0 =      VSINP: DS 2

```

```

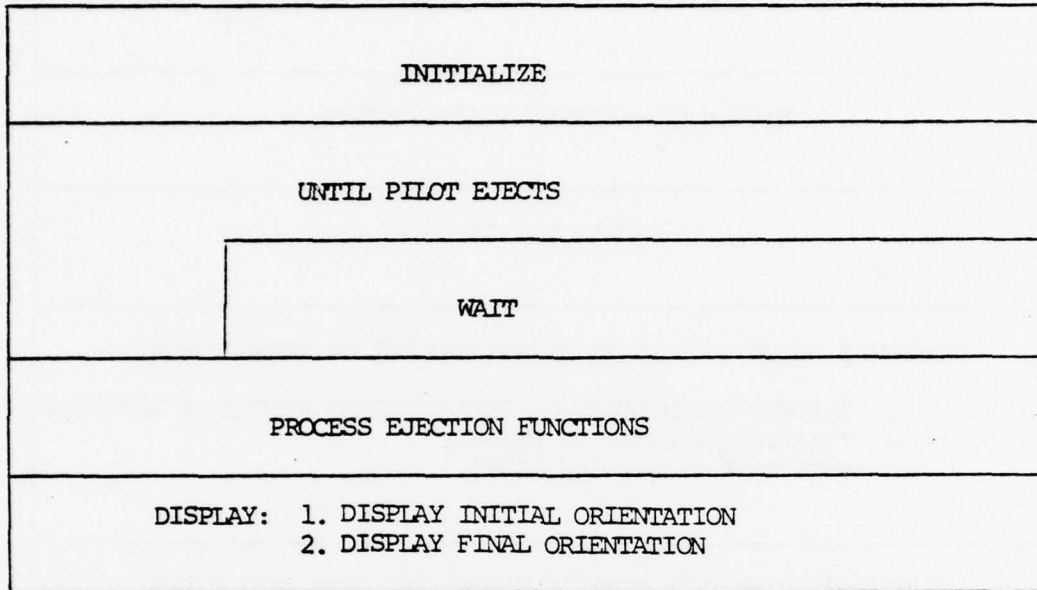
41B2      VSPTR:  DS 2
41B4      PDRFTM: DS 2
41B6      ALT:    DS 2
41B8      SPEED:  DS 2
41BA      INICNTR: DS 2
41BC      RKTFLC: DS 1
41BD      TWNTYFV: DS 2
41C6      ORG 41C6H
41C6      YSUM1:  DS 2
41CA      ORG 41CAH
41CA      PSUM1:  DS 2
41CE      ORG 41CEH
41CE      RSUM1:  DS 2
41D2      ORG 41D2H
41D2      YSUM2:  DS 2
41D6      ORG 41D6H
41D6      PSUM2:  DS 2
41DA      ORG 41DAH
41DA      RSUM2:  DS 2
41DD      ORG 41DDH
41DD      YAINC:  DS 1
41DE      PCINC:  DS 1
41DF      RLINC:  DS 1
41E2      ORG 41E2H
41E2      D31:    DS 2
41E4      D32:    DS 2
41E6      D33:    DS 2
41EA      ORG 41EAH
41EA      YAWR:   DS 2
41EC      PICHHR: DS 2
41EE      ROLLR:  DS 2
41FO      ORG 41FOH
41FO      QPOS:   DS 2
41F2      QNEG:   DS 2
41F4      SEQINDX: DS 1
41F5      TOGGL:  DS 1
41F6      SAVE:   DS 2
41F8      DCCT:   DS 2
41FA      SCPTR:  DS 2
41FC      TLMPTR: DS 2
4200      ORG 4200H
4200      FCBRD1: DS 1
4201 5244415441 DB 'RDATA1 DAT'
420C      DS 21
4221      FCBDRFTM: DS 1
4222 445246544D DB 'DRFTMSG TXT'
422D      DS 21
4242      FCBDEMO:  DS 1
4243 44454D4F44 DB 'DEMODSP TXT'
424E      DS 21
4263      FCBMENU:
4264 4D454E554D DB 'MENUMSG TXT'
426F      DS 21
4284      FCNT:   DS 1
4285 444320203DFDISP: DB 'DC = '
4292 0A0C      DB 'OAH,OCH'
4294 24        DB 'S'
    
```

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4295	0A0A0D	FDISP1:	DB	OAH,OAH,ODH
4298	494E495449		DB	'INITIAL ORIENTATION'
42AB	20202020		DB	'
42AF	46494E414C		DB	'FINAL ORIENTATION'
42C0	0D		DB	ODH
42C1	444331203D		DB	'DC1 = 0.0'
42CA	0A0D		DB	OAH,ODH
42CC	444332203D		DB	'DC2 = 1.0'
42D5	0A0D		DB	OAH,ODH
42D7	444333203D		DB	'DC3 = 0.0'
42E0	24		DB	'S'
42E1			END	100H

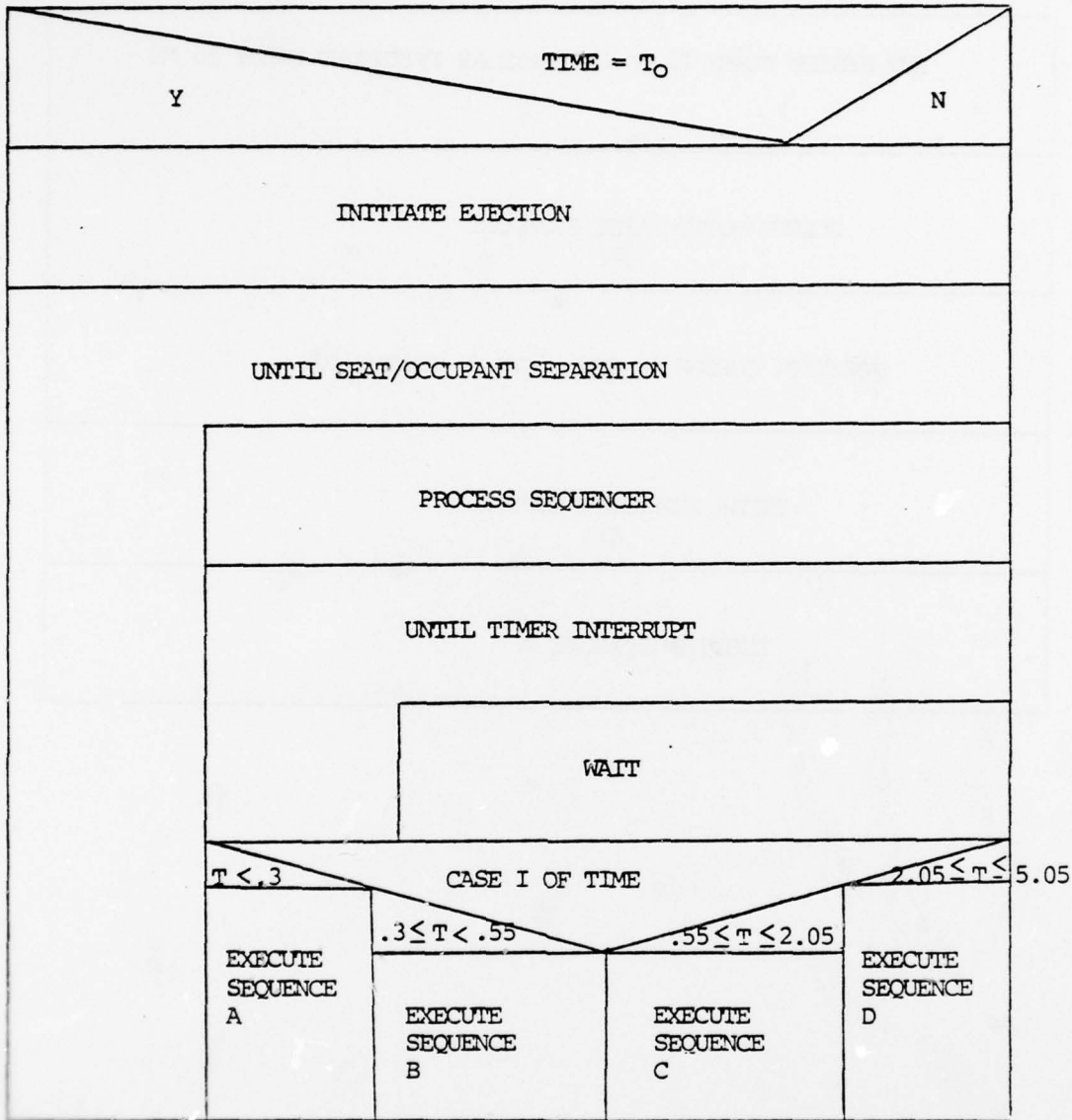
4.2 FLOW DIAGRAMS



INITIALIZE:

SET UP LOCATION 3CH TO HANDLE TIMER INTERRUPTS
INITIALIZE (RESET) SYSTEM TIMERS
INITIALIZE CRT
DETERMINE WHICH TEST IS TO BE RUN AND SET UP APPROPRIATE: <ol style="list-style-type: none">1. INITIAL ORIENTATION OF SEAT/OCCUPANT SYSTEM AT EJECTION2. 'INITIAL ORIENTATION MESSAGE'3. RATE DATA FILE TO BE READ
INITIALIZE DISK FILE CONTROL BLOCKS AND OPEN DISK FILES
INITIALIZE PROGRAM VARIABLES
INITIALIZE RATE DATA
DETERMINE TIME OF PARACHUTE DISREEFING/SEAT/OCCUPANT SEPARATION
RE-INITIALIZE CRT
DISPLAY EJECTION FUNCTIONS ON CRT

PROCESS EJECTION FUNCTIONS



INITIATE EJECTION

SET SYSTEM TIMER T1 TO GENERATE AN INTERRUPT EVERY 25 MS

DELETE BOTTOM LINE FROM CRT

POSITION CURSOR ON CRT (ROW 2, COLUMN 40)

CLEAR INTERRUPT COUNTER

EXECUTE SEQUENCE A

PROCESS SEQUENCER

A		CASE I OF PREVIOUS SEQUENCE EXECUTED					
CASE I OF TIME OF NEXT INTERRUPT		B			C		
T < .3		CASE I OF TIME OF NEXT INTERRUPT			WAS C JUST EXECUTED FOR 1ST TIME?		
T = .3		T < .55			Y		
REPOSITION CURSOR TO ROW 2 COLUMN 40		REPOSITION CURSOR TO ROW 8 COLUMN 40			CASE I OF TIME OF NEXT		
SET SEQUENCE PTS FOR SEQUENCE B		SET TIMER TO GENERATE INT EVERY 2.5 MS			t < INT. t = 2.05		
		SET FLAG FOR 1ST TIME IN SEQUENCE C			CLEAR 1ST TIME FLAG		
		SET SEQUENCE POINTER FOR SEQUENCE C			SAVE # OF 25 MS INTERRUPTS		
					CLEAR INT. CNTR TO BEGIN CNING # OF 2.5 MS INTERRUPTS		
					SET SEQ PTR FOR SEQ D		

EXECUTE SEQUENCE A

EJCTRIN:

UNTIL 6 SQUIBS HAVE BEEN FIRED

'FIRE SQUIB' (SEND 3 CHARACTER SEQUENCE - lf,
bs,* TO CRT)

EXECUTE SEQUENCE B

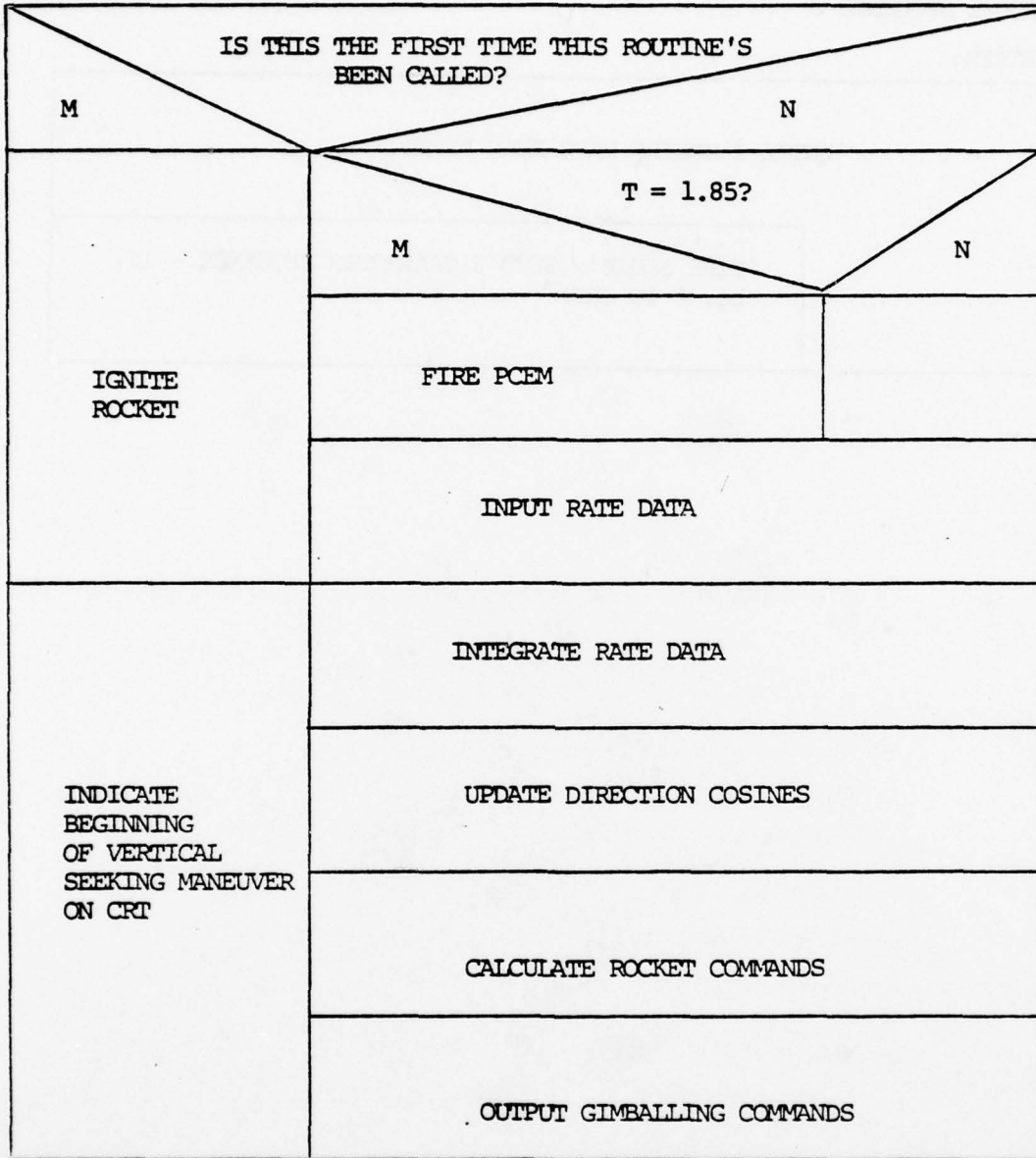
CIPLTRIN:

UNTIL 2 SQUIBS HAVE BEEN FIRED

'FIRE SQUIB' (SEND 3 CHARACTER SEQUENCE - lf,
bs, * TO CRT)

EXECUTE SEQUENCE C

RKTSEQ:



EXECUTE SEQUENCE D

PARSEP:

ELAPSED TIME T = PREDETERMINED TIME FOR SEQUENCE D EXECUTION?	
Y	N
UNTIL 2 SQUIBS HAVE BEEN FIRED	
'FIRE SQUIB' (SEND 3 CHARACTERS SEQUENCE lf, bs, *, TO CRT)	

4.3 Program Variables

- ALT:** The address of the first of two consecutive bytes of memory in which the binary representation of the altitude at the time of ejection is stored after being converted from ASCII.
- ALST:** The address of the first of 2 consecutive bytes of memory in which the LST 2 bytes of the 4 byte value corresponding to $(f_0x_1 - f_1x_0)$ in the linear interpolation formula are stored.
- AMST:** The address of the first of 2 consecutive bytes of memory in which the MST 2 bytes of the 4 byte value corresponding to $f_0x_1 - f_1x_0$ in the linear interpolation formula are stored.
- ANSL:** The address of the first of 2 consecutive bytes of memory in which the LST 2 bytes of the 4 byte product calculated in the subroutine MULTIPLY are stored. This parameter is returned to the CALLing routine.
- ANSM:** The address of the first of 2 consecutive bytes of memory in which the MST 2 bytes of the 4 byte product calculated in the subroutine MULTIPLY are stored. This parameter is returned to the CALLing routine.
- BS:** The 8 bit code (00001000=08H) which causes the display cursor to move non-destructively to the left one position.
- CARYSV:** The address of the first of 2 consecutive bytes of memory used in the MULTIPLY subroutine to save the carry bits produced by adding, 'column by column', three 16 bit binary numbers. (See discussion of multiplication algorithm.)
- CNT:** The address of the byte of memory used to count 16 passes through the multiplication loop.
- CTR20:** The address of a byte of memory used in the linear interpolation subroutine as a counter to generate 20 data points for each set of interpolating points.
- CTR60:** The address of a byte of memory used as a counter to make 60 passes through the linear interpolation subroutine each time it is called. (Note: One pass generates 20 data points (including the interpolating points) X 60 passes = 1200 points generated by each CALL.)
- DOCT:** The address of a byte of memory used to keep track of which of the three direction cosines is to be output to the telemetry package. (One of the three is output every 2.5 ms.)

- DVNDL: The address of the first of two consecutive bytes of memory containing the LST 2 bytes of the 4 byte dividend passed to the subroutine DIVIDE.
- DVNDM: The address of the first of two consecutive bytes of memory containing the MST 2 bytes of the 4 byte dividend, passed to the subroutine DIVIDE.
- DVSRL: The address of the first of two consecutive bytes of memory containing the LST 2 bytes of the 4 byte divisor, passed to the subroutine DIVIDE.
- DVSRM: The address of the first of two consecutive bytes of memory containing the MST 2 bytes of the 4 byte divisor, which is one of the two parameters passed to the subroutine DIVIDE.
- D31: The address of the first of two consecutive bytes of memory containing the 16 bit direction cosine of the angle from the X-axis to the vertical.
- D32: The address of the first of two consecutive bytes of memory containing the 16 bit direction cosine of the angle from the Y-axis to the vertical.
- D33: The address of the first of two consecutive bytes of memory containing the 16 bit direction cosine of the angle from the Z-axis to the vertical.
- ESC: The 8-bit code (00011011 =1B₁₆) representing the ESCAPE character which is the first character of any ESCAPE sequence sent to the display. (These sequences provide mode control and some cursor control.)
- FCBDEMO: The address of the 33 byte buffer defining the file control block for the disk file DEMOMSG.TXT, required for disk I/O under EDOS.
- FCBDRFIM: The address of the 33 byte buffer defining the file control block for the disk file DRFIMSG.TXT, required for disk I/O under EDOS.
- FCBMENU: The address of the 33 byte buffer defining the file control block for the disk file MENUMSG.TXT, required for disk I/O under EDOS.
- FCBRD1: The address of the 33 byte buffer defining the file control block for either the disk file RDATAL.DAT or RDATA2.DAT, required for disk I/O under EDOS.

- FOONE:** The address of the first of two consecutive bytes of memory in which the value corresponding to f_1 in the linear interpolation formula is temporarily stored.
- FZERO:** The address of the first of two consecutive bytes of memory in which the value corresponding to f_0 in the linear interpolation formula is temporarily stored.
- FOXLL:** The address of the first of two consecutive bytes of memory in which the LST 2 bytes of the 4 byte value corresponding to $(f_0 x_1)$ in the linear interpolation formula are stored.
- FOXLM:** The address of the first of two consecutive bytes of memory in which the MST 2 bytes of the 4 byte value corresponding to $(f_0 x_1)$ in the linear interpolation formula are stored.
- FLMFO:** The address of the first of two consecutive bytes of memory in which the value corresponding to $(f_1 - f_0)$ in the linear interpolation formula is stored.
- INBUF:** The address of an 82 byte buffer required for CRT input under EDOS.
- INCNTR:** The address of the first of two consecutive bytes of memory used to count the number of timer interrupts in order to calculate elapsed time since ejection.
- IVAL:** The address of the first of two consecutive bytes of memory containing the value corresponding to x_i in the linear interpolation formula.
- LF:** The 8-bit code (00001010 = 0AH) which causes the cursor to move one line down in the same column position (LINE FEED).
- LGT:** The 8-bit code (00101010 = 2AH) which causes the character '*' to be displayed on the CRT.
- LISVSP:** The address of the first of 2 consecutive bytes of memory used to save the stack pointer at the beginning of the linear interpolation subroutine for correct return when done.
- MLTP1:** The address of the first of two consecutive bytes of memory in which the multiplicand (one of two parameters passed to the subroutine MULTIPLY) is stored.
- MLTP2:** The address of the first of two consecutive bytes of memory in which the multiplier (one of two parameters passed to the subroutine MULTIPLY) is stored.
- MSVSP:** The address of the first of two consecutive bytes of memory used to save the stack pointer at the beginning of the MULTIPLY subroutine for correct return when done.

- MOVPTM:** The address of the first of two consecutive bytes of memory used as a pointer to move each record of the rate data file into the proper area of memory as it is read from the disk.
- NEED30:** The address of the first of thirty consecutive bytes of memory to which the stack pointer must be set before CALLing the subroutine in the VIOROM (at memory location F803) which displays the character in the accumulator).
- PCINC:** The address of the byte of memory used as a flag to control $\Delta\theta_y$ in implementing the Crowder Hession Update Algorithm. Its value is determined by pitch rate data.
- PDRFTM:** The address of the first of two consecutive bytes of memory in which the calculated parachute disreefing item is stored.
- PICHR:** The address of the first of two consecutive bytes of memory used to save the sum required in order to use the trapezoid rule to integrate pitch rate data (see detailed discussion of trapezoidal rule).
- PSUM1:** The address of the first of two consecutive bytes of memory used in the implementation of the trapezoid rule, which contain, at any given time during the vertical seeking maneuver, the partial sum of pitch rate data whose value at time t is defined as:

$$\text{at } t=2.5 \quad \text{PSUM1}=(0+q_{t-1.25})$$

$$\text{at } t=5.0, 7.5 \dots 1500 \quad \text{PSUM}=(q_{t-3.75} + q_{t-1.25})$$

(where t = number of elapsed milliseconds since the beginning of the vertical seeking maneuver).

- PSUM2:** The address of the first of two consecutive bytes of memory used in basically the same way as PSUM1, whose value at time t is defined as:

$$\text{at } t=2.5 \quad \text{PSUM2}=(0+q_t)$$

$$\text{at } t=5.0, 7.5 \dots 1500 \quad \text{PSUM2}=(q_{t-2.5} + q_{t-1.25})$$

- QNEG:** The address of the first of two consecutive bytes of memory containing the binary value corresponding to the quantity in the trapezoidal rule (see detailed discussion).

$$-(2A/\Delta h) = -0000_H = F340_H$$

- OPOS: The address of the first of two consecutive bytes of memory containing the binary value corresponding to the quantity in the trapezoidal rule (see detailed discussion).
- $2A/\Delta h = 0000_H$
- QUOTL: The address of the first of two consecutive bytes of memory containing the LST 2 bytes of the 4 byte quotient calculated in the subroutine DIVIDE. This parameter is passed to the CALLing routine.
- QUOTM: The address of the first of two consecutive bytes of memory containing the MST 2 bytes of the 4 byte quotient calculated in the subroutine DIVIDE. This parameter is passed to the CALLing routine.
- REML: The address of the first of two consecutive bytes of memory used in the subroutine DIVIDE for temporary storage of the LST 2 bytes of the 4 byte dividend, updated with each pass through the divide loop.
- REMM: The address of the first of two consecutive bytes of memory used in the subroutine DIVIDE for temporarily storing the MST 2 bytes of the 4 byte dividend updated with each pass through the divide loop.
- RKIFLG: The address of a byte of memory used as a flag word to indicate when sequence C is being executed for the first time.
- RLINC: The address of the byte of memory used as a flag to control $\Delta\theta_x$ in implementing the Crowder Hession Direction Cosine Update Algorithm. Its value is determined by roll rate data.
- ROLLR: The address of the first of two consecutive bytes of memory used to save the sum required in order to use the trapezoid rule to integrate roll rate data. (See detailed discussion of trapezoid rule.)
- RSUM1: The address of the first of two consecutive bytes of memory used in the implementation of the trapezoid rule, which contain, at a given time during the vertical seeking maneuver the partial sum of roll rate data whose value at time t is defined as:

$$\begin{aligned} \text{at } t=2.5 & \quad \text{RSUM1} = (0 + p_{t-1.25}) \\ \text{at } t=5.0, 7.5, \dots, 1500 & \quad \text{RSUM1} = (p_{t-3.75} + p_{t-1.25}) \end{aligned}$$

where t = number of elapsed milliseconds since the beginning of the vertical seeking maneuver).

- RSUM2:** The address of the first of two consecutive bytes of memory used in basically the same way as RSUM1, whose value at time t is defined as:
- at $t = 2.5$ $RSUM2 = (0 + p_t)$
- at $t = 5.0, 7.5 \dots 1500$ $RSUM2 = (p_{t-2.5} + p_t)$
- SAVE:** The address of the first of two consecutive bytes of memory used to save the stack pointer at the beginning of the cosine update subroutine for correct return when done.
- SCPTR:** The address of the first of two consecutive bytes of memory used as a pointer to the block of memory (locations 3800_H to $3CAF_H$) in which the rocket gimbaling commands are stored.
- SCRATCH:** The address of the first of two consecutive bytes of memory used to save the return address for correct return from the MULTIPLY subroutine when CALLED by the linear interpolation subroutine (LINT).
- SEQINDX:** The address of the byte of memory which determines to which of 4 sequences control of the program is passed.
- SIGN:** The address of the byte of memory used to keep track of the correct sign of the product calculated in the MULTIPLY subroutine or of the quotient calculated by the DIVIDE subroutine.
- SPEED:** The address of the first of two consecutive bytes of memory in which the hexadecimal representation of the speed of the pilot at ejection is stored.
- STRLOC:** The address of the first of two consecutive bytes of memory passed as a parameter to the linear interpolation subroutine which designates the beginning of one of three blocks of memory in which interpolated rate data is to be stored.
- STRPT:** The address of the first of two consecutive bytes of memory passed as a parameter to the linear interpolation subroutine which designates the beginning of one of three blocks of memory containing 60 interpolating points.
- TMPTR:** The address of the first of two consecutive bytes of memory designating where within a block of memory (locations $3CB0H$ to $414FH$) telemetry output data is to be stored.
- TMSP:** The address of the first of two consecutive bytes of memory used to save the contents of the stack pointer before CALLing the subroutine MULTIPLY.

- TOGGL: The address of a byte of memory used to keep track of which of the two passes through the cosine update routine that take place every 2.5 ms., the current pass is.
- TWNTYFV: The address of the first of two consecutive bytes of memory used to save the number of 25 ms interrupts received.
- VSINP: The address of the first of two consecutive bytes of memory used as a pointer within a 12 byte block of rate data.
- VSPTR: The address of the first of two consecutive bytes of memory used as a pointer within the block of memory containing all of the rate data for the current vertical seeking maneuver to designate the 12 bytes of rate data which will be input with the next timer interrupts.
- XZERO: The address of the first of two consecutive bytes of memory in which the value corresponding to x_0 in the linear interpolation formula is temporarily stored.
- YAINC: The address of the byte of memory used as a flag to control $\Delta\theta_z$ in implementing the Crowder-Hession Cosine Update Algorithm. Its value is determined by yaw rate data.
- YAWR: The address of the first of two consecutive bytes of memory used to save the sum required in order to use the trapezoidal rule to integrate yaw rate data. (See detailed discussion of trapezoidal rule).
- YSUM1: The address of the first of two consecutive bytes of memory used in the implementation of the trapezoid rule, which contain, at any given time during the vertical seeking maneuver, the partial sum of yaw rate data and whose value at time t is defined as:
- at $t=2.5$ $YSUM1=(0+r_{t-1.25})$
- at $t=5.0, 7.5\dots 1500$ $YSUM1=(r_{t-3.75}+r_{t-1-25})$
- (where t = number of elapsed milliseconds since the beginning of the vertical seeking maneuver.)
- YSUM2: The address of the first of two consecutive bytes of memory used in basically the same way as YSUM1, whose value at time t is defined as:
- at $t=2.5$ $PSUM2=(0+r_t)$
- at $t=5.0, 7.5\dots 1500$ $PSUM2=(r_{t-2.5}+r_t)$

4.4 Memory Map of Data Buffers and Program Variables

	3600	3610	3620	3630	3640	3650	3660	3670	3680	3690	36A0	36B0	36C0	36D0	36E0	36F0
00	(r ₀)	(r ₁₆₀)	(r ₃₂₀)	(r ₄₈₀)	(r ₆₄₀)	(r ₈₀₀)	(r ₉₆₀)	(r ₁₁₂₀)	(r ₁₂₈₀)	(r ₁₄₄₀)	(r ₁₆₀₀)	(r ₁₇₆₀)	(r ₁₉₂₀)	(r ₂₀₈₀)	(r ₂₂₄₀)	(r ₂₄₀₀)
01																
02	(r ₂₀)	(r ₁₈₀)	(r ₃₄₀)	(r ₅₀₀)	(r ₆₆₀)	(r ₈₂₀)	(r ₉₈₀)	(r ₁₁₄₀)	(r ₁₃₀₀)	(r ₁₄₆₀)	(r ₁₆₂₀)	(r ₁₇₈₀)	(r ₁₉₄₀)	(r ₂₁₀₀)	(r ₂₂₆₀)	(r ₂₄₂₀)
03																
04	(r ₄₀)	(r ₂₀₀)	(r ₃₆₀)	(r ₅₂₀)	(r ₆₈₀)	(r ₈₄₀)	(r ₁₀₀₀)	(r ₁₁₆₀)	(r ₁₃₂₀)	(r ₁₄₈₀)	(r ₁₆₄₀)	(r ₁₈₀₀)	(r ₁₉₆₀)	(r ₂₁₂₀)	(r ₂₂₈₀)	(r ₂₄₄₀)
05																
06	(r ₆₀)	(r ₂₂₀)	(r ₃₈₀)	(r ₅₄₀)	(r ₇₀₀)	(r ₈₆₀)	(r ₁₀₂₀)	(r ₁₁₈₀)	(r ₁₃₄₀)	(r ₁₅₀₀)	(r ₁₆₆₀)	(r ₁₈₂₀)	(r ₁₉₈₀)	(r ₂₁₄₀)	(r ₂₃₀₀)	(r ₂₄₆₀)
07																
08	(r ₈₀)	(r ₂₄₀)	(r ₄₀₀)	(r ₅₆₀)	(r ₇₂₀)	(r ₈₈₀)	(r ₁₀₄₀)	(r ₁₂₀₀)	(r ₁₃₆₀)	(r ₁₅₂₀)	(r ₁₆₈₀)	(r ₁₈₄₀)	(r ₂₀₀₀)	(r ₂₁₆₀)	(r ₂₃₂₀)	(r ₂₄₈₀)
09																
0A	(r ₁₀₀)	(r ₂₆₀)	(r ₄₂₀)	(r ₅₈₀)	(r ₇₄₀)	(r ₉₀₀)	(r ₁₀₆₀)	(r ₁₂₂₀)	(r ₁₃₈₀)	(r ₁₅₄₀)	(r ₁₇₀₀)	(r ₁₈₆₀)	(r ₂₀₂₀)	(r ₂₁₈₀)	(r ₂₃₄₀)	(r ₂₅₀₀)
0B																
0C	(r ₁₂₀)	(r ₂₈₀)	(r ₄₄₀)	(r ₆₀₀)	(r ₇₆₀)	(r ₉₂₀)	(r ₁₀₈₀)	(r ₁₂₄₀)	(r ₁₄₀₀)	(r ₁₅₆₀)	(r ₁₇₂₀)	(r ₁₈₈₀)	(r ₂₀₄₀)	(r ₂₂₀₀)	(r ₂₃₆₀)	(r ₂₅₂₀)
0D																
0E	(r ₁₄₀)	(r ₃₀₀)	(r ₄₆₀)	(r ₆₂₀)	(r ₇₈₀)	(r ₉₄₀)	(r ₁₁₀₀)	(r ₁₂₆₀)	(r ₁₄₂₀)	(r ₁₅₈₀)	(r ₁₇₄₀)	(r ₁₉₀₀)	(r ₂₀₆₀)	(r ₂₂₂₀)	(r ₂₃₈₀)	(r ₂₅₄₀)
0F																

00	3700	(P120)	3710	(P250)	(P410)	3720	(P600)	3730	(P810)	3740	(P920)	3750	(P1080)	3760	(P1180)	3770		3780		3790		37A0		37B0		37C0	CNT	37D0	DVNDI	37E0		37F0	CNTRL						
01		(P140)		(P300)		(P410)		(P520)		(P630)		(P740)		(P850)		(P960)												ANSL							CNTRL				
02		(P160)		(P320)		(P430)		(P540)		(P650)		(P760)		(P870)		(P980)												M ^L TP2							I VAL				
03		(P180)		(P340)		(P450)		(P560)		(P670)		(P780)		(P890)		(P1000)												ANSM							MOVPT				
04		(P200)		(P360)		(P480)		(P600)		(P720)		(P840)		(P960)		(P1080)												CARRY ^{SV}							FMFφ				
05		(P220)		(P380)		(P500)		(P620)		(P740)		(P860)		(P980)		(P1100)												M ^L TP1							LI ^{SV} SP				
06		(P240)		(P400)		(P520)		(P640)		(P760)		(P880)		(P1000)		(P1120)												MSVSP							FZERO				
07																													QUOTL							STRLOC			
08																													QUOTM							STRPT			
09																													REML							ALST			
0A																													REMM							AMST			
0B																													SIGN							FφX ₁ L			
0C																																				FφX ₁ M			
0D																																							
0E																																							
0F																																							

00	3800	3810	3820	3830	3840	3850	3860	3870	3880	3890	38A0	38B0	38C0	38D0	38E0	38F0
01	(SC ₁)	(SC ₉)	(SC ₁₁)	(SC ₂₅)	(SC ₃₃)	(SC ₄₁)	(SC ₄₉)	(SC ₅₇)	(SC ₆₅)	(SC ₇₃)	(SC ₈₁)	(SC ₈₉)	(SC ₉₇)	(SC ₁₀₅)	(SC ₁₁₃)	(SC ₁₂₁)
02	(SC ₂)															
03	(SC ₃)															
04																
05																
06	(SC ₄)															
07																
08	(SC ₅)															
09																
0A	(SC ₆)															
0B																
0C	(SC ₇)															
0D																
0E	(SC ₈)	(SC ₁₆)	(SC ₂₄)	(SC ₃₂)	(SC ₄₀)	(SC ₄₈)	(SC ₅₆)	(SC ₆₄)	(SC ₇₂)	(SC ₈₀)	(SC ₈₈)	(SC ₉₆)	(SC ₁₀₄)	(SC ₁₁₂)	(SC ₁₂₀)	(SC ₁₂₈)
0F																

00	(Tel. 553)	4100	4110	4120	4130	4140	4150	4160	4170	4180	4190	41A0	41B0	41C0	41D0	41E0	41F0
01	(Tel. 551)	(Tel. 559)	(Tel. 571)	(Tel. 583)	(Tel. 595)	(Tel. 597)	(Tel. 599)	(Tel. 600)									
02																	
03																	
04																	
05																	
06																	
07																	
08																	
09																	
0A																	
0B																	
0C																	
0D																	
0E	(Tel. 580)	(Tel. 576)	(Tel. 581)	(Tel. 572)	(Tel. 582)	(Tel. 592)	(Tel. 594)										
0F																	

	4260	4210	4220	4230	4240	4250	4260	4270	4280	4290	42A0	42B0	42C0	42D0	42E0	42F0
00	FCBDD1								(O)	(F)	(O)	(I)	(Carriage int)	(=)	(f)	
01	(R)		FCBDDP11						(R)	(f)	(R)	(N)	(D)	(f)		
02	(D)		(D)	FCBDEIX					(I)	(line feed)	(I)	(A)	(C)			
03	(A)		(R)	(D)					(E)	(Carriage int)	(E)	(L)	(I)	(.)		
04	(T)		(F)	(E)				FCNT	(N)	(f)	(N)	(B)	(f)			
05	(A)		(T)	(M)				FDISP (D)	(T)	(line feed)	(T)	(O)	(=)	(line feed)		
06	(L 2)		(M)	(O)				(C)	(A)	(line feed)	(A)	(R)	(f)	(Carriage int)		
07	(f)		(S)	(D)				(f)	(T)	(Carriage int)	(T)	(I)		(D)		
08	(B)		(G)	(S)				(f)	(I)	(I)	(I)	(E)	(.)	(C)		
09	(D)		(f)	(P)				(=)	(O)	(N)	(O)	(N)		(3)		
0A	(A)		(T)	(f)				(f)	(N)	(I)	(N)	(T)	(line feed)	(f)		
0B	(T)		(X)	(T)				(f)	(f)	(T)	(f)	(A)	(Carriage int)	(=)		
0C			(T)	(X)				(f)	(b)	(I)	(b)	(T)	(D)	(f)		
0D				(T)				(.)	(b)	(A)	(b)	(T)	(C)	(.)		
0E								(f)	(b)	(L)	(b)	(O)	(2)	(.)		
0F								(f)	(F)	(f)	(F)	(N)	(f)			

5. USER'S GUIDE

5.1 Objective

The objective of the program DEMO is to demonstrate, on the IMSAI PCS 80/30 software development system, the capability of the INTEL 8085 μ P to perform the real-time timing and sequencing required to execute the functions of a vertical seeking ejection seat. A listing of the program can be found in section 4.1.

5.2 Approach/Assumptions

Because of its nature as a software development system, the IMSAI PCS 80/30 lacks the specialized hardware interfaces and "peripheral devices" that would be found on a true ejection seat system. To compensate for this, the program goes through a lengthy initialization process before the demonstration of the real-time timing, sequencing and simulated execution of the ejection functions takes place. The program is capable of simulating an ejection from an initial orientation of a 90° roll or a 180° roll.

5.3 Input

Below is a list of the input files and parameters required by the program. The files are permanently stored on the disk and read as required during execution of the program; the parameters are input by the user as described in section 5.5. A brief description of each is given here.

5.3.1 DISK FILES

5.3.1.1 MENUMSG.TXT

This file contains the message displayed on the CRT, giving the user a choice of executing the ejection from an initial orientation of a 90° roll or a 180° roll. The message is shown in section 5.5-1.

5.3.1.2 RDATA1.DAT or RDATA2.DAT

These files contain the rate data interpolating points for the 90° roll test and the 180° roll test respectively. When the user selects the initial orientation, the appropriate RDATA file is read into memory. Using the information contained in the file, the 3600 pieces of rate data required to execute the vertical seeking maneuver are generated and stored in memory locations 4AE04-66FFH.

5.3.1.3 DRFMSG.TXT

This file contains the messages displayed on the CRT asking the user to input the altitude and speed at ejection. The messages are shown in sections 5.5-2 and 5.5-3 respectively.

5.3.1.4 DEMOSP.TXT

This file contains a list of all of the ejection functions to be executed along with instructions on how to begin the demonstration. The message is shown in section 5.5-5.

5.3.2 Keyboard Input

5.3.2.1 Test Number

The user selects the initial orientation of the ejection seat system. TEST 1 executes the ejection from an initial orientation of a 90° roll; TEST 2 executes the ejection from an initial orientation of a 180° roll.

5.3.2.2 Initial Altitude and Speed

These two parameters determine the time at which the functions PARACHUTE DISREEFINING and SEAT/OCCUPANT SEPARATION are executed as defined in Figure 2.12.

5.3.2.3 Ejection Signal

When all of the initialization functions have been completed, the program waits for the character 'E' to be input. This initiates the execution of the ejection sequence.

5.4 Output

To indicate the execution of each of the ejection functions, the program displays the character '*' next to the function being performed. When all of the ejection functions have been executed, the program displays the direction cosines of the initial orientation of the ejection seat system and its orientation at the completion of the vertical seeking maneuver. Using these, the position of the ejection seat system can be determined. (See Figure 2.2). The final CRT displays for the 90° roll test and the 180° roll test are shown in Figure 5.1(a) and 5.1(b) respectively.

5.5 Program Set Up/Run Procedure

After loading the diskette entitled "VRTSK", the program can be run as follows:

1. Type "DEMO" as an IMDOS resident console command

The program will clear the screen and display the message

SELECT DESIRED TEST

1. 90 DEGREE ROLL
2. 180 DEGREE ROLL

uP EJECTION SEAT FEASIBILITY DEMO

Emergency O2 Generation
 Inertial Reel Firing
 Neck Bladder Inflation
 Hip Thruster Firing
 Canopy Removal
 Gyro Spinup
 Seat Release
 Catapult Initiation
 Rocket Initiation
 Rocket Gimbaling Initiated
 PCEM Fired
 Rocket Gimbaling Completed
 Parachute Disreefed
 Seat/Occupant Separated

(a)

Initial Orientation	Final Orientation
D31 = 0.000	D31 = -.184
D32 = 1.000	D32 = .004
D33 = 0.000	D33 = -.969

uP EJECTION SEAT FEASIBILITY DEMO

Emergency O2 Generation
 Inertial Reel Firing
 Neck Bladder Inflation
 Hip Thruster Firing
 Canopy Removal
 Gyro Spinup
 Seat Release
 Catapult Initiation
 Rocket Initiation
 Rocket Gimbaling Initiated
 PCEM Fired
 Rocket Gimbaling Completed
 Parachute Disreefed
 Seat/Occupant Separated

(b)

Initial Orientation	Final Orientation
D31 = 0.000	D31 = .164
D32 = 0.000	D32 = .089
D33 = 1.000	D33 = -.970

5.1 Final CRT Displays

2. Type "1" or "2"

Entering an invalid test number causes the "SELECT DESIRED TEST" message to be reissued. When a valid entry is made, the program will initialize the rate data for the test selected. (This takes 1.5-2.0 minutes). When the rate data initialization is complete, the program will display the message

ENTER ALTITUDE AT EJECTION (0-18,000 ft.)

3. Type a valid response and hit carriage return

Entering an invalid altitude causes the "ENTER ALTIITUDE" message to be reissued. When a valid entry is made, the program will display the message

ENTER SPEED AT EJECTION (0-600 KEAS)

4. Type a valid response and hit carriage return

Entering an invalid speed causes the "ENTER SPEED" message to be reissued. When a valid entry is made, the following display will appear on the CRT

μ P EJECTION SEAT FEASIBILITY DEMO

Emergency O2 Generation
Inertial Reel Firing
Neck Bladder Inflation
Hip Thruster Firing
Canopy Removal
Gyro Spinup
Seat Release
Catapult Initiation
Rocket Initiation
Rocket Gimballing Initiated
PCEM Fired
Rocket Gimballing Completed
Parachute Disreefed
Seat/Occupant Separated

TO BEGIN DEMONSTRATION, PRESS 'E'

5. Type "E"

The program is now demonstrating, in real-time, the timing, sequencing and simulated execution of the ejection functions. The demonstration takes either 2.05 or 5.05 seconds to run, depending on the time of PARACHUTE DISREEFING/SEAT/OCCUPANT SEPARATION.

5.6 Special Features

Some modifications were made to the program to create a second version (PRNTOUT). PRNTOUT performs the same functions as DEMO (though not in real time), but also provides hardcopy output tracing each step in the execution of the vertical seeking maneuver.

PRNTOUT outputs the following data:

- T - time (in milliseconds) since the beginning of the vertical seeking maneuver.
- R - yaw rate data (in deg./sec.) input at time T
- Q - pitch rate data (in deg./sec.) input at time T
- P - roll rate data (in deg./sec.) input at time T
- DC1 - direction cosine of the angle from the x-axis to the vertical after being updated at time T
- DC2 - direction cosine of the angle from the Y-axis to the vertical after being updated at time T
- DC3 - direction cosine of the angle from the z-axis to the vertical after being updated at time T
- RLCMND - the roll steering command generated at time T
- PCCMND - the pitch steering command generated at time T

Appendix A contains a program listing of PRNTOUT along with the data output for the 90° roll test and the 180° roll test.

After loading the diskette entitled "VRTSK", PRNTOUT can be run as follows:

1. Type "PRNTOUT" as an IMDOS resident console command

The program will clear the screen and display the message

SELECT DESIRED TEST

1. 90 DEGREE ROLL
2. 180 DEGREE ROLL

2. Type "1" or "2"

Entering an invalid test number causes the "SELECT DESIRED TEST" message to be reissued. When a valid entry is made, the program will initialize the rate data for the test selected. (This takes 1.5-2.0 minutes). When the rate data initialization is complete, the program will display the message

ENTER ALTIITUDE AT EJECTION (0-18,000 ft.)

3. Type a valid response and hit carriage return

Entering an invalid altitude causes the "ENTER ALTIITUDE" message to be reissued. When a valid entry is made, the program will display the message

ENTER SPEED AT EJECTION (0-600 KEAS)

4. Type a valid response and hit carriage return

Entering an invalid speed causes the "ENTER SPEED" message to be reissued. When a valid entry is made, the following display will appear on the CRT

μP EJECTION SEAT FEASIBILITY DEMO

Emergency O2 Generation
Inertial Reel Firing
Neck Bladder Inflation
Hip Thruster Firing
Canopy Removal
Gyro Spinup
Seat Release
Catapult Initiation
Rocket Initiation
Rocket Gimbaling Initiated
PCEM Fired
Rocket Gimbaling Completed
Parachute Disreefed
Seat/Occupant Separated

TO BEGIN DEMONSTRATION, PRESS 'E'

5. Type "E"

The program is now executing the ejection functions, printing the data described above as each step in the vertical seeking algorithm is completed. Running PRNTOUT takes approximately 50 minutes.

5.7 Outline of Changes for Implementation in an Actual Ejection Seat System

As previously mentioned, the demonstration program was written for implementation on a software development system; some changes are required if it is to be implemented in an actual ejection seat system. These changes are outlined below. (Refer to the program listing in section 4.1).

a) Delete the following lines:

108
 10B
 111
 117
 11D
 120
 132 - 19B
 1DF - 1EE
 1FE - 393
 59D - 628
 6B7 - 745
 77F - 7AE
 7C7 - 7E1
 802 - 813
 82B - 83C
 842 - 847
 874 - 877
 A5B - BC9

If no multiplication or division is required

394 - 59C

b) Delete the initialization of the following variables (end of listing).

ASSDRV	INIT	SETIOB	FLMFO	FOX1M
BDOS	INLINE	UNMOUNT	TMPSP	INBUF
CLOSE	LIST	WRITE	STRLOC	VSINP
CONIN	MAKE	BEGYIP	STRTPY	VSPTR
CONOUT	MOUNT	BEGPIP	ALST	TWNTYFV

CONRDY	OPEN	BEGRIP	AMST	SCPTR
DELETE	PHYDRV	YRDATA	CTR20	TLMPTR
DRVIN	PRINT	PRDATA	CTR60	FCBRD1
DRVOUT	READ	RRDATA	IVAL	FCBDRFTM
ERMSG	RENAME	LIJUNK	XZERO	RCBDEMO
GETALO	SEARCH	ESC	LISVSP	FCBMENV
GETCUR	SELECT	BS	FZERO	FCNT
GETIOB	SERCHN	LGT	FONE	FDISP
GETVCB	SETEUF	MOVPTR	FOXLL	FDISP1

- c) Change line 10E to CALL INZDCS, where INZDCS is a sub-routine which inputs the direction cosines of the initial orientation of the ejection seat system, converts them to the scaling used in the program (see section 2.1.4.1), and stores them in D31, D32 and D33. (Note: This may be part of the routine EJECT, that is, input at the time of ejection).
- d) The subroutine INZRST75 (lines 126-131) may have to be changed if the 2.5 ms interrupt received by the system directs the program counter to a location other than 3C.
- e) If the time of parachute disreefing and seat/occupant separation is determined only by the altitude and speed of the ejection seat system at ejection, these two values (ALT and SPEED) should be input with the initial orientation values D31, D32 and D33. Their time of execution should be stored in PARDRFTM (in terms of 2.5 ms interrupts). If the conversion from altitude and speed to time is determined as defined by Figure 2.12, the code from lines 62B-66C and A45-A53 can be used. (This requires that the MULT and DIVIDE subroutines be left in) Figure 2.12, as implemented in the code, is represented by the following equations: (If a similar, but different, parachute deployment chart is used, the changes can be made as noted.)

1. if ALT ≥ 14000 ft, T = 4.5 (test in line 62E)
2. if ALT < 6000 ft, T = 1.5 (test in line 638)
3. if SPEED < 240 KEAS, T = 1.5 (test in line 642)
4. if ALT ≥ 'a', T = 4.5 (test in line 6A5)
5. if ALT < 'a', T = 1.5 (test in line 6A5)

where 'a' is the altitude on the diagonal, corresponding to the given speed. 'a' is computed using the equation of the diagonal as follows

$$F(x_1) = a = \frac{(f_0 x_1 - f_1 x_0) + ((f_1 - f_0) (x_1))}{(x_1 - x_0)}$$

$$a = \frac{(14000)(600) - (6000)(240) + ((6000-14000)(\text{SPEED}))}{(600-240)}$$

This is implemented in the code (lines 649-6A1) as:

$$a = 19333 - 22.2(\text{SPEED})$$

If an entirely different method of determining the time of parachute disreefing/seat/occupant separation is used, the code from lines 62B-6BC and A45-A53 should be deleted, and code implemented to determine the time as defined.

- f) For the first .55 seconds after ejection, the interrupt counter is counting 25 ms interrupts; after that, it is counting 2.5 ms interrupts. Two separate rates were used to allow time during the first .55 seconds to interface with the display. In an actual system, the interrupt rate would most likely be constant (2.5 ms or whatever is to be used). Since the time of execution of the functions is determined by counting the number of interrupts, the comparison values used would have to be changed. Each of these comparison values is noted below.
- line 6A9, 6B0 - Set time of parachute disreefing/seat/occupant separation (=number of 2.5 ms interrupts since beginning of vertical seeking maneuver)
- line 7FB - Test if time to start sequence B (next interrupt = 12th 25 ms interrupt?)
- line 824 - Test if time to start sequence C (next interrupt = 21st 25 ms interrupt?)
- line 860 - Test if end of vertical seeking maneuver (last interrupt = 600th 2.5 ms interrupt?)
- line 89A - Test if time to execute Fire PCEM (520th 2.5 ms interrupt?)
- g) The routine EJKEY (lines 746-755) would have to be changed to input the ejection signal as defined by the system.
- h) The routine INRAITDA (lines 8A9-8DD) inputs the six pieces of rate data required every 2.5 ms. In the demonstration program, this data is read from a memory buffer; in an actual system it would be read through an I/O port as defined by the hardware designed to interface with the gyros.

This routine also performs part of the integration as follows:

1. read $r_{t-1.25}$
save it - (replaces $r_{t=3.75}$)
calculate YSUM1 (see section 4.3)
2. read $q_{t-1.25}$
save it - (replaces $q_{t-3.75}$)
calculate PSUM1 (see section 4.3)
3. read $p_{t-1.25}$
save it - (replaces $p_{t-3.75}$)
calculate RSUM1 (see section 4.3)
4. read r_t
save it - (replaces $r_{t-2.5}$)
calculate YSUM2 (see section 4.3)
5. read q_t
save it - (replaces $q_{t-2.5}$)
calculate PSUM2 (see section 4.3)
6. read p_t
save it - (replaces $p_{t-2.5}$)
calculate RSUM2 (see section 4.3)

This part of the integration would have to be done in the Input Data Routine written to replace INRAIDTA. The values $r_{t-1.25}$, $q_{t-1.25}$, $p_{t-1.25}$, r_t , q_t , p_t , YSUM1, PSUM1, RSUM1, YSUM2, PSUM2, RSUM2 should be stored in memory as shown in section 4.4.

- i) In the demonstration program, the steering commands and telemetry output data are stored in memory in the form defined by the China Lake system. (This is done in lines A06-A0D and A2C-A33 respectively). In an actual system, these would be output through an I/O port to a D/A converter in the form defined by the hardware interface designed for the system used.
- j) The subroutines enabling the execution of the ejection functions would have to be changed to execute the functions as defined by the specially designed hardware interface

used on the seat. These subroutines are (reference Table 2.3):

EJCTRTN (7B7-7B9) - enables SEQUENCE A functions.

CTPLTRTN (7Bf-7C1) - enables SEQUENCE B functions.

RKFSTM (887-889) - enables Rocket Ignition.

CKPCEM (8A2-8A6) - enables Fire PCEM.

PARSEP (A56-A58) - enables SEQUENCE D functions.

- k) The code would have to be assembled to begin executing from location 0000.

APPENDIX A

The following listings show the yaw, pitch and roll input rate data, the 3 direction cosines and the steering commands generated at each step (every 1.25 ms) in the execution of the vertical seeking maneuver.

A.1 Vertical Seeking Maneuver - 90° Roll Test

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T	R	O	P	DC1	DC2	DC3	RL.CMND	PC.CMND
0.00	0	0	0	0.000	1.000	0.000		
0001.25	000	000	-001	0.000	1.000	0.000		
0002.50	001	000	-001	0.000	1.000	0.000	BF	7F
0003.75	001	000	-002	0.000	1.000	0.000		
0005.00	002	000	-003	0.000	1.000	0.000	BF	7F
0006.25	002	000	-003	0.000	1.000	0.000		
0007.50	003	000	-004	0.000	1.000	0.000	BF	7F
0008.75	003	001	-005	0.000	1.000	0.000		
0010.00	003	001	-006	0.000	1.000	0.000	BF	7F
0011.25	004	001	-006	0.000	1.000	0.000		
0012.50	004	001	-007	0.000	1.000	0.000	BF	7F
0013.75	005	001	-008	0.000	1.000	0.000		
0015.00	005	001	-008	0.000	1.000	0.000	BF	7F
0016.25	006	001	-009	0.000	1.000	0.000		
0017.50	006	001	-010	0.000	1.000	0.000	BF	7F
0018.75	007	001	-011	0.000	1.000	0.000		
0020.00	007	001	-011	0.000	1.000	0.000	BF	7F
0021.25	008	002	-012	0.000	1.000	0.000		
0022.50	008	002	-012	0.000	1.000	0.000	BF	7F
0023.75	008	002	-013	0.000	1.000	0.000		
0025.00	009	002	-014	0.000	1.000	0.000	BF	7F
0026.25	009	002	-014	0.000	1.000	0.000		
0027.50	008	001	-015	0.000	1.000	0.000	BF	7F
0028.75	008	001	-016	0.000	1.000	0.000		
0030.00	008	000	-016	0.000	1.000	0.000	BF	7F
0031.25	008	000	-017	0.000	1.000	0.000		
0032.50	007	000	-017	0.000	1.000	0.000	BF	7F
0033.75	007	-000	-018	0.000	1.000	0.000		
0035.00	007	-001	-018	0.000	1.000	0.000	BF	7F
0036.25	007	-001	-019	0.000	1.000	0.000		
0037.50	006	-001	-020	0.000	1.000	0.000	BF	7F
0038.75	006	-002	-020	0.000	1.000	0.000		
0040.00	006	-002	-021	0.000	1.000	0.000	BF	7F
0041.25	006	-002	-021	0.000	1.000	0.000		
0042.50	005	-003	-022	0.000	1.000	0.000	BF	7F
0043.75	005	-003	-022	0.000	1.000	0.008		
0045.00	005	-003	-023	0.000	1.000	0.008	BF	7F
0046.25	005	-004	-023	0.000	1.000	0.008		
0047.50	004	-004	-024	0.000	1.000	0.008	BF	7F
0048.75	004	-005	-024	0.000	1.000	0.008		
0050.00	004	-005	-025	0.000	1.000	0.008	BF	7F
0051.25	004	-005	-024	0.000	1.000	0.008		
0052.50	003	-006	-024	0.000	1.000	0.008	BF	7F
0053.75	003	-006	-024	0.000	1.000	0.008		
0055.00	003	-007	-023	0.000	1.000	0.008	BF	7F
0056.25	002	-007	-023	0.000	1.000	0.008		
0057.50	002	-008	-022	0.000	1.000	0.008	BF	7F
0058.75	002	-008	-022	0.000	1.000	0.008		
0060.00	001	-009	-022	0.000	1.000	0.008	BF	7F
0061.25	001	-009	-021	0.000	1.000	0.008		
0062.50	001	-010	-021	0.000	1.000	0.008	BF	7F
0063.75	001	-010	-021	0.000	1.000	0.008		
0065.00	000	-010	-020	0.000	1.000	0.008	BF	7F
0066.25	000	-011	-020	0.000	1.000	0.016		
0067.50	-000	-011	-019	0.000	1.000	0.016	BE	7F
0068.75	-000	-012	-019	0.000	1.000	0.016		
0070.00	-001	-012	-019	0.000	1.000	0.016	BE	7F
0071.25	-001	-012	-018	0.000	1.000	0.016		
0072.50	-001	-013	-018	0.000	1.000	0.016	BE	7F
0073.75	-002	-013	-017	0.000	1.000	0.016		
0075.00	-002	-014	-017	0.000	1.000	0.016	BE	7F

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T	R	Q	P	DC1	DC2	DC3	REL. CMD	PC. CMD
0076.25	-001	-014	-013	0.000	1.000	0.016		
0077.50	-000	-014	-010	0.000	1.000	0.015	BE	7F
0078.75	000	-014	-007	0.000	1.000	0.016		
0080.00	001	-014	-003	0.000	1.000	0.016	BE	7F
0081.25	002	-014	000	0.000	1.000	0.016		
0082.50	003	-014	003	0.000	1.000	0.016	BE	7F
0083.75	004	-014	007	0.000	1.000	0.016		
0085.00	004	-014	010	0.000	1.000	0.016	BE	7F
0086.25	005	-014	014	0.000	1.000	0.016		
0087.50	006	-014	017	0.000	1.000	0.016	BE	7F
0088.75	007	-014	021	0.000	1.000	0.016		
0090.00	008	-014	024	0.000	1.000	0.016	BE	7F
0091.25	008	-015	027	0.000	1.000	0.016		
0092.50	009	-015	031	0.000	1.000	0.016	BE	7F
0093.75	010	-015	034	0.000	1.000	0.016		
0095.00	011	-015	037	0.000	1.000	0.016	BE	7F
0096.25	011	-015	041	0.000	1.000	0.016		
0097.50	012	-015	044	0.000	1.000	0.016	BE	7F
0098.75	013	-015	048	0.000	1.000	0.016		
0100.00	014	-015	051	0.000	1.000	0.016	BE	7F
0101.25	015	-014	055	0.000	1.000	0.016		
0102.50	016	-013	059	0.000	1.000	0.016	BE	7F
0103.75	017	-012	063	0.000	1.000	0.016		
0105.00	018	-011	067	0.008	1.000	0.016	BE	7F
0106.25	020	-010	071	0.008	1.000	0.008		
0107.50	021	-009	075	0.008	1.000	0.008	BE	7F
0108.75	022	-008	079	0.008	1.000	0.008		
0110.00	023	-007	083	0.008	1.000	0.008	BE	7F
0111.25	024	-006	087	0.008	1.000	0.008		
0112.50	025	-006	091	0.008	1.000	0.000	BE	7F
0113.75	026	-005	095	0.008	1.000	0.000		
0115.00	027	-004	099	0.008	1.000	0.000	BE	7F
0116.25	028	-003	103	0.008	1.000	0.000		
0117.50	029	-002	107	0.008	1.000	-0.007	BF	7F
0118.75	031	-001	111	0.008	1.000	-0.007		
0120.00	032	000	115	0.008	1.000	-0.007	BF	7F
0121.25	033	001	119	0.008	1.000	-0.007		
0122.50	034	002	123	0.008	1.000	-0.015	BF	7F
0123.75	035	003	127	0.016	1.000	-0.015		
0125.00	036	004	131	0.016	1.000	-0.015	BF	7F
0126.25	036	004	134	0.016	0.999	-0.023		
0127.50	037	004	137	0.016	0.999	-0.023	BF	7F
0128.75	037	004	139	0.016	0.999	-0.023		
0130.00	038	005	142	0.016	0.999	-0.031	BF	7F
0131.25	038	005	145	0.016	0.999	-0.031		
0132.50	039	005	148	0.016	0.999	-0.031	BF	7F
0133.75	039	005	150	0.016	0.999	-0.038		
0135.00	040	005	153	0.016	0.999	-0.038	BF	7F
0136.25	040	006	156	0.016	0.998	-0.046		
0137.50	041	006	159	0.023	0.998	-0.046	BF	7F
0138.75	042	006	161	0.023	0.998	-0.046		
0140.00	042	006	164	0.023	0.998	-0.054	BF	7F
0141.25	043	006	167	0.023	0.998	-0.054		
0142.50	043	007	170	0.023	0.997	-0.061	BF	7F
0143.75	043	007	172	0.023	0.997	-0.061		
0145.00	044	007	175	0.023	0.997	-0.061	BF	7F
0146.25	044	007	178	0.023	0.997	-0.069		
0147.50	045	007	181	0.023	0.997	-0.069	BF	7F
0148.75	045	008	183	0.031	0.996	-0.077		
0150.00	046	008	185	0.031	0.996	-0.077	BF	7F

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	T	R	Q	P	DC1	DC2	DC3	REL. CORR.	PO. CORR.
	0151.25	046	007	187	0.031	0.995	-0.034		
	0152.50	047	006	188	0.031	0.995	-0.084	BF	7c
	0153.75	048	005	189	0.031	0.995	-0.092		
	0155.00	048	005	191	0.031	0.995	-0.092	BF	7c
	0156.25	049	004	192	0.031	0.994	-0.100		
	0157.50	049	003	193	0.031	0.994	-0.100	BF	7c
	0158.75	050	002	194	0.031	0.993	-0.107		
	0160.00	050	001	195	0.039	0.993	-0.107	BF	7c
	0161.25	051	001	196	0.039	0.992	-0.115		
	0162.50	052	000	197	0.039	0.992	-0.115	BF	7c
	0163.75	052	-001	199	0.039	0.991	-0.123		
	0165.00	053	-001	200	0.039	0.991	-0.123	BF	7c
	0166.25	053	-002	201	0.039	0.990	-0.130		
	0167.50	054	-003	202	0.039	0.990	-0.130	BF	7c
	0168.75	054	-004	203	0.046	0.988	-0.138		
	0170.00	055	-005	204	0.046	0.988	-0.138	BF	7c
	0171.25	055	-005	205	0.046	0.987	-0.146		
	0172.50	056	-006	207	0.046	0.987	-0.146	BF	7c
	0173.75	056	-007	208	0.046	0.986	-0.154		
	0175.00	057	-008	209	0.046	0.986	-0.154	BF	7c
	0176.25	058	-008	210	0.046	0.985	-0.161		
	0177.50	058	-009	211	0.046	0.985	-0.161	BF	7c
	0178.75	059	-009	212	0.054	0.983	-0.169		
	0180.00	060	-010	212	0.054	0.983	-0.169	CO	7c
	0181.25	060	-010	213	0.054	0.982	-0.177		
	0182.50	061	-011	214	0.054	0.982	-0.177	CO	7c
	0183.75	062	-011	215	0.054	0.980	-0.184		
	0185.00	062	-012	216	0.054	0.980	-0.184	CO	7c
	0186.25	063	-012	217	0.062	0.978	-0.192		
	0187.50	064	-013	217	0.062	0.978	-0.192	CO	7c
	0188.75	064	-013	218	0.062	0.977	-0.199		
	0190.00	065	-014	219	0.062	0.975	-0.207	CO	7c
	0191.25	065	-014	220	0.062	0.975	-0.207		
	0192.50	066	-015	221	0.062	0.973	-0.214	CO	7c
	0193.75	067	-015	222	0.069	0.973	-0.214		
	0195.00	067	-016	223	0.069	0.971	-0.222	CO	7B
	0196.25	068	-016	223	0.069	0.971	-0.222		
	0197.50	069	-017	224	0.069	0.969	-0.229	CO	7B
	0198.75	069	-017	225	0.069	0.969	-0.229		
	0200.00	070	-018	226	0.069	0.967	-0.237	C1	7B
	0201.25	070	-018	227	0.077	0.965	-0.245		
	0202.50	070	-018	228	0.077	0.965	-0.245	C1	7B
	0203.75	070	-018	229	0.077	0.963	-0.252		
	0205.00	070	-018	230	0.074	0.963	-0.252	C1	7B
	0206.25	071	-018	231	0.074	0.961	-0.260		
	0207.50	071	-018	232	0.074	0.961	-0.260	C1	7B
	0208.75	071	-018	233	0.082	0.958	-0.267		
	0210.00	071	-018	234	0.082	0.956	-0.275	C1	7A
	0211.25	071	-018	235	0.082	0.956	-0.275		
	0212.50	071	-018	236	0.082	0.953	-0.282	C1	7A
	0213.75	072	-018	237	0.082	0.953	-0.282		
	0215.00	072	-018	238	0.082	0.951	-0.290	CO	7A
	0216.25	072	-018	239	0.089	0.948	-0.297		
	0217.50	072	-018	240	0.089	0.948	-0.297	CO	7A
	0218.75	072	-018	241	0.089	0.946	-0.304		
	0220.00	072	-018	242	0.089	0.946	-0.304	CO	7A
	0221.25	072	-018	243	0.089	0.943	-0.312		
	0222.50	073	-018	244	0.097	0.940	-0.319	CO	7A
	0223.75	073	-018	245	0.097	0.940	-0.319		
	0225.00	073	-018	246	0.097	0.937	-0.326	CO	7A

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	T	R	Q	P	DC1	DC2	DC3	REL. CORR.	PO. CORR.
	1201.25	024	-016	014	0.053	0.061	-0.984		

T	R	Q	P	DC1	DC2	DC3	RL. CMD	PC. CMD
0224.25	073	-018	246	0.097	0.937	-0.326		
0227.50	073	-019	247	0.097	0.935	-0.333	C3	79
0229.75	074	-020	247	0.097	0.932	-0.341		
0230.00	074	-020	248	0.104	0.931	-0.341	C4	79
0231.25	074	-021	248	0.104	0.928	-0.348		
0232.50	074	-021	249	0.101	0.926	-0.356	C3	79
0233.75	074	-022	249	0.101	0.926	-0.356		
0235.00	075	-023	250	0.101	0.923	-0.363	C3	79
0236.25	075	-023	250	0.108	0.922	-0.363		
0237.50	075	-024	251	0.108	0.919	-0.370	C4	79
0238.75	076	-024	251	0.108	0.916	-0.377		
0240.00	076	-025	251	0.108	0.916	-0.377	C4	79
0241.25	076	-026	252	0.108	0.913	-0.384		
0242.50	076	-026	252	0.115	0.909	-0.391	C4	78
0243.75	077	-027	253	0.115	0.909	-0.391		
0245.00	077	-027	253	0.115	0.906	-0.399	C5	78
0246.25	077	-028	254	0.115	0.906	-0.399		
0247.50	077	-029	254	0.115	0.903	-0.406	C5	78
0248.75	078	-029	255	0.122	0.899	-0.412		
0250.00	078	-030	255	0.122	0.899	-0.412	C5	78
0251.25	078	-031	255	0.122	0.895	-0.419		
0252.50	078	-031	255	0.119	0.892	-0.427	C5	78
0253.75	078	-032	255	0.119	0.892	-0.427		
0255.00	078	-033	255	0.126	0.888	-0.434	C6	77
0256.25	079	-033	255	0.126	0.884	-0.441		
0257.50	079	-034	255	0.126	0.884	-0.441	C6	77
0258.75	079	-035	255	0.126	0.880	-0.448		
0260.00	079	-035	255	0.126	0.877	-0.455	C6	77
0261.25	079	-036	255	0.126	0.877	-0.455		
0262.50	079	-037	255	0.133	0.872	-0.462	C7	77
0263.75	080	-038	255	0.133	0.872	-0.462		
0265.00	080	-038	255	0.133	0.869	-0.468	C7	77
0266.25	080	-039	254	0.129	0.865	-0.476		
0267.50	080	-040	254	0.129	0.865	-0.476	C7	77
0268.75	080	-041	254	0.135	0.860	-0.483		
0270.00	080	-041	254	0.135	0.856	-0.489	C8	77
0271.25	080	-042	254	0.135	0.856	-0.489		
0272.50	081	-043	254	0.135	0.852	-0.496	C8	77
0273.75	081	-043	254	0.135	0.848	-0.503		
0275.00	081	-044	254	0.142	0.847	-0.503	C8	76
0276.25	081	-044	254	0.142	0.843	-0.509		
0277.50	081	-045	253	0.142	0.843	-0.509	C9	76
0278.75	081	-045	252	0.138	0.839	-0.517		
0280.00	081	-046	252	0.144	0.834	-0.523	C9	76
0281.25	081	-046	251	0.144	0.834	-0.523		
0282.50	081	-047	250	0.144	0.830	-0.530	C9	76
0283.75	081	-047	250	0.144	0.825	-0.536		
0285.00	081	-047	249	0.144	0.825	-0.536	CA	75
0286.25	081	-048	249	0.151	0.820	-0.542		
0287.50	081	-048	248	0.151	0.820	-0.542	CA	75
0288.75	081	-049	247	0.146	0.816	-0.550		
0290.00	081	-049	247	0.146	0.811	-0.556	CB	75
0291.25	082	-050	246	0.146	0.811	-0.556		
0292.50	082	-050	245	0.153	0.806	-0.563	CB	75
0293.75	082	-051	245	0.153	0.801	-0.569		
0295.00	082	-051	244	0.153	0.801	-0.569	CB	75
0296.25	082	-052	244	0.153	0.797	-0.575		
0297.50	082	-052	243	0.153	0.797	-0.575	CC	75
0298.75	082	-052	243	0.154	0.791	-0.582		
0300.00	082	-053	242	0.154	0.786	-0.588	CC	75

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I	R	Q	P	DC1	DC2	DC3	REL. CORR.	PC. CORR.
0301.25	082	-053	241	0.154	0.786	-0.588		
0302.50	082	-053	241	0.154	0.782	-0.594	CC	75
0303.75	081	-053	240	0.154	0.782	-0.594		
0305.00	081	-053	239	0.160	0.776	-0.600	CD	75
0306.25	081	-053	239	0.160	0.771	-0.606		
0307.50	081	-053	238	0.160	0.771	-0.606	CD	75
0308.75	081	-053	238	0.155	0.766	-0.614		
0310.00	081	-053	237	0.155	0.766	-0.614	CD	75
0311.25	081	-053	236	0.161	0.760	-0.619		
0312.50	080	-053	236	0.161	0.755	-0.625	CE	75
0313.75	080	-053	235	0.161	0.755	-0.625		
0315.00	080	-053	235	0.161	0.750	-0.631	CE	75
0316.25	080	-053	234	0.161	0.750	-0.631		
0317.50	080	-054	234	0.162	0.744	-0.638	CF	75
0318.75	080	-054	233	0.162	0.739	-0.644		
0320.00	079	-054	232	0.162	0.739	-0.644	CF	75
0321.25	079	-054	232	0.162	0.734	-0.650		
0322.50	079	-054	231	0.162	0.734	-0.650	DO	75
0323.75	079	-054	230	0.167	0.727	-0.655		
0325.00	079	-054	230	0.167	0.727	-0.655	DO	75
0326.25	079	-054	229	0.167	0.722	-0.661		
0327.50	079	-054	228	0.162	0.717	-0.668	D1	75
0328.75	079	-054	227	0.162	0.717	-0.668		
0330.00	079	-054	226	0.168	0.710	-0.673	D1	75
0331.25	079	-054	225	0.168	0.710	-0.673		
0332.50	079	-054	224	0.168	0.705	-0.679	D1	75
0333.75	079	-055	223	0.168	0.705	-0.679		
0335.00	078	-055	222	0.168	0.699	-0.684	D2	75
0336.25	078	-055	221	0.167	0.693	-0.691		
0337.50	078	-055	220	0.167	0.693	-0.691	D2	75
0338.75	078	-055	219	0.167	0.687	-0.696		
0340.00	078	-055	218	0.167	0.687	-0.696	D3	75
0341.25	078	-055	217	0.167	0.682	-0.701		
0342.50	078	-055	216	0.173	0.681	-0.701	D3	74
0343.75	078	-055	215	0.173	0.675	-0.707		
0345.00	078	-055	214	0.167	0.675	-0.708	D3	75
0346.25	078	-056	213	0.167	0.669	-0.713		
0347.50	078	-056	212	0.167	0.669	-0.713	D4	75
0348.75	078	-056	211	0.172	0.662	-0.718		
0350.00	078	-056	210	0.172	0.657	-0.723	D4	74
0351.25	078	-056	209	0.172	0.657	-0.723		
0352.50	077	-056	207	0.172	0.651	-0.729	D5	74
0353.75	077	-056	206	0.167	0.651	-0.730		
0355.00	077	-056	205	0.172	0.644	-0.735	D5	75
0356.25	077	-056	203	0.172	0.644	-0.735		
0357.50	077	-056	202	0.172	0.638	-0.740	D6	75
0358.75	076	-057	201	0.172	0.638	-0.740		
0360.00	076	-057	199	0.172	0.632	-0.745	D6	75
0361.25	076	-057	198	0.172	0.632	-0.745		
0362.50	076	-057	197	0.176	0.625	-0.750	D6	74
0363.75	076	-057	195	0.170	0.625	-0.751		
0365.00	075	-057	194	0.170	0.619	-0.756	D7	75
0366.25	075	-057	192	0.170	0.619	-0.756		
0367.50	075	-057	191	0.170	0.613	-0.761	D7	75
0368.75	075	-057	190	0.175	0.612	-0.761		
0370.00	074	-057	188	0.175	0.606	-0.765	D8	74
0371.25	074	-058	187	0.175	0.606	-0.765		
0372.50	074	-058	186	0.169	0.606	-0.767	D8	75
0373.75	074	-058	184	0.169	0.600	-0.771		
0375.00	074	-058	183	0.174	0.599	-0.771	D8	74

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T	R	Q	P	DC1	DC2	DC3	RL.CMND	PC.CMND
0375.25	074	-058	182	0.174	0.593	-0.776		
0377.50	074	-058	181	0.174	0.593	-0.776	09	74
0379.75	074	-058	181	0.174	0.586	-0.781		
0380.00	074	-058	180	0.167	0.586	-0.782	09	75
0381.25	074	-058	179	0.167	0.580	-0.786		
0382.50	074	-058	178	0.172	0.579	-0.786	09	74
0383.75	074	-058	177	0.172	0.573	-0.791		
0385.00	073	-058	176	0.172	0.573	-0.791	0A	74
0386.25	073	-058	175	0.172	0.573	-0.791		
0387.50	073	-058	174	0.172	0.567	-0.795	0A	74
0388.75	073	-058	174	0.170	0.565	-0.797		
0390.00	073	-058	173	0.170	0.559	-0.801	0B	75
0391.25	073	-058	172	0.170	0.559	-0.801		
0392.50	073	-058	171	0.170	0.552	-0.805	0B	75
0393.75	073	-058	170	0.170	0.552	-0.805		
0395.00	073	-058	169	0.174	0.545	-0.810	0C	74
0396.25	073	-058	169	0.174	0.545	-0.810		
0397.50	073	-058	168	0.168	0.545	-0.811	0C	75
0398.75	073	-058	167	0.168	0.538	-0.815		
0400.00	073	-058	166	0.168	0.538	-0.815	0C	75
0401.25	073	-058	165	0.168	0.532	-0.819		
0402.50	072	-058	165	0.172	0.531	-0.819	0D	74
0403.75	072	-057	164	0.172	0.531	-0.819		
0405.00	072	-057	163	0.172	0.524	-0.823	0D	74
0406.25	072	-057	163	0.166	0.524	-0.825		
0407.50	072	-057	162	0.166	0.518	-0.829	0D	75
0408.75	071	-057	161	0.170	0.516	-0.829		
0410.00	071	-057	161	0.170	0.516	-0.829	0D	75
0411.25	071	-057	160	0.170	0.510	-0.833		
0412.50	071	-056	160	0.170	0.510	-0.833	0E	75
0413.75	071	-056	159	0.170	0.503	-0.837		
0415.00	070	-056	158	0.163	0.503	-0.838	0E	75
0416.25	070	-056	158	0.167	0.502	-0.838		
0417.50	070	-056	157	0.167	0.495	-0.842	0F	75
0418.75	070	-056	156	0.167	0.495	-0.842		
0420.00	070	-055	156	0.167	0.489	-0.845	0F	75
0421.25	069	-055	155	0.167	0.489	-0.845		
0422.50	069	-055	154	0.167	0.489	-0.845	0F	75
0423.75	069	-055	154	0.164	0.481	-0.850		
0425.00	069	-055	153	0.164	0.481	-0.850	0G	75
0426.25	069	-055	152	0.164	0.474	-0.854		
0427.50	069	-055	151	0.164	0.474	-0.854	0G	75
0428.75	069	-054	150	0.164	0.474	-0.854		
0430.00	068	-054	149	0.164	0.467	-0.858	0I	75
0431.25	068	-054	148	0.168	0.466	-0.858		
0432.50	068	-054	147	0.168	0.466	-0.858	0I	75
0433.75	068	-054	146	0.161	0.459	-0.863		
0435.00	068	-054	145	0.161	0.459	-0.863	0I	75
0436.25	068	-053	143	0.161	0.453	-0.866		
0437.50	068	-053	142	0.164	0.451	-0.866	0J	75
0438.75	068	-053	141	0.164	0.451	-0.866		
0440.00	068	-053	140	0.164	0.444	-0.870	0J	75
0441.25	068	-053	139	0.164	0.444	-0.870		
0442.50	067	-053	138	0.157	0.444	-0.871	0J	75
0443.75	067	-053	137	0.157	0.438	-0.874		
0445.00	067	-053	136	0.161	0.436	-0.874	0K	75
0446.25	067	-052	135	0.161	0.436	-0.874		
0447.50	067	-052	134	0.161	0.429	-0.877	0K	75
0448.75	067	-052	133	0.161	0.429	-0.877		
0450.00	067	-052	132	0.161	0.429	-0.877	0K	75

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T	R	Q	P	DC1	DC2	DC3	RL.OMID	PC.OMID
0451.25	067	-052	120	0.161	0.422	-0.881		
0452.50	066	-052	123	0.157	0.421	-0.882	E4	75
0453.75	066	-052	126	0.157	0.421	-0.882		
0455.00	065	-051	123	0.157	0.414	-0.885	E4	75
0456.25	065	-051	121	0.157	0.414	-0.885		
0457.50	065	-051	119	0.157	0.414	-0.885	E4	75
0458.75	064	-051	117	0.157	0.407	-0.888		
0460.00	064	-051	115	0.160	0.406	-0.888	E5	75
0461.25	064	-051	113	0.153	0.406	-0.890		
0462.50	064	-051	111	0.153	0.406	-0.890	E5	76
0463.75	063	-051	108	0.153	0.399	-0.893		
0465.00	063	-051	106	0.153	0.399	-0.893	E5	76
0466.25	062	-051	104	0.153	0.399	-0.893		
0467.50	062	-050	102	0.153	0.392	-0.896	E5	76
0468.75	062	-050	100	0.156	0.391	-0.896		
0470.00	061	-050	098	0.156	0.391	-0.896	E5	76
0471.25	061	-050	096	0.149	0.391	-0.897		
0472.50	061	-050	094	0.149	0.384	-0.900	E6	76
0473.75	060	-050	092	0.149	0.384	-0.900		
0475.00	060	-050	089	0.149	0.384	-0.900	E6	76
0476.25	060	-050	090	0.152	0.383	-0.900		
0477.50	060	-050	091	0.152	0.383	-0.900	E6	76
0478.75	060	-050	091	0.152	0.376	-0.903		
0480.00	060	-050	092	0.152	0.376	-0.903	E6	76
0481.25	060	-050	093	0.145	0.376	-0.904		
0482.50	060	-050	094	0.145	0.376	-0.904	E6	75
0483.75	060	-050	094	0.145	0.368	-0.907		
0485.00	060	-049	095	0.148	0.367	-0.907	E7	76
0486.25	060	-049	096	0.148	0.367	-0.907		
0487.50	060	-049	096	0.148	0.367	-0.907	E7	76
0488.75	060	-049	097	0.148	0.360	-0.910		
0490.00	060	-049	097	0.148	0.360	-0.910	E7	76
0491.25	060	-049	098	0.140	0.360	-0.911		
0492.50	060	-049	099	0.140	0.360	-0.911	E7	77
0493.75	060	-049	099	0.143	0.352	-0.913		
0495.00	060	-049	100	0.143	0.352	-0.913	E8	76
0496.25	060	-049	101	0.143	0.352	-0.913		
0497.50	060	-049	102	0.143	0.352	-0.913	E8	76
0498.75	060	-049	102	0.143	0.345	-0.916		
0500.00	060	-049	103	0.143	0.345	-0.916	E8	76
0501.25	060	-048	103	0.138	0.344	-0.917		
0502.50	059	-048	102	0.138	0.344	-0.917	E9	77
0503.75	059	-047	102	0.138	0.336	-0.920		
0505.00	059	-047	101	0.138	0.336	-0.920	E9	77
0506.25	059	-047	101	0.138	0.336	-0.920		
0507.50	059	-046	101	0.138	0.336	-0.920	E9	77
0508.75	058	-046	100	0.138	0.329	-0.922		
0510.00	058	-045	100	0.141	0.328	-0.922	E9	76
0511.25	058	-045	100	0.141	0.328	-0.922		
0512.50	058	-044	099	0.134	0.328	-0.923	E9	77
0513.75	058	-044	099	0.134	0.321	-0.926		
0515.00	057	-043	099	0.134	0.321	-0.926	EA	77
0516.25	057	-043	098	0.134	0.321	-0.926		
0517.50	057	-043	098	0.134	0.321	-0.926	EA	77
0518.75	057	-042	098	0.136	0.313	-0.928		
0520.00	057	-042	097	0.136	0.313	-0.928	EA	77
0521.25	056	-041	097	0.136	0.313	-0.928		
0522.50	056	-041	097	0.135	0.313	-0.928	EA	77
0523.75	056	-041	096	0.129	0.305	-0.932		
0525.00	056	-040	096	0.129	0.305	-0.932	EB	77

T	R	Q	P	DC1	DC2	DC3	RL.CMID	PC.CMID
0520.25	056	-040	095	0.129	0.305	-0.932		
0527.50	055	-039	093	0.131	0.304	-0.932	EB	77
0528.75	055	-039	092	0.131	0.297	-0.934		
0530.00	055	-039	090	0.131	0.297	-0.934	EB	77
0531.25	054	-038	088	0.131	0.297	-0.934		
0532.50	054	-038	087	0.131	0.297	-0.934	EB	77
0533.75	054	-038	085	0.131	0.297	-0.934		
0535.00	053	-037	084	0.131	0.290	-0.936	EC	77
0536.25	053	-037	083	0.133	0.289	-0.936		
0537.50	053	-037	081	0.126	0.289	-0.937	EC	77
0538.75	053	-037	079	0.126	0.289	-0.937		
0540.00	052	-036	078	0.126	0.289	-0.937	EC	77
0541.25	052	-036	076	0.126	0.281	-0.940		
0542.50	052	-036	075	0.126	0.281	-0.940	ED	77
0543.75	051	-035	074	0.126	0.281	-0.940		
0545.00	051	-035	072	0.126	0.281	-0.940	ED	77
0546.25	051	-035	070	0.128	0.280	-0.940		
0547.50	051	-034	069	0.128	0.273	-0.942	ED	77
0548.75	050	-034	067	0.128	0.273	-0.942		
0550.00	050	-034	066	0.128	0.273	-0.942	ED	77
0551.25	050	-034	065	0.121	0.273	-0.943		
0552.50	049	-034	064	0.121	0.273	-0.943	ED	78
0553.75	049	-034	064	0.121	0.273	-0.943		
0555.00	049	-033	063	0.121	0.265	-0.945	EE	78
0556.25	048	-033	062	0.123	0.264	-0.945		
0557.50	048	-033	061	0.123	0.264	-0.945	EE	78
0558.75	048	-033	060	0.123	0.264	-0.945		
0560.00	047	-033	060	0.123	0.264	-0.945	EE	78
0561.25	047	-033	059	0.123	0.264	-0.945		
0562.50	047	-033	058	0.123	0.264	-0.945	EE	78
0563.75	047	-033	057	0.123	0.257	-0.947		
0565.00	046	-033	056	0.123	0.257	-0.947	EE	78
0566.25	046	-033	055	0.117	0.256	-0.948		
0567.50	046	-032	055	0.117	0.256	-0.948	EE	78
0568.75	045	-032	054	0.117	0.256	-0.948		
0570.00	045	-032	053	0.117	0.256	-0.948	EE	78
0571.25	045	-032	052	0.117	0.256	-0.948		
0572.50	044	-032	052	0.117	0.249	-0.949	EF	78
0573.75	044	-032	051	0.117	0.249	-0.949		
0575.00	044	-032	050	0.117	0.249	-0.949	EF	78
0576.25	044	-032	051	0.117	0.249	-0.949		
0577.50	044	-032	052	0.119	0.248	-0.949	EF	78
0578.75	044	-031	053	0.119	0.248	-0.949		
0580.00	044	-031	053	0.119	0.248	-0.949	EF	78
0581.25	044	-031	054	0.111	0.248	-0.950		
0582.50	044	-031	055	0.111	0.240	-0.952	EF	78
0583.75	045	-030	055	0.111	0.240	-0.952		
0585.00	045	-030	057	0.111	0.240	-0.952	EF	78
0586.25	045	-030	058	0.111	0.240	-0.952		
0587.50	045	-030	059	0.111	0.240	-0.952	EF	78
0588.75	045	-029	060	0.113	0.240	-0.952		
0590.00	045	-029	061	0.113	0.240	-0.952	EF	78
0591.25	045	-029	062	0.113	0.232	-0.954		
0592.50	045	-028	063	0.113	0.232	-0.954	FO	78
0593.75	045	-028	064	0.113	0.232	-0.954		
0595.00	045	-028	064	0.113	0.232	-0.954	FO	78
0596.25	046	-028	065	0.113	0.232	-0.954		
0597.50	046	-027	066	0.113	0.232	-0.954	FO	78
0598.75	046	-027	067	0.105	0.224	-0.957		
0600.00	046	-027	068	0.107	0.224	-0.957	FO	79

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T	R	Q	P	DC1	DC2	DC3	RL CMD	PC CMD
0601.25	046	-027	066	0.107	0.224	-0.957		
0602.50	045	-026	065	0.107	0.224	-0.957	F0	79
0603.75	045	-026	064	0.107	0.224	-0.957		
0605.00	045	-026	063	0.107	0.224	-0.957	F0	79
0606.25	044	-026	061	0.107	0.216	-0.958		
0607.50	044	-025	060	0.107	0.216	-0.958	F1	79
0608.75	044	-025	058	0.107	0.216	-0.958		
0610.00	043	-025	057	0.107	0.216	-0.958	F1	79
0611.25	043	-025	056	0.109	0.215	-0.958		
0612.50	043	-024	054	0.109	0.215	-0.958	F1	79
0613.75	043	-024	053	0.109	0.215	-0.958		
0615.00	042	-024	052	0.109	0.208	-0.960	F1	79
0616.25	042	-024	050	0.109	0.208	-0.960		
0617.50	042	-023	049	0.101	0.208	-0.961	F1	79
0618.75	041	-023	048	0.101	0.208	-0.961		
0620.00	041	-023	046	0.101	0.208	-0.961	F1	79
0621.25	041	-023	045	0.101	0.208	-0.961		
0622.50	041	-022	043	0.103	0.207	-0.961	F1	79
0623.75	040	-022	042	0.103	0.207	-0.961		
0625.00	040	-022	041	0.103	0.199	-0.962	F2	79
0626.25	039	-022	039	0.103	0.199	-0.962		
0627.50	039	-022	038	0.103	0.199	-0.962	F2	79
0628.75	039	-022	036	0.103	0.199	-0.962		
0630.00	038	-022	034	0.103	0.199	-0.962	F2	79
0631.25	038	-022	033	0.103	0.199	-0.962		
0632.50	037	-022	031	0.103	0.199	-0.962	F2	79
0633.75	037	-022	030	0.103	0.199	-0.962		
0635.00	037	-022	028	0.104	0.199	-0.962	F2	79
0636.25	036	-022	026	0.104	0.199	-0.962		
0637.50	036	-022	025	0.104	0.199	-0.962	F2	79
0638.75	035	-022	023	0.104	0.199	-0.962		
0640.00	035	-022	021	0.097	0.199	-0.963	F2	79
0641.25	035	-023	020	0.097	0.191	-0.964		
0642.50	034	-023	018	0.097	0.191	-0.964	F2	79
0643.75	034	-023	017	0.097	0.191	-0.964		
0645.00	033	-023	015	0.097	0.191	-0.964	F2	79
0646.25	033	-023	014	0.097	0.191	-0.964		
0647.50	033	-023	012	0.097	0.191	-0.964	F2	79
0648.75	032	-023	011	0.097	0.191	-0.964		
0650.00	032	-023	009	0.098	0.190	-0.964	F2	79
0651.25	032	-023	011	0.098	0.190	-0.964		
0652.50	032	-022	014	0.098	0.190	-0.964	F2	79
0653.75	033	-022	017	0.098	0.190	-0.964		
0655.00	033	-022	019	0.098	0.190	-0.964	F2	79
0656.25	033	-022	022	0.098	0.190	-0.964		
0657.50	034	-021	025	0.098	0.190	-0.964	F2	79
0658.75	034	-021	027	0.098	0.190	-0.964		
0660.00	034	-021	030	0.098	0.190	-0.964	F2	79
0661.25	035	-021	033	0.098	0.190	-0.964		
0662.50	035	-021	035	0.091	0.190	-0.965	F2	7A
0663.75	035	-020	038	0.091	0.190	-0.965		
0665.00	035	-020	041	0.092	0.182	-0.967	F3	7A
0666.25	036	-019	043	0.092	0.182	-0.967		
0667.50	036	-019	046	0.092	0.182	-0.967	F3	7A
0668.75	036	-019	049	0.092	0.182	-0.967		
0670.00	037	-019	051	0.092	0.182	-0.967	F3	7A
0671.25	037	-019	054	0.092	0.182	-0.967		
0672.50	037	-018	056	0.092	0.182	-0.967	F3	7A
0673.75	038	-018	059	0.092	0.182	-0.967		
0675.00	038	-018	062	0.092	0.175	-0.968	F3	7A

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T	R	Q	P	DC1	DC2	DC3	RL. CMD	PC. CMD
0676.25	038	-018	051	0.022	0.175	-0.968		
0677.50	038	-017	060	0.022	0.175	-0.968	F3	7A
0678.75	038	-017	059	0.024	0.174	-0.968		
0680.00	039	-016	057	0.024	0.174	-0.968	F3	7A
0681.25	039	-016	056	0.024	0.174	-0.968		
0682.50	039	-016	055	0.024	0.174	-0.968	F3	7A
0683.75	039	-015	054	0.024	0.166	-0.969		
0685.00	039	-015	053	0.024	0.166	-0.969	F4	7A
0686.25	040	-015	052	0.024	0.166	-0.969		
0687.50	040	-014	051	0.024	0.166	-0.969	F4	7A
0688.75	040	-014	050	0.024	0.166	-0.969		
0690.00	040	-014	049	0.024	0.166	-0.969	F4	7A
0691.25	040	-013	048	0.027	0.166	-0.970		
0692.50	041	-013	046	0.027	0.166	-0.970	F4	7A
0693.75	041	-013	045	0.027	0.158	-0.971		
0695.00	041	-012	044	0.027	0.158	-0.971	F4	7A
0696.25	041	-012	043	0.027	0.158	-0.971		
0697.50	041	-012	042	0.027	0.158	-0.971	F4	7A
0698.75	042	-011	041	0.027	0.158	-0.971		
0700.00	042	-011	040	0.027	0.158	-0.971	F4	7A
0701.25	041	-011	037	0.027	0.158	-0.971		
0702.50	040	-011	033	0.027	0.158	-0.971	F4	7A
0703.75	039	-011	030	0.028	0.157	-0.971		
0705.00	038	-011	027	0.028	0.157	-0.971	F4	7A
0706.25	038	-011	024	0.028	0.157	-0.971		
0707.50	037	-011	021	0.028	0.150	-0.972	F5	7A
0708.75	036	-011	017	0.028	0.150	-0.972		
0710.00	035	-011	014	0.028	0.150	-0.972	F5	7A
0711.25	034	-011	011	0.028	0.150	-0.972		
0712.50	033	-011	008	0.028	0.150	-0.972	F5	7A
0713.75	032	-011	004	0.028	0.150	-0.972		
0715.00	032	-011	001	0.028	0.150	-0.972	F5	7A
0716.25	031	-012	-002	0.028	0.150	-0.972		
0717.50	030	-012	-006	0.029	0.149	-0.972	F5	7A
0718.75	029	-012	-009	0.029	0.149	-0.972		
0720.00	028	-012	-012	0.029	0.149	-0.972	F5	7A
0721.25	027	-012	-015	0.029	0.149	-0.972		
0722.50	027	-012	-019	0.029	0.149	-0.972	F5	7A
0723.75	026	-012	-022	0.029	0.149	-0.972		
0725.00	025	-012	-025	0.029	0.149	-0.972	F5	7A
0726.25	025	-012	-024	0.029	0.149	-0.972		
0727.50	025	-013	-023	0.029	0.149	-0.972	F5	7A
0728.75	024	-013	-022	0.029	0.149	-0.972		
0730.00	024	-013	-022	0.029	0.149	-0.972	F5	7A
0731.25	024	-014	-021	0.029	0.149	-0.972		
0732.50	024	-014	-020	0.022	0.149	-0.973	F5	7A
0733.75	024	-014	-019	0.022	0.149	-0.973		
0735.00	024	-015	-019	0.022	0.149	-0.973	F5	7A
0736.25	024	-015	-018	0.023	0.149	-0.973		
0737.50	023	-015	-017	0.023	0.149	-0.973	F5	7A
0738.75	023	-016	-016	0.023	0.149	-0.973		
0740.00	023	-016	-015	0.023	0.149	-0.973	F5	7A
0741.25	023	-016	-014	0.023	0.149	-0.973		
0742.50	023	-017	-014	0.023	0.149	-0.973	F5	7A
0743.75	023	-017	-013	0.023	0.149	-0.973		
0745.00	022	-017	-012	0.023	0.149	-0.973	F5	7A
0746.25	022	-018	-011	0.023	0.149	-0.973		
0747.50	022	-018	-011	0.023	0.149	-0.973	F5	7A
0748.75	022	-019	-010	0.023	0.149	-0.973		
0750.00	022	-019	-009	0.023	0.149	-0.973	F5	7A

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T	R	Q	P	DC1	DC2	DC3	RL. CMD	PL. CMD
0751.25	023	-018	-005	0.083	0.149	-0.973		
0752.50	023	-013	-002	0.083	0.149	-0.973	F5	7A
0753.75	024	-017	002	0.083	0.149	-0.973		
0755.00	025	-017	005	0.083	0.149	-0.973	F5	7A
0756.25	026	-016	009	0.083	0.149	-0.973		
0757.50	026	-016	012	0.084	0.148	-0.973	F5	7A
0758.75	027	-015	016	0.084	0.148	-0.973		
0760.00	028	-014	020	0.084	0.148	-0.973	F5	7A
0761.25	029	-014	023	0.084	0.148	-0.973		
0762.50	030	-013	027	0.084	0.148	-0.973	F5	7A
0763.75	030	-013	030	0.076	0.148	-0.974		
0765.00	031	-012	033	0.076	0.148	-0.974	F5	7B
0766.25	032	-012	037	0.076	0.148	-0.974		
0767.50	032	-011	041	0.076	0.148	-0.974	F5	7B
0768.75	033	-011	044	0.076	0.148	-0.974		
0770.00	034	-010	048	0.076	0.148	-0.974	F5	7B
0771.25	035	-010	051	0.076	0.148	-0.974		
0772.50	035	-009	055	0.076	0.148	-0.974	F5	7B
0773.75	036	-008	058	0.077	0.147	-0.974		
0775.00	037	-008	062	0.077	0.147	-0.974	F5	7B
0776.25	037	-008	060	0.077	0.147	-0.974		
0777.50	036	-007	058	0.077	0.147	-0.974	F5	7B
0778.75	036	-007	056	0.077	0.147	-0.974		
0780.00	036	-006	055	0.077	0.140	-0.975	F6	7B
0781.25	036	-006	053	0.077	0.140	-0.975		
0782.50	035	-006	051	0.077	0.140	-0.975	F6	7B
0783.75	035	-005	049	0.077	0.140	-0.975		
0785.00	035	-005	047	0.077	0.140	-0.975	F6	7B
0786.25	035	-005	046	0.077	0.140	-0.975		
0787.50	034	-004	044	0.078	0.139	-0.975	F6	7A
0788.75	034	-004	042	0.078	0.139	-0.975		
0790.00	034	-004	040	0.078	0.139	-0.975	F6	7A
0791.25	034	-003	038	0.078	0.132	-0.976		
0792.50	033	-003	037	0.078	0.132	-0.976	F6	7A
0793.75	033	-003	035	0.078	0.132	-0.976		
0795.00	033	-002	033	0.078	0.132	-0.976	F6	7A
0796.25	033	-002	031	0.078	0.132	-0.976		
0797.50	032	-002	030	0.078	0.132	-0.976	F6	7A
0798.75	032	-001	029	0.078	0.132	-0.976		
0800.00	032	-001	026	0.078	0.132	-0.976	F6	7A
0801.25	031	-001	022	0.078	0.132	-0.976		
0802.50	030	-001	018	0.079	0.131	-0.976	F6	7A
0803.75	029	-002	014	0.079	0.131	-0.976		
0805.00	028	-002	010	0.079	0.131	-0.976	F6	7A
0806.25	027	-002	007	0.079	0.131	-0.976		
0807.50	026	-003	003	0.079	0.131	-0.976	F6	7A
0808.75	025	-003	-001	0.079	0.131	-0.976		
0810.00	024	-003	-005	0.079	0.131	-0.976	F6	7A
0811.25	023	-004	-009	0.079	0.131	-0.976		
0812.50	022	-004	-013	0.079	0.131	-0.976	F6	7A
0813.75	021	-004	-017	0.079	0.131	-0.976		
0815.00	021	-004	-021	0.079	0.131	-0.976	F6	7A
0816.25	020	-005	-025	0.079	0.131	-0.976		
0817.50	019	-005	-029	0.079	0.131	-0.976	F6	7A
0818.75	018	-005	-032	0.079	0.131	-0.976		
0820.00	017	-005	-036	0.079	0.131	-0.976	F6	7A
0821.25	016	-006	-040	0.079	0.131	-0.976		
0822.50	015	-006	-044	0.079	0.131	-0.976	F6	7A
0823.75	014	-007	-048	0.079	0.131	-0.976		
0825.00	013	-007	-052	0.080	0.130	-0.976	F6	7A

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T	R	Q	P	DC1	DC2	DC3	RL.CMND	PC.CMND
0826.25	013	-007	-049	0.080	0.130	-0.976		
0827.50	014	-007	-047	0.080	0.130	-0.976	F6	7A
0828.75	014	-007	-044	0.080	0.130	-0.976		
0830.00	015	-007	-042	0.080	0.130	-0.976	F6	7A
0831.25	015	-008	-039	0.080	0.130	-0.976		
0832.50	016	-008	-036	0.080	0.130	-0.976	F6	7A
0833.75	016	-008	-034	0.080	0.130	-0.976		
0835.00	017	-008	-031	0.080	0.130	-0.976	F6	7A
0836.25	017	-008	-029	0.080	0.130	-0.976		
0837.50	018	-008	-026	0.080	0.130	-0.976	F6	7A
0838.75	018	-009	-023	0.080	0.130	-0.976		
0840.00	018	-009	-021	0.080	0.138	-0.975	F6	7A
0841.25	019	-009	-018	0.080	0.138	-0.975		
0842.50	019	-009	-016	0.080	0.138	-0.975	F6	7A
0843.75	020	-009	-013	0.080	0.138	-0.975		
0845.00	020	-009	-010	0.080	0.138	-0.975	F6	7A
0846.25	021	-009	-008	0.073	0.138	-0.975		
0847.50	021	-010	-005	0.073	0.138	-0.975	F6	7B
0848.75	021	-010	-003	0.073	0.138	-0.975		
0850.00	022	-010	000	0.073	0.138	-0.975	F6	7B
0851.25	023	-010	004	0.073	0.138	-0.975		
0852.50	024	-009	008	0.073	0.138	-0.975	F6	7B
0853.75	025	-009	012	0.074	0.138	-0.975		
0855.00	026	-009	016	0.074	0.138	-0.975	F6	7B
0856.25	026	-008	021	0.074	0.138	-0.975		
0857.50	027	-008	025	0.074	0.138	-0.975	F6	7B
0858.75	028	-008	029	0.074	0.138	-0.975		
0860.00	029	-007	033	0.074	0.138	-0.975	F6	7B
0861.25	030	-007	037	0.074	0.138	-0.975		
0862.50	031	-007	041	0.074	0.138	-0.975	F6	7B
0863.75	032	-007	045	0.074	0.138	-0.975		
0865.00	033	-006	049	0.074	0.138	-0.975	F6	7B
0866.25	033	-006	053	0.074	0.138	-0.975		
0867.50	034	-006	057	0.074	0.138	-0.975	F6	7B
0868.75	035	-005	061	0.074	0.138	-0.975		
0870.00	036	-005	065	0.075	0.137	-0.975	F6	7B
0871.25	037	-005	070	0.075	0.129	-0.976		
0872.50	038	-004	074	0.075	0.129	-0.976	F6	7B
0873.75	039	-004	078	0.075	0.129	-0.976		
0875.00	040	-004	082	0.075	0.129	-0.976	F6	7B
0876.25	039	-004	079	0.075	0.129	-0.976		
0877.50	039	-004	077	0.075	0.122	-0.977	F7	7B
0878.75	038	-004	074	0.075	0.122	-0.977		
0880.00	038	-003	071	0.075	0.122	-0.977	F7	7B
0881.25	037	-003	069	0.075	0.122	-0.977		
0882.50	037	-003	066	0.075	0.122	-0.977	F7	7B
0883.75	036	-003	064	0.075	0.121	-0.977		
0885.00	036	-003	061	0.075	0.114	-0.978	F7	7B
0886.25	035	-003	058	0.075	0.114	-0.978		
0887.50	035	-003	056	0.075	0.114	-0.978	F7	7B
0888.75	034	-003	053	0.075	0.114	-0.978		
0890.00	034	-003	051	0.075	0.114	-0.978	F7	7B
0891.25	033	-003	048	0.075	0.114	-0.978		
0892.50	033	-002	045	0.075	0.114	-0.978	F7	7B
0893.75	032	-002	043	0.075	0.106	-0.979		
0895.00	032	-002	040	0.075	0.106	-0.979	F8	7B
0896.25	031	-002	038	0.075	0.106	-0.979		
0897.50	031	-002	035	0.076	0.105	-0.979	F8	7B
0898.75	030	-002	032	0.076	0.105	-0.979		
0900.00	030	-002	030	0.076	0.105	-0.979	F8	7B

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T	R	Q	P	DC1	DC2	DC3	REL. CHID	PC. 17.10
0901.25	029	-002	026	0.076	0.105	-0.979		
0902.50	028	-002	022	0.076	0.105	-0.979	F8	75
0903.75	027	-002	019	0.076	0.105	-0.979		
0905.00	026	-002	015	0.076	0.105	-0.979	F8	75
0906.25	025	-003	011	0.076	0.105	-0.979		
0907.50	024	-003	008	0.076	0.105	-0.979	F8	75
0908.75	023	-003	004	0.076	0.105	-0.979		
0910.00	023	-003	000	0.076	0.105	-0.979	F8	75
0911.25	022	-003	-003	0.076	0.105	-0.979		
0912.50	021	-003	-007	0.076	0.105	-0.979	F8	75
0913.75	020	-004	-011	0.076	0.105	-0.979		
0915.00	019	-004	-014	0.076	0.105	-0.979	F8	75
0916.25	018	-004	-018	0.076	0.105	-0.979		
0917.50	017	-004	-022	0.077	0.105	-0.979	F8	75
0918.75	016	-004	-026	0.077	0.105	-0.979		
0920.00	016	-004	-029	0.077	0.105	-0.979	F8	75
0921.25	015	-004	-033	0.077	0.105	-0.979		
0922.50	014	-005	-037	0.077	0.105	-0.979	F8	75
0923.75	013	-005	-040	0.077	0.105	-0.979		
0925.00	012	-005	-044	0.077	0.105	-0.979	F8	75
0926.25	012	-005	-042	0.077	0.105	-0.979		
0927.50	013	-005	-039	0.077	0.105	-0.979	F8	75
0928.75	013	-005	-037	0.077	0.105	-0.979		
0930.00	014	-005	-034	0.077	0.105	-0.979	F8	75
0931.25	014	-006	-032	0.077	0.105	-0.979		
0932.50	015	-006	-030	0.077	0.105	-0.979	F8	75
0933.75	015	-006	-027	0.077	0.105	-0.979		
0935.00	016	-006	-025	0.077	0.105	-0.979	F8	75
0936.25	016	-006	-022	0.077	0.105	-0.979		
0937.50	017	-006	-020	0.077	0.105	-0.979	F8	75
0938.75	018	-007	-018	0.077	0.105	-0.979		
0940.00	018	-007	-015	0.077	0.105	-0.979	F8	75
0941.25	019	-007	-013	0.077	0.105	-0.979		
0942.50	019	-007	-011	0.077	0.105	-0.979	F8	75
0943.75	020	-007	-008	0.077	0.105	-0.979		
0945.00	020	-007	-006	0.077	0.105	-0.979	F8	75
0946.25	021	-007	-003	0.069	0.105	-0.979		
0947.50	021	-008	-001	0.069	0.105	-0.979	F8	75
0948.75	021	-008	001	0.070	0.104	-0.979		
0950.00	022	-008	004	0.070	0.104	-0.979	F8	75
0951.25	023	-008	007	0.070	0.104	-0.979		
0952.50	023	-007	010	0.070	0.104	-0.979	F8	75
0953.75	024	-007	013	0.070	0.104	-0.979		
0955.00	025	-007	017	0.070	0.104	-0.979	F8	75
0956.25	025	-006	020	0.070	0.104	-0.979		
0957.50	026	-006	023	0.070	0.104	-0.979	F8	75
0958.75	027	-006	026	0.070	0.104	-0.979		
0960.00	028	-005	030	0.070	0.104	-0.979	F8	75
0961.25	028	-005	033	0.070	0.104	-0.979		
0962.50	029	-005	036	0.070	0.104	-0.979	F8	75
0963.75	030	-005	039	0.070	0.104	-0.979		
0965.00	030	-004	042	0.070	0.104	-0.979	F8	75
0966.25	031	-004	045	0.070	0.104	-0.979		
0967.50	032	-004	049	0.071	0.104	-0.979	F8	75
0968.75	032	-003	052	0.071	0.104	-0.979		
0970.00	033	-003	055	0.071	0.104	-0.979	F8	75
0971.25	034	-003	058	0.071	0.104	-0.979		
0972.50	034	-002	062	0.071	0.104	-0.979	F8	75
0973.75	035	-002	065	0.071	0.104	-0.979		
0975.00	036	-002	068	0.071	0.104	-0.979	F8	75

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T	R	Q	P	DC1	DC2	DC3	RL.CMND	PC.CMND
0975.25	035	-002	065	0.071	0.096	-0.980		
0977.50	035	-002	063	0.071	0.096	-0.980	F8	7B
0979.75	034	-002	061	0.071	0.096	-0.980		
0980.00	034	-002	058	0.071	0.096	-0.980	F8	7B
0981.25	034	-002	056	0.071	0.096	-0.980		
0982.50	033	-002	054	0.071	0.096	-0.980	F8	7B
0983.75	033	-002	051	0.071	0.088	-0.981		
0985.00	032	-001	049	0.071	0.088	-0.981	F9	7B
0986.25	032	-001	047	0.071	0.088	-0.981		
0987.50	032	-001	044	0.071	0.088	-0.981	F9	7B
0989.75	031	-001	042	0.071	0.088	-0.981		
0990.00	031	-001	040	0.071	0.088	-0.981	F9	7B
0991.25	030	-001	037	0.071	0.088	-0.981		
0992.50	030	-001	035	0.071	0.088	-0.981	F9	7B
0993.75	029	-001	032	0.071	0.088	-0.981		
0995.00	029	-001	030	0.071	0.088	-0.981	F9	7B
0996.25	028	-001	028	0.071	0.080	-0.981		
0997.50	028	-001	025	0.071	0.080	-0.981	F9	7B
0999.75	027	-001	023	0.072	0.080	-0.981		
1000.00	027	-001	021	0.072	0.080	-0.981	F9	7B
1001.25	026	-001	018	0.072	0.080	-0.981		
1002.50	025	-001	015	0.072	0.080	-0.981	F9	7B
1003.75	024	-002	012	0.072	0.080	-0.981		
1005.00	024	-002	010	0.072	0.080	-0.981	F9	7B
1006.25	023	-002	007	0.072	0.080	-0.981		
1007.50	022	-002	004	0.072	0.080	-0.981	F9	7B
1008.75	021	-003	001	0.072	0.080	-0.981		
1010.00	021	-003	-001	0.072	0.080	-0.981	F9	7B
1011.25	020	-003	-004	0.072	0.080	-0.981		
1012.50	019	-003	-007	0.072	0.080	-0.981	F9	7B
1013.75	018	-004	-010	0.072	0.080	-0.981		
1015.00	017	-004	-013	0.072	0.080	-0.981	F9	7B
1016.25	017	-004	-015	0.072	0.080	-0.981		
1017.50	016	-004	-016	0.072	0.080	-0.981	F9	7B
1018.75	015	-005	-021	0.072	0.080	-0.981		
1020.00	014	-005	-024	0.072	0.080	-0.981	F9	7B
1021.25	013	-005	-027	0.072	0.080	-0.981		
1022.50	013	-005	-029	0.073	0.079	-0.981	F9	7B
1023.75	012	-005	-032	0.073	0.079	-0.981		
1025.00	011	-005	-035	0.073	0.079	-0.981	F9	7B
1026.25	011	-005	-033	0.073	0.079	-0.981		
1027.50	011	-006	-031	0.073	0.079	-0.981	F9	7B
1029.75	012	-007	-029	0.073	0.079	-0.981		
1030.00	012	-007	-027	0.073	0.079	-0.981	F9	7B
1031.25	012	-007	-025	0.073	0.079	-0.981		
1032.50	013	-007	-024	0.073	0.079	-0.981	F9	7B
1033.75	013	-008	-022	0.073	0.079	-0.981		
1035.00	013	-008	-020	0.073	0.079	-0.981	F9	7B
1036.25	014	-008	-018	0.073	0.079	-0.981		
1037.50	014	-009	-016	0.073	0.079	-0.981	F9	7B
1039.75	014	-009	-014	0.073	0.079	-0.981		
1041.00	014	-009	-012	0.073	0.079	-0.981	F9	7B
1041.25	015	-009	-010	0.073	0.079	-0.981		
1042.50	015	-010	-009	0.073	0.079	-0.981	F9	7B
1043.75	015	-010	-007	0.073	0.079	-0.981		
1045.00	016	-010	-005	0.073	0.079	-0.981	F9	7B
1046.25	016	-010	-003	0.073	0.079	-0.981		
1047.50	016	-011	-001	0.073	0.079	-0.981	F9	7B
1048.75	017	-011	001	0.073	0.079	-0.981		
1050.00	017	-011	003	0.073	0.079	-0.981	F9	7B

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T	R	Q	P	DC1	DC2	DC3	RL. CMD	PC. CMD
1051.25	017	-011	005	0.065	0.079	-0.982		
1052.50	018	-011	007	0.065	0.079	-0.982	F9	7B
1053.75	019	-010	010	0.065	0.079	-0.982		
1055.00	019	-010	012	0.065	0.079	-0.982	F9	7B
1056.25	020	-010	014	0.065	0.079	-0.982		
1057.50	020	-010	016	0.066	0.079	-0.982	F9	7B
1058.75	021	-010	018	0.066	0.079	-0.982		
1060.00	021	-009	021	0.066	0.079	-0.982	F9	7B
1061.25	022	-009	023	0.066	0.079	-0.982		
1062.50	022	-009	025	0.066	0.079	-0.982	F9	7B
1063.75	023	-009	027	0.066	0.079	-0.982		
1065.00	023	-009	029	0.066	0.079	-0.982	F9	7B
1066.25	024	-008	032	0.066	0.079	-0.982		
1067.50	025	-008	034	0.066	0.079	-0.982	F9	7B
1068.75	025	-008	036	0.066	0.079	-0.982		
1070.00	026	-008	038	0.066	0.079	-0.982	F9	7B
1071.25	026	-008	040	0.066	0.079	-0.982		
1072.50	027	-007	043	0.066	0.079	-0.982	F9	7B
1073.75	027	-007	045	0.066	0.079	-0.982		
1075.00	028	-007	047	0.066	0.079	-0.982	F9	7B
1076.25	028	-007	049	0.066	0.079	-0.982		
1077.50	027	-007	043	0.066	0.078	-0.982	F9	7B
1078.75	027	-007	042	0.066	0.078	-0.982		
1080.00	026	-007	040	0.066	0.078	-0.982	F9	7B
1081.25	026	-007	038	0.066	0.078	-0.982		
1082.50	026	-007	036	0.066	0.078	-0.982	F9	7B
1083.75	025	-007	034	0.066	0.071	-0.983		
1085.00	025	-006	032	0.066	0.071	-0.983	FA	7B
1086.25	025	-006	031	0.066	0.071	-0.983		
1087.50	024	-006	029	0.066	0.071	-0.983	FA	7B
1088.75	024	-006	027	0.066	0.071	-0.983		
1090.00	024	-006	025	0.066	0.071	-0.983	FA	7B
1091.25	023	-006	023	0.066	0.071	-0.983		
1092.50	023	-006	022	0.066	0.071	-0.983	FA	7B
1093.75	022	-006	020	0.066	0.071	-0.983		
1095.00	022	-006	018	0.066	0.071	-0.983	FA	7B
1096.25	022	-006	016	0.066	0.071	-0.983		
1097.50	021	-006	015	0.066	0.071	-0.983	FA	7B
1098.75	021	-006	013	0.067	0.070	-0.983		
1100.00	021	-006	011	0.067	0.070	-0.983	FA	7B
1101.25	020	-006	010	0.067	0.070	-0.983		
1102.50	020	-006	008	0.067	0.070	-0.983	FA	7B
1103.75	019	-006	007	0.067	0.070	-0.983		
1105.00	019	-006	005	0.067	0.070	-0.983	FA	7B
1106.25	018	-007	004	0.067	0.070	-0.983		
1107.50	018	-007	002	0.067	0.070	-0.983	FA	7B
1108.75	017	-007	000	0.067	0.070	-0.983		
1110.00	017	-007	-001	0.067	0.070	-0.983	FA	7B
1111.25	016	-007	-002	0.067	0.070	-0.983		
1112.50	016	-007	-004	0.067	0.070	-0.983	FA	7B
1113.75	015	-008	-005	0.067	0.070	-0.983		
1115.00	015	-008	-007	0.067	0.070	-0.983	FA	7B
1116.25	014	-008	-008	0.067	0.070	-0.983		
1117.50	014	-008	-010	0.067	0.070	-0.983	FA	7B
1118.75	013	-008	-011	0.059	0.070	-0.983		
1120.00	013	-008	-013	0.059	0.070	-0.983	FA	7C
1121.25	012	-008	-014	0.059	0.070	-0.983		
1122.50	012	-008	-016	0.059	0.070	-0.983	FA	7C
1123.75	011	-009	-017	0.059	0.070	-0.983		
1125.00	011	-009	-019	0.059	0.070	-0.983	FA	7C

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T	R	Q	P	DC1	DC2	DC3	RL. CMND	PC. CMND
1126.25	011	-009	-018	0.059	0.070	-0.983		
1127.50	012	-009	-017	0.059	0.070	-0.983	FA	7C
1128.75	012	-009	-016	0.059	0.070	-0.983		
1130.00	012	-010	-015	0.059	0.070	-0.983	FA	7C
1131.25	013	-010	-015	0.059	0.070	-0.983		
1132.50	013	-010	-014	0.059	0.070	-0.983	FA	7C
1133.75	013	-010	-013	0.059	0.070	-0.983		
1135.00	014	-010	-012	0.059	0.070	-0.983	FA	7C
1136.25	014	-010	-011	0.059	0.070	-0.983		
1137.50	014	-011	-011	0.059	0.070	-0.983	FA	7C
1138.75	015	-011	-010	0.059	0.070	-0.983		
1140.00	015	-011	-009	0.059	0.070	-0.983	FA	7C
1141.25	015	-011	-008	0.059	0.070	-0.983		
1142.50	016	-011	-007	0.059	0.070	-0.983	FA	7C
1143.75	016	-011	-006	0.059	0.070	-0.983		
1145.00	016	-011	-005	0.059	0.070	-0.983	FA	7C
1146.25	017	-011	-004	0.059	0.070	-0.983		
1147.50	017	-012	-004	0.059	0.070	-0.983	FA	7C
1148.75	018	-012	-003	0.059	0.070	-0.983		
1150.00	018	-012	-002	0.059	0.070	-0.983	FA	7C
1151.25	018	-012	-001	0.059	0.070	-0.983		
1152.50	019	-012	-000	0.059	0.070	-0.983	FA	7C
1153.75	019	-012	000	0.059	0.070	-0.983		
1155.00	019	-012	001	0.059	0.070	-0.983	FA	7C
1156.25	019	-012	002	0.059	0.070	-0.983		
1157.50	020	-012	003	0.059	0.070	-0.983	FA	7C
1158.75	020	-012	004	0.059	0.070	-0.983		
1160.00	020	-011	004	0.059	0.070	-0.983	FA	7C
1161.25	021	-011	005	0.060	0.069	-0.983		
1162.50	021	-011	006	0.060	0.069	-0.983	FA	7C
1163.75	021	-011	007	0.060	0.069	-0.983		
1165.00	021	-011	008	0.060	0.069	-0.983	FA	7C
1166.25	022	-011	009	0.052	0.069	-0.983		
1167.50	022	-011	009	0.052	0.069	-0.983	FA	7C
1168.75	022	-011	010	0.052	0.069	-0.983		
1170.00	023	-011	011	0.052	0.069	-0.983	FA	7C
1171.25	023	-011	011	0.052	0.069	-0.983		
1172.50	023	-011	012	0.052	0.069	-0.983	FA	7C
1173.75	024	-011	013	0.052	0.069	-0.983		
1175.00	024	-011	014	0.052	0.069	-0.983	FA	7C
1176.25	024	-011	014	0.052	0.069	-0.983		
1177.50	024	-011	014	0.052	0.069	-0.983	FA	7C
1178.75	024	-012	014	0.052	0.069	-0.983		
1180.00	024	-012	014	0.052	0.069	-0.983	FA	7C
1181.25	024	-012	014	0.052	0.069	-0.983		
1182.50	024	-012	014	0.053	0.069	-0.983	FA	7C
1183.75	024	-013	014	0.053	0.069	-0.983		
1185.00	024	-013	014	0.053	0.069	-0.983	FA	7C
1186.25	024	-013	014	0.053	0.069	-0.983		
1187.50	024	-013	014	0.053	0.069	-0.983	FA	7C
1188.75	024	-014	014	0.053	0.069	-0.983		
1190.00	024	-014	014	0.053	0.069	-0.983	FA	7C
1191.25	024	-014	015	0.053	0.069	-0.983		
1192.50	024	-014	015	0.053	0.069	-0.983	FA	7C
1193.75	024	-015	015	0.053	0.069	-0.983		
1195.00	024	-015	015	0.053	0.069	-0.983	FA	7C
1196.25	024	-015	015	0.053	0.069	-0.983		
1197.50	024	-015	015	0.053	0.061	-0.984	FB	7C
1198.75	024	-016	015	0.053	0.061	-0.984		
1200.00	024	-016	015	0.053	0.061	-0.984	FB	7C

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T	R	Q	P	DC1	DC2	DC3	ML. CMD	PC. CMD
1201.25	024	-016	014	0.053	0.061	-0.984		
1202.50	024	-016	014	0.053	0.061	-0.984	FB	7C
1203.75	023	-017	013	0.053	0.061	-0.984		
1205.00	023	-017	013	0.045	0.061	-0.984	FB	7D
1206.25	023	-017	012	0.045	0.061	-0.984		
1207.50	023	-017	012	0.045	0.061	-0.984	FB	7D
1208.75	023	-018	011	0.045	0.061	-0.984		
1210.00	023	-018	011	0.045	0.061	-0.984	FB	7D
1211.25	022	-018	010	0.045	0.061	-0.984		
1212.50	022	-018	010	0.045	0.061	-0.984	FB	7D
1213.75	022	-019	009	0.045	0.061	-0.984		
1215.00	022	-019	008	0.045	0.061	-0.984	FB	7D
1216.25	022	-019	008	0.045	0.061	-0.984		
1217.50	022	-019	007	0.045	0.061	-0.984	FB	7D
1218.75	021	-020	007	0.045	0.061	-0.984		
1220.00	021	-020	006	0.045	0.061	-0.984	FB	7D
1221.25	021	-020	006	0.045	0.061	-0.984		
1222.50	021	-020	005	0.045	0.061	-0.984	FB	7D
1223.75	021	-021	004	0.045	0.061	-0.984		
1225.00	021	-021	004	0.045	0.061	-0.984	FB	7D
1226.25	021	-021	004	0.046	0.061	-0.984		
1227.50	021	-021	004	0.046	0.061	-0.984	FB	7D
1228.75	021	-022	004	0.046	0.061	-0.984		
1230.00	021	-022	004	0.038	0.061	-0.984	FB	7D
1231.25	021	-022	004	0.038	0.061	-0.984		
1232.50	021	-023	004	0.038	0.061	-0.984	FB	7D
1233.75	021	-023	004	0.038	0.061	-0.984		
1235.00	021	-023	003	0.038	0.061	-0.984	FB	7D
1236.25	021	-023	003	0.038	0.061	-0.984		
1237.50	021	-024	003	0.038	0.061	-0.984	FB	7D
1238.75	021	-024	003	0.038	0.061	-0.984		
1240.00	021	-024	003	0.038	0.061	-0.984	FB	7D
1241.25	021	-025	003	0.038	0.061	-0.984		
1242.50	021	-025	003	0.038	0.061	-0.984	FB	7D
1243.75	021	-025	003	0.038	0.061	-0.984		
1245.00	021	-026	003	0.038	0.061	-0.984	FB	7D
1246.25	021	-026	003	0.038	0.061	-0.984		
1247.50	021	-026	003	0.038	0.061	-0.984	FB	7D
1248.75	021	-027	003	0.038	0.061	-0.984		
1250.00	021	-027	003	0.038	0.061	-0.984	FB	7D
1251.25	021	-027	003	0.031	0.061	-0.985		
1252.50	021	-027	003	0.031	0.061	-0.985	FB	7E
1253.75	021	-028	003	0.031	0.061	-0.985		
1255.00	021	-028	003	0.031	0.061	-0.985	FB	7E
1256.25	021	-028	003	0.031	0.061	-0.985		
1257.50	021	-028	003	0.031	0.061	-0.985	FB	7E
1258.75	021	-029	004	0.031	0.061	-0.985		
1260.00	020	-029	004	0.031	0.061	-0.985	FB	7E
1261.25	020	-029	004	0.031	0.061	-0.985		
1262.50	020	-030	004	0.031	0.061	-0.985	FB	7E
1263.75	020	-030	004	0.031	0.061	-0.985		
1265.00	020	-030	004	0.031	0.061	-0.985	FB	7E
1266.25	020	-030	004	0.031	0.061	-0.985		
1267.50	020	-031	004	0.031	0.061	-0.985	FB	7E
1268.75	020	-031	004	0.023	0.061	-0.985		
1270.00	020	-031	004	0.023	0.061	-0.985	FB	7E
1271.25	020	-031	005	0.023	0.061	-0.985		
1272.50	020	-032	005	0.023	0.061	-0.985	FB	7E
1273.75	020	-032	005	0.023	0.061	-0.985		
1275.00	020	-032	005	0.023	0.060	-0.985	FB	7E

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T	R	Q	P	DC1	DC2	DC3	RL.CMND	PC.CMND
1276.25	020	-032	005	0.023	0.060	-0.985		
1277.50	020	-032	005	0.023	0.060	-0.985	FB	7E
1278.75	021	-033	006	0.023	0.060	-0.985		
1280.00	021	-033	006	0.023	0.053	-0.985	FB	7E
1281.25	021	-033	006	0.023	0.053	-0.985		
1282.50	021	-034	006	0.023	0.053	-0.985	FB	7E
1283.75	021	-034	007	0.015	0.053	-0.985		
1285.00	021	-034	007	0.015	0.053	-0.985	FB	7F
1286.25	022	-035	007	0.015	0.053	-0.985		
1287.50	022	-035	007	0.015	0.053	-0.985	FB	7F
1288.75	022	-035	008	0.015	0.053	-0.985		
1290.00	022	-035	008	0.015	0.053	-0.985	FB	7F
1291.25	022	-036	008	0.015	0.053	-0.985		
1292.50	023	-036	008	0.015	0.053	-0.985	FB	7F
1293.75	023	-036	009	0.015	0.053	-0.985		
1295.00	023	-037	009	0.015	0.053	-0.985	FB	7F
1296.25	023	-037	009	0.015	0.053	-0.985		
1297.50	023	-037	009	0.008	0.053	-0.985	FB	7F
1298.75	024	-038	010	0.008	0.053	-0.985		
1300.00	024	-038	010	0.008	0.053	-0.985	FB	7F
1301.25	024	-038	011	0.008	0.053	-0.985		
1302.50	024	-038	011	0.008	0.053	-0.985	FB	7F
1303.75	024	-038	012	0.008	0.053	-0.985		
1305.00	024	-038	012	0.008	0.053	-0.985	FB	7F
1306.25	024	-038	013	0.008	0.053	-0.985		
1307.50	024	-038	013	0.008	0.053	-0.985	FB	7F
1308.75	024	-038	014	0.008	0.053	-0.985		
1310.00	024	-037	015	0.008	0.053	-0.985	FB	7F
1311.25	024	-037	015	0.000	0.053	-0.985		
1312.50	024	-037	016	0.000	0.053	-0.985	FB	7F
1313.75	024	-037	017	0.000	0.053	-0.985		
1315.00	024	-037	017	0.000	0.053	-0.985	FB	7F
1316.25	025	-037	018	0.000	0.053	-0.985		
1317.50	025	-037	018	0.000	0.053	-0.985	FB	7F
1318.75	025	-037	019	0.000	0.053	-0.985		
1320.00	025	-037	020	0.000	0.053	-0.985	FB	7F
1321.25	025	-037	020	0.000	0.053	-0.985		
1322.50	025	-037	021	0.000	0.053	-0.985	FB	7F
1323.75	025	-037	021	0.000	0.045	-0.986		
1325.00	025	-037	022	-0.007	0.045	-0.986	FC	80
1326.25	025	-037	022	-0.007	0.045	-0.986		
1327.50	024	-036	021	-0.007	0.045	-0.986	FC	80
1328.75	024	-036	021	-0.007	0.045	-0.986		
1330.00	024	-036	021	-0.007	0.045	-0.986	FC	80
1331.25	024	-036	021	-0.007	0.045	-0.986		
1332.50	024	-036	021	-0.007	0.045	-0.986	FC	80
1333.75	023	-035	021	-0.007	0.045	-0.986		
1335.00	023	-035	020	-0.007	0.045	-0.986	FC	80
1336.25	023	-035	020	-0.007	0.045	-0.986		
1337.50	023	-035	020	-0.007	0.045	-0.986	FC	80
1338.75	023	-035	020	-0.015	0.045	-0.986		
1340.00	022	-034	020	-0.015	0.045	-0.986	FC	80
1341.25	022	-034	019	-0.015	0.045	-0.986		
1342.50	022	-034	019	-0.015	0.045	-0.986	FC	80
1343.75	022	-034	019	-0.015	0.045	-0.986		
1345.00	021	-034	019	-0.015	0.045	-0.986	FC	80
1346.25	021	-033	019	-0.015	0.045	-0.986		
1347.50	021	-033	018	-0.015	0.037	-0.986	FC	80
1348.75	021	-033	018	-0.015	0.037	-0.986		
1350.00	021	-033	018	-0.015	0.037	-0.986	FC	80

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T	R	Q	P	DC1	DC2	DC3	BL. CMD	PC. CMD
1201.25	024	-016	014	0.053	0.061	-0.984		
1202.50	024	-016	014	0.053	0.061	-0.984	FB	7D
1203.75	023	-017	013	0.053	0.061	-0.984		
1205.00	023	-017	013	0.045	0.061	-0.984	FB	7D
1206.25	023	-017	012	0.045	0.061	-0.984		
1207.50	023	-017	012	0.045	0.061	-0.984	FB	7D
1208.75	023	-018	011	0.045	0.061	-0.984		
1210.00	023	-018	011	0.045	0.061	-0.984	FB	7D
1211.25	022	-018	010	0.045	0.061	-0.984		
1212.50	022	-018	010	0.045	0.061	-0.984	FB	7D
1213.75	022	-019	009	0.045	0.061	-0.984		
1215.00	022	-019	008	0.045	0.061	-0.984	FB	7D
1216.25	022	-019	008	0.045	0.061	-0.984		
1217.50	022	-019	007	0.045	0.061	-0.984	FB	7D
1218.75	021	-020	007	0.045	0.061	-0.984		
1220.00	021	-020	006	0.045	0.061	-0.984	FB	7D
1221.25	021	-020	006	0.045	0.061	-0.984		
1222.50	021	-020	005	0.045	0.061	-0.984	FB	7D
1223.75	021	-021	004	0.045	0.061	-0.984		
1225.00	021	-021	004	0.045	0.061	-0.984	FB	7D
1226.25	021	-021	004	0.046	0.061	-0.984		
1227.50	021	-021	004	0.046	0.061	-0.984	FB	7D
1228.75	021	-022	004	0.046	0.061	-0.984		
1230.00	021	-022	004	0.038	0.061	-0.984	FB	7D
1231.25	021	-022	004	0.038	0.061	-0.984		
1232.50	021	-023	004	0.038	0.061	-0.984	FB	7D
1233.75	021	-023	004	0.038	0.061	-0.984		
1235.00	021	-023	003	0.038	0.061	-0.984	FB	7D
1236.25	021	-023	003	0.038	0.061	-0.984		
1237.50	021	-024	003	0.038	0.061	-0.984	FB	7D
1238.75	021	-024	003	0.038	0.061	-0.984		
1240.00	021	-024	003	0.038	0.061	-0.984	FB	7D
1241.25	021	-025	003	0.038	0.061	-0.984		
1242.50	021	-025	003	0.038	0.061	-0.984	FB	7D
1243.75	021	-025	003	0.038	0.061	-0.984		
1245.00	021	-026	003	0.038	0.061	-0.984	FB	7D
1246.25	021	-026	003	0.038	0.061	-0.984		
1247.50	021	-026	003	0.038	0.061	-0.984	FB	7D
1248.75	021	-027	003	0.038	0.061	-0.984		
1250.00	021	-027	003	0.038	0.061	-0.984	FB	7D
1251.25	021	-027	003	0.031	0.061	-0.985		
1252.50	021	-027	003	0.031	0.061	-0.985	FB	7E
1253.75	021	-028	003	0.031	0.061	-0.985		
1255.00	021	-028	003	0.031	0.061	-0.985	FB	7E
1256.25	021	-028	003	0.031	0.061	-0.985		
1257.50	021	-028	003	0.031	0.061	-0.985	FB	7E
1258.75	021	-029	004	0.031	0.061	-0.985		
1260.00	020	-029	004	0.031	0.061	-0.985	FB	7E
1261.25	020	-029	004	0.031	0.061	-0.985		
1262.50	020	-030	004	0.031	0.061	-0.985	FB	7E
1263.75	020	-030	004	0.031	0.061	-0.985		
1265.00	020	-030	004	0.031	0.061	-0.985	FB	7E
1266.25	020	-030	004	0.031	0.061	-0.985		
1267.50	020	-031	004	0.031	0.061	-0.985	FB	7E
1268.75	020	-031	004	0.023	0.061	-0.985		
1270.00	020	-031	004	0.023	0.061	-0.985	FB	7E
1271.25	020	-031	005	0.023	0.061	-0.985		
1272.50	020	-032	005	0.023	0.061	-0.985	FB	7E
1273.75	020	-032	005	0.023	0.061	-0.985		
1275.00	020	-032	005	0.023	0.060	-0.985	FB	7E

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T	R	Q	P	DC1	DC2	DC3	RL.CMHD	PC.CMHD
1351.25	021	-033	018	-0.015	0.037	-0.986		
1352.50	021	-034	017	-0.015	0.037	-0.986	FC	80
1353.75	021	-034	017	-0.023	0.037	-0.986		
1355.00	021	-035	016	-0.023	0.037	-0.986	FC	81
1356.25	021	-035	016	-0.023	0.037	-0.986		
1357.50	021	-036	016	-0.023	0.037	-0.986	FC	81
1358.75	021	-036	015	-0.023	0.037	-0.986		
1360.00	022	-037	015	-0.023	0.037	-0.986	FC	81
1361.25	022	-037	015	-0.023	0.037	-0.986		
1362.50	022	-038	014	-0.023	0.037	-0.986	FC	81
1363.75	022	-039	014	-0.023	0.037	-0.986		
1365.00	022	-039	014	-0.023	0.037	-0.986	FC	81
1366.25	022	-040	013	-0.030	0.037	-0.985		
1367.50	022	-040	013	-0.030	0.037	-0.985	FC	81
1368.75	022	-041	013	-0.030	0.037	-0.985		
1370.00	022	-041	012	-0.030	0.037	-0.985	FC	81
1371.25	023	-042	012	-0.030	0.037	-0.985		
1372.50	023	-042	012	-0.030	0.037	-0.985	FC	81
1373.75	023	-043	011	-0.030	0.037	-0.985		
1375.00	023	-043	011	-0.030	0.037	-0.985	FC	81
1376.25	023	-043	011	-0.030	0.037	-0.985		
1377.50	023	-044	011	-0.030	0.037	-0.985	FC	81
1378.75	023	-045	012	-0.038	0.037	-0.985		
1380.00	024	-045	012	-0.038	0.037	-0.985	81	FB
1381.25	024	-046	012	-0.038	0.037	-0.985		
1382.50	024	-046	013	-0.038	0.030	-0.985	80	FB
1383.75	024	-047	013	-0.038	0.030	-0.985		
1385.00	024	-047	013	-0.038	0.030	-0.985	80	FB
1386.25	025	-048	014	-0.038	0.030	-0.985		
1387.50	025	-049	014	-0.038	0.030	-0.985	80	FB
1388.75	025	-049	014	-0.038	0.030	-0.985		
1390.00	025	-050	014	-0.046	0.030	-0.985	80	FB
1391.25	025	-050	015	-0.046	0.030	-0.985		
1392.50	026	-051	015	-0.046	0.030	-0.985	80	FB
1393.75	026	-051	015	-0.046	0.030	-0.985		
1395.00	026	-052	016	-0.046	0.030	-0.985	80	FB
1396.25	026	-052	016	-0.046	0.030	-0.985		
1397.50	026	-053	016	-0.046	0.030	-0.985	80	FB
1398.75	027	-053	017	-0.054	0.030	-0.985		
1400.00	027	-054	017	-0.054	0.030	-0.985	80	FA
1401.25	027	-055	017	-0.054	0.030	-0.985		
1402.50	027	-056	017	-0.054	0.030	-0.985	80	FA
1403.75	027	-057	017	-0.054	0.030	-0.985		
1405.00	027	-058	017	-0.054	0.030	-0.985	80	FA
1406.25	027	-058	017	-0.054	0.030	-0.985		
1407.50	027	-059	017	-0.054	0.030	-0.985	80	FA
1408.75	027	-060	017	-0.061	0.030	-0.984		
1410.00	027	-061	017	-0.061	0.030	-0.984	80	FA
1411.25	027	-062	017	-0.061	0.030	-0.984		
1412.50	027	-063	017	-0.061	0.030	-0.984	80	FA
1413.75	027	-064	017	-0.061	0.030	-0.984		
1415.00	027	-065	017	-0.061	0.023	-0.984	80	FA
1416.25	028	-065	018	-0.069	0.023	-0.984		
1417.50	028	-066	018	-0.069	0.023	-0.984	80	FA
1418.75	028	-067	018	-0.069	0.023	-0.984		
1420.00	028	-068	018	-0.069	0.023	-0.984	80	FA
1421.25	028	-069	018	-0.069	0.023	-0.984		
1422.50	028	-070	018	-0.069	0.023	-0.984	80	FA
1423.75	028	-071	018	-0.077	0.023	-0.983		
1425.00	028	-072	018	-0.077	0.023	-0.983	80	FA

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T	R	D	P	DC1	DC2	DC3	RL. C. 10	PO. 10
1426.25	028	-073	018	-0.077	0.023	-0.983	80	F8
1427.50	028	-074	018	-0.077	0.023	-0.983	80	F8
1428.75	028	-074	018	-0.077	0.023	-0.983	80	F8
1430.00	028	-075	018	-0.084	0.023	-0.983	80	F8
1431.25	028	-075	018	-0.084	0.023	-0.983	80	F8
1432.50	028	-077	018	-0.084	0.023	-0.983	80	F8
1433.75	029	-078	019	-0.084	0.023	-0.983	80	F8
1435.00	029	-079	019	-0.084	0.023	-0.983	80	F8
1436.25	029	-080	019	-0.084	0.023	-0.983	80	F8
1437.50	029	-080	019	-0.092	0.023	-0.982	80	F8
1438.75	029	-081	019	-0.092	0.024	-0.982	80	F8
1440.00	029	-082	019	-0.092	0.024	-0.982	80	F8
1441.25	029	-083	019	-0.092	0.024	-0.982	80	F8
1442.50	029	-084	019	-0.092	0.016	-0.982	80	F8
1443.75	029	-085	019	-0.099	0.016	-0.981	80	F7
1445.00	029	-085	019	-0.099	0.016	-0.981	80	F7
1446.25	030	-086	020	-0.099	0.016	-0.981	80	F7
1447.50	030	-087	020	-0.099	0.016	-0.981	80	F7
1448.75	030	-088	020	-0.107	0.016	-0.980	80	F7
1450.00	030	-089	020	-0.107	0.016	-0.980	80	F7
1451.25	030	-090	020	-0.107	0.016	-0.980	80	F7
1452.50	030	-090	020	-0.107	0.016	-0.980	80	F7
1453.75	030	-091	020	-0.107	0.016	-0.980	80	F6
1455.00	030	-092	020	-0.115	0.016	-0.980	80	F6
1456.25	030	-092	020	-0.115	0.017	-0.980	80	F6
1457.50	030	-093	021	-0.115	0.017	-0.980	80	F6
1458.75	030	-094	021	-0.115	0.017	-0.980	80	F6
1460.00	030	-095	021	-0.122	0.017	-0.979	80	F6
1461.25	030	-095	021	-0.122	0.017	-0.979	80	F6
1462.50	030	-096	021	-0.122	0.017	-0.979	80	F6
1463.75	030	-096	021	-0.122	0.017	-0.979	80	F5
1465.00	030	-097	021	-0.130	0.017	-0.978	80	F5
1466.25	030	-098	021	-0.130	0.017	-0.978	7F	F5
1467.50	030	-099	021	-0.130	0.010	-0.978	7F	F5
1468.75	030	-099	021	-0.130	0.010	-0.978	7F	F5
1470.00	030	-100	021	-0.138	0.010	-0.977	7F	F5
1471.25	030	-101	022	-0.138	0.010	-0.977	7F	F5
1472.50	030	-101	022	-0.138	0.011	-0.977	7F	F5
1473.75	030	-102	022	-0.138	0.011	-0.977	7F	F4
1475.00	030	-103	022	-0.146	0.011	-0.976	7F	F4
1476.25	030	-104	022	-0.146	0.011	-0.976	7F	F4
1477.50	030	-104	022	-0.146	0.011	-0.976	7F	F4
1478.75	030	-105	022	-0.146	0.011	-0.976	7F	F4
1480.00	030	-106	022	-0.153	0.011	-0.974	7F	F4
1481.25	030	-107	022	-0.153	0.011	-0.974	7F	F4
1482.50	031	-107	022	-0.153	0.011	-0.974	7F	F4
1483.75	031	-108	023	-0.153	0.011	-0.974	7F	F3
1485.00	031	-109	023	-0.161	0.011	-0.973	7F	F3
1486.25	031	-110	023	-0.161	0.011	-0.973	7F	F3
1487.50	031	-110	023	-0.161	0.011	-0.973	7F	F3
1488.75	031	-111	023	-0.169	0.011	-0.972	7F	F3
1490.00	031	-112	023	-0.169	0.004	-0.972	7F	F3
1491.25	031	-113	023	-0.169	0.004	-0.972	7F	F3
1492.50	031	-113	023	-0.169	0.004	-0.972	7F	F3
1493.75	032	-114	023	-0.176	0.004	-0.970	7F	F3
1495.00	032	-115	023	-0.176	0.004	-0.970	7F	F3
1496.25	032	-116	024	-0.176	0.004	-0.970	7F	F3
1497.50	032	-117	024	-0.184	0.004	-0.969	7F	F3
1498.75	032	-117	024	-0.184	0.004	-0.969	7F	F3
1500.00	032	-118	024	-0.184	0.004	-0.969	7F	F3

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T	R	Q	P	DC1	DC2	DC3	RL CMD	PC CMD
1351.25	021	-033	018	-0.015	0.037	-0.986		
1352.50	021	-034	017	-0.015	0.037	-0.986	FC	80
1353.75	021	-034	017	-0.023	0.037	-0.986		
1355.00	021	-035	016	-0.023	0.037	-0.986	FC	81
1356.25	021	-035	016	-0.023	0.037	-0.986		
1357.50	021	-036	016	-0.023	0.037	-0.986	FC	81
1358.75	021	-036	015	-0.023	0.037	-0.986		
1360.00	022	-037	015	-0.023	0.037	-0.986	FC	81
1361.25	022	-037	015	-0.023	0.037	-0.986		
1362.50	022	-038	014	-0.023	0.037	-0.986	FC	81
1363.75	022	-039	014	-0.023	0.037	-0.986		
1365.00	022	-039	014	-0.023	0.037	-0.986	FC	81
1366.25	022	-040	013	-0.030	0.037	-0.985		
1367.50	022	-040	013	-0.030	0.037	-0.985	FC	81
1368.75	022	-041	013	-0.030	0.037	-0.985		
1370.00	022	-041	012	-0.030	0.037	-0.985	FC	81
1371.25	023	-042	012	-0.030	0.037	-0.985		
1372.50	023	-042	012	-0.030	0.037	-0.985	FC	81
1373.75	023	-043	011	-0.030	0.037	-0.985		
1375.00	023	-043	011	-0.030	0.037	-0.985	FC	81
1376.25	023	-043	011	-0.030	0.037	-0.985		
1377.50	023	-044	011	-0.030	0.037	-0.985	FC	81
1378.75	023	-045	012	-0.038	0.037	-0.985		
1380.00	024	-045	012	-0.038	0.037	-0.985	81	FB
1381.25	024	-046	012	-0.038	0.037	-0.985		
1382.50	024	-046	013	-0.038	0.030	-0.985	80	FB
1383.75	024	-047	013	-0.038	0.030	-0.985		
1385.00	024	-047	013	-0.038	0.030	-0.985	80	FB
1386.25	025	-048	014	-0.038	0.030	-0.985		
1387.50	025	-049	014	-0.038	0.030	-0.985	80	FB
1388.75	025	-049	014	-0.038	0.030	-0.985		
1390.00	025	-050	014	-0.046	0.030	-0.985	80	FB
1391.25	025	-050	015	-0.046	0.030	-0.985		
1392.50	026	-051	015	-0.046	0.030	-0.985	80	FB
1393.75	026	-051	015	-0.046	0.030	-0.985		
1395.00	026	-052	016	-0.046	0.030	-0.985	80	FB
1396.25	026	-052	016	-0.046	0.030	-0.985		
1397.50	026	-053	016	-0.046	0.030	-0.985	80	FB
1398.75	027	-053	017	-0.054	0.030	-0.985		
1400.00	027	-054	017	-0.054	0.030	-0.985	80	FA
1401.25	027	-055	017	-0.054	0.030	-0.985		
1402.50	027	-056	017	-0.054	0.030	-0.985	80	FA
1403.75	027	-057	017	-0.054	0.030	-0.985		
1405.00	027	-058	017	-0.054	0.030	-0.985	80	FA
1406.25	027	-058	017	-0.054	0.030	-0.985		
1407.50	027	-059	017	-0.054	0.030	-0.985	80	FA
1408.75	027	-060	017	-0.061	0.030	-0.984		
1410.00	027	-061	017	-0.061	0.030	-0.984	80	FA
1411.25	027	-062	017	-0.061	0.030	-0.984		
1412.50	027	-063	017	-0.061	0.030	-0.984	80	FA
1413.75	027	-064	017	-0.061	0.030	-0.984		
1415.00	027	-065	017	-0.061	0.023	-0.984	80	FA
1416.25	028	-065	018	-0.069	0.023	-0.984		
1417.50	028	-065	018	-0.069	0.023	-0.984	80	FA
1418.75	028	-067	018	-0.069	0.023	-0.984		
1420.00	028	-068	018	-0.069	0.023	-0.984	80	FA
1421.25	028	-069	018	-0.069	0.023	-0.984		
1422.50	028	-070	018	-0.069	0.023	-0.984	80	FA
1423.75	028	-071	018	-0.077	0.023	-0.983		
1425.00	028	-072	018	-0.077	0.023	-0.983	80	FA

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T	R	Q	P	DC1	DC2	DC3	RL. CORR	PC. CORR
1426.25	028	-073	018	-0.077	0.023	-0.983		
1427.50	028	-074	018	-0.077	0.023	-0.983	30	F6
1428.75	028	-074	018	-0.077	0.023	-0.983		
1430.00	028	-075	018	-0.084	0.023	-0.983	30	F6
1431.25	028	-075	018	-0.084	0.023	-0.983		
1432.50	028	-077	018	-0.084	0.023	-0.983	30	F6
1433.75	029	-078	019	-0.084	0.023	-0.983		
1435.00	029	-079	019	-0.084	0.023	-0.983	30	F6
1436.25	029	-080	019	-0.084	0.023	-0.983		
1437.50	029	-080	019	-0.092	0.023	-0.982	30	F6
1438.75	029	-081	019	-0.092	0.024	-0.982		
1440.00	029	-082	019	-0.092	0.024	-0.982	30	F6
1441.25	029	-083	019	-0.092	0.024	-0.982		
1442.50	029	-084	019	-0.092	0.016	-0.982	30	F6
1443.75	029	-085	019	-0.099	0.016	-0.981		
1445.00	029	-085	019	-0.099	0.016	-0.981	30	F7
1446.25	030	-086	020	-0.099	0.016	-0.981		
1447.50	030	-087	020	-0.099	0.016	-0.981	30	F7
1448.75	030	-088	020	-0.107	0.016	-0.980		
1450.00	030	-089	020	-0.107	0.016	-0.980	30	F7
1451.25	030	-090	020	-0.107	0.016	-0.980		
1452.50	030	-090	020	-0.107	0.016	-0.980	30	F7
1453.75	030	-091	020	-0.107	0.016	-0.980		
1455.00	030	-092	020	-0.115	0.016	-0.980	30	F6
1456.25	030	-092	020	-0.115	0.017	-0.980		
1457.50	030	-093	021	-0.115	0.017	-0.980	30	F6
1458.75	030	-094	021	-0.115	0.017	-0.980		
1460.00	030	-095	021	-0.122	0.017	-0.979	30	F6
1461.25	030	-095	021	-0.122	0.017	-0.979		
1462.50	030	-096	021	-0.122	0.017	-0.979	30	F6
1463.75	030	-096	021	-0.122	0.017	-0.979		
1465.00	030	-097	021	-0.130	0.017	-0.978	30	F5
1466.25	030	-098	021	-0.130	0.017	-0.978		
1467.50	030	-099	021	-0.130	0.010	-0.978	7F	F5
1468.75	030	-099	021	-0.130	0.010	-0.978		
1470.00	030	-100	021	-0.138	0.010	-0.977	7F	F5
1471.25	030	-101	022	-0.138	0.010	-0.977		
1472.50	030	-101	022	-0.138	0.011	-0.977	7F	F5
1473.75	030	-102	022	-0.138	0.011	-0.977		
1475.00	030	-103	022	-0.146	0.011	-0.976	7F	F4
1476.25	030	-104	022	-0.146	0.011	-0.976		
1477.50	030	-104	022	-0.146	0.011	-0.976	7F	F4
1478.75	030	-105	022	-0.146	0.011	-0.976		
1480.00	030	-106	022	-0.153	0.011	-0.974	7F	F4
1481.25	030	-107	022	-0.153	0.011	-0.974		
1482.50	031	-107	022	-0.153	0.011	-0.974	7F	F4
1483.75	031	-108	023	-0.153	0.011	-0.974		
1485.00	031	-109	023	-0.161	0.011	-0.973	7F	F3
1486.25	031	-110	023	-0.161	0.011	-0.973		
1487.50	031	-110	023	-0.161	0.011	-0.973	7F	F3
1488.75	031	-111	023	-0.169	0.011	-0.972		
1490.00	031	-112	023	-0.169	0.004	-0.972	7F	F3
1491.25	031	-113	023	-0.169	0.004	-0.972		
1492.50	031	-113	023	-0.169	0.004	-0.972	7F	F3
1493.75	032	-114	023	-0.176	0.004	-0.970		
1495.00	032	-115	023	-0.176	0.004	-0.970	7F	F3
1496.25	032	-115	024	-0.176	0.004	-0.970		
1497.50	032	-117	024	-0.184	0.004	-0.969	7F	F3
1498.75	032	-117	024	-0.184	0.004	-0.969		
1500.00	032	-118	024	-0.184	0.004	-0.969	7F	F3

A.2 Vertical Seeking Maneuver - 180° Roll Test

REPORT NO. NADC-79240-60

T	R	Q	P	DC1	DC2	DC3	RL.CMND	PC.CMND
0.00	0	0	0	0.000	0.000	1.000		
0001.25	-000	000	000	0.000	0.000	1.000		
0002.50	-001	000	000	0.000	0.000	1.000	7F	7F
0003.75	-001	000	000	0.000	0.000	1.000		
0005.00	-001	001	000	0.000	0.000	1.000	7F	7F
0006.25	-002	001	000	0.000	0.000	1.000		
0007.50	-002	001	000	0.000	0.000	1.000	7F	7F
0008.75	-002	001	001	0.000	0.000	1.000		
0010.00	-003	001	001	0.000	0.000	1.000	7F	7F
0011.25	-003	002	001	0.000	0.000	1.000		
0012.50	-003	002	001	0.000	0.000	1.000	7F	7F
0013.75	-004	002	001	0.000	0.000	1.000		
0015.00	-004	002	001	0.000	0.000	1.000	7F	7F
0016.25	-004	002	001	0.000	0.000	1.000		
0017.50	-005	003	001	0.000	0.000	1.000	7F	7F
0018.75	-005	003	001	0.000	0.000	1.000		
0020.00	-005	003	001	0.000	0.000	1.000	7F	7F
0021.25	-006	003	002	0.000	0.000	1.000		
0022.50	-006	003	002	0.000	0.000	1.000	7F	7F
0023.75	-007	004	002	0.000	0.000	1.000		
0025.00	-007	004	002	0.000	0.000	1.000	7F	7F
0026.25	-007	004	003	0.000	0.000	1.000		
0027.50	-007	004	005	0.000	0.000	1.000	7F	7F
0028.75	-007	004	006	0.000	0.000	1.000		
0030.00	-007	005	008	0.000	0.000	1.000	7F	7F
0031.25	-007	005	009	0.000	0.000	1.000		
0032.50	-007	005	010	0.000	0.000	1.000	7F	7F
0033.75	-007	005	012	0.000	0.000	1.000		
0035.00	-007	005	013	0.000	0.000	1.000	7F	7F
0036.25	-007	006	014	0.000	0.000	1.000		
0037.50	-007	006	016	0.000	0.000	1.000	7F	7F
0038.75	-007	006	017	0.000	0.000	1.000		
0040.00	-007	006	019	0.000	0.000	1.000	7F	7F
0041.25	-007	006	020	0.000	0.000	1.000		
0042.50	-007	007	021	0.000	0.000	1.000	7F	7F
0043.75	-007	007	023	0.000	0.000	1.000		
0045.00	-007	007	024	0.000	0.000	1.000	7F	7F
0046.25	-007	007	026	0.000	0.000	1.000		
0047.50	-007	007	027	0.000	0.000	1.000	7F	7F
0048.75	-007	008	028	0.000	0.000	1.000		
0050.00	-007	008	030	0.000	0.000	1.000	7F	7F
0051.25	-006	008	033	0.000	0.000	1.000		
0052.50	-005	008	036	0.000	0.000	1.000	7F	7F
0053.75	-004	008	039	0.000	0.008	1.000		
0055.00	-003	009	042	0.000	0.008	1.000	7F	7F
0056.25	-002	009	045	0.000	0.008	1.000		
0057.50	-001	009	048	0.000	0.008	1.000	7F	7F
0058.75	-000	009	051	0.000	0.008	1.000		
0060.00	001	009	054	0.000	0.008	1.000	7F	7F
0061.25	002	009	057	0.000	0.008	1.000		
0062.50	003	010	060	0.000	0.008	1.000	7F	7F
0063.75	003	010	064	0.000	0.016	1.000		
0065.00	004	010	066	0.000	0.016	1.000	80	7F
0066.25	005	010	070	0.000	0.016	1.000		
0067.50	006	010	073	0.000	0.016	1.000	80	7F
0068.75	007	010	076	0.000	0.016	1.000		
0070.00	008	010	079	0.000	0.016	1.000	80	7F
0071.25	009	011	082	0.000	0.023	1.000		
0072.50	010	011	086	0.000	0.023	1.000	80	7F
0073.75	011	011	088	0.000	0.023	1.000		
0075.00	012	011	091	0.000	0.023	1.000	80	7F

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T	R	Q	P	DC1	DC2	DC3	RL.CMND	PC.CMND
0076.25	013	011	094	0.000	0.023	1.000		
0077.50	014	011	097	0.000	0.031	1.000	80	7F
0078.75	015	011	100	0.000	0.031	1.000		
0080.00	016	012	103	0.000	0.031	1.000	80	7F
0081.25	017	012	106	0.000	0.031	1.000		
0082.50	018	012	109	-0.008	0.039	1.000	81	80
0083.75	019	012	113	-0.008	0.039	1.000		
0085.00	020	012	116	-0.008	0.039	1.000	81	80
0086.25	021	013	119	-0.008	0.046	0.999		
0087.50	022	013	122	-0.008	0.046	0.999	81	80
0088.75	023	013	125	-0.008	0.046	0.999		
0090.00	024	013	128	-0.008	0.054	0.999	82	80
0091.25	025	013	131	-0.008	0.054	0.999		
0092.50	026	014	134	-0.008	0.054	0.999	82	80
0093.75	027	014	138	-0.008	0.062	0.999		
0095.00	028	014	140	-0.008	0.062	0.999	82	80
0095.25	029	014	144	-0.008	0.062	0.999		
0097.50	030	014	147	-0.008	0.069	0.998	83	80
0098.75	031	015	150	-0.008	0.069	0.998		
0100.00	032	015	153	-0.008	0.069	0.998	83	80
0101.25	033	015	156	-0.008	0.077	0.998		
0102.50	034	015	159	-0.008	0.077	0.998	83	80
0103.75	035	015	162	-0.008	0.077	0.998		
0105.00	036	015	166	-0.007	0.085	0.997	84	80
0106.25	037	016	169	-0.007	0.085	0.997		
0107.50	038	016	172	-0.007	0.093	0.997	84	80
0108.75	039	016	175	-0.007	0.093	0.997		
0110.00	040	016	179	-0.007	0.100	0.996	85	80
0111.25	041	016	182	-0.007	0.100	0.996		
0112.50	042	016	185	-0.007	0.108	0.995	85	80
0113.75	043	017	188	-0.007	0.108	0.995		
0115.00	044	017	191	-0.007	0.108	0.995	85	80
0116.25	045	017	194	-0.015	0.116	0.995		
0117.50	046	017	198	-0.014	0.116	0.995	85	80
0118.75	047	017	201	-0.014	0.124	0.994		
0120.00	048	017	204	-0.014	0.124	0.994	86	80
0121.25	049	017	207	-0.014	0.131	0.993		
0122.50	050	018	211	-0.014	0.131	0.993	87	80
0123.75	051	018	214	-0.014	0.139	0.992		
0125.00	052	018	217	-0.014	0.147	0.991	88	80
0126.25	053	017	221	-0.014	0.147	0.991		
0127.50	054	017	225	-0.013	0.154	0.990	88	80
0128.75	055	016	229	-0.013	0.154	0.990		
0130.00	056	016	233	-0.013	0.162	0.989	89	80
0131.25	057	016	237	-0.013	0.162	0.989		
0132.50	058	015	242	-0.013	0.170	0.988	89	80
0133.75	059	015	246	-0.013	0.177	0.986		
0135.00	060	014	250	-0.013	0.177	0.986	8A	80
0136.25	061	014	254	-0.012	0.185	0.985		
0137.50	062	013	258	-0.012	0.185	0.985	8A	80
0138.75	063	013	262	-0.012	0.193	0.984		
0140.00	064	012	265	-0.012	0.200	0.982	8B	80
0141.25	065	012	270	-0.012	0.200	0.982		
0142.50	066	011	274	-0.012	0.208	0.981	8C	80
0143.75	067	011	278	-0.012	0.216	0.979		
0145.00	068	011	283	-0.010	0.216	0.979	8C	80
0146.25	069	010	287	-0.010	0.223	0.978		
0147.50	070	010	291	-0.010	0.231	0.976	8D	80
0148.75	071	009	295	-0.010	0.238	0.974		
0150.00	072	009	299	-0.010	0.238	0.974	8E	80

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T	R	Q	P	DC1	DC2	DC3	BL. CMD	PO. DIV
0151.25	073	008	302	-0.016	0.246	0.972		
0152.50	074	008	306	-0.016	0.254	0.970	8F	71
0153.75	075	007	309	-0.016	0.261	0.968		
0155.00	076	007	312	-0.016	0.261	0.968	8F	81
0156.25	077	006	315	-0.016	0.269	0.966		
0157.50	078	006	319	-0.016	0.276	0.964	90	81
0158.75	079	005	322	-0.014	0.284	0.962		
0160.00	080	004	325	-0.014	0.291	0.960	91	80
0161.25	081	004	328	-0.014	0.291	0.960		
0162.50	082	003	331	-0.014	0.299	0.958	92	80
0163.75	083	003	335	-0.014	0.306	0.956		
0165.00	084	002	338	-0.011	0.314	0.953	93	80
0166.25	085	002	341	-0.011	0.321	0.951		
0167.50	086	001	344	-0.011	0.322	0.948	94	80
0168.75	087	001	348	-0.011	0.328	0.948		
0170.00	088	000	351	-0.009	0.336	0.946	94	80
0171.25	089	-000	354	-0.009	0.343	0.943		
0172.50	090	-001	357	-0.009	0.350	0.941	95	80
0173.75	091	-001	361	-0.009	0.358	0.938		
0175.00	092	-002	364	-0.009	0.365	0.935	96	80
0176.25	093	-002	367	-0.006	0.372	0.932		
0177.50	094	-003	369	-0.006	0.379	0.930	97	80
0178.75	095	-003	372	-0.006	0.387	0.927		
0180.00	096	-004	374	-0.006	0.394	0.924	98	80
0181.25	097	-004	377	-0.003	0.401	0.921		
0182.50	098	-005	380	-0.003	0.401	0.921	98	80
0183.75	099	-005	383	-0.003	0.408	0.918		
0185.00	100	-006	385	-0.003	0.415	0.915	99	80
0186.25	101	-006	388	0.000	0.422	0.911		
0187.50	102	-007	391	0.000	0.429	0.908	9A	7F
0188.75	103	-008	393	0.000	0.436	0.905		
0190.00	104	-008	396	0.000	0.443	0.901	9B	7F
0191.25	105	-009	398	0.004	0.450	0.898		
0192.50	106	-009	401	0.004	0.457	0.895	9C	7F
0193.75	107	-010	404	0.004	0.464	0.891		
0195.00	108	-010	406	0.004	0.471	0.888	9D	7F
0196.25	109	-011	409	0.007	0.478	0.884		
0197.50	110	-011	412	0.007	0.485	0.880	9E	7F
0198.75	111	-011	414	0.007	0.492	0.876		
0200.00	112	-012	417	0.007	0.498	0.873	9E	7F
0201.25	112	-012	415	0.011	0.505	0.869		
0202.50	111	-013	413	0.011	0.512	0.865	9F	7F
0203.75	111	-013	411	0.011	0.518	0.861		
0205.00	111	-014	409	0.015	0.525	0.857	A0	7F
0206.25	111	-014	407	0.015	0.532	0.853		
0207.50	111	-015	405	0.015	0.538	0.849	A1	7F
0208.75	110	-015	403	0.015	0.545	0.845		
0210.00	110	-016	401	0.019	0.551	0.841	A2	7E
0211.25	110	-016	399	0.019	0.558	0.836		
0212.50	110	-017	397	0.019	0.564	0.832	A3	7E
0213.75	110	-018	395	0.024	0.570	0.828		
0215.00	109	-018	394	0.024	0.577	0.823	A3	7E
0216.25	109	-019	392	0.024	0.583	0.819		
0217.50	109	-019	390	0.024	0.589	0.814	A4	7E
0218.75	109	-020	388	0.028	0.596	0.810		
0220.00	109	-020	386	0.028	0.602	0.805	A5	7E
0221.25	108	-021	384	0.028	0.608	0.801		
0222.50	108	-021	382	0.028	0.614	0.796	A6	7E
0223.75	108	-021	380	0.033	0.620	0.791		
0225.00	108	-022	378	0.033	0.626	0.786	A7	7D

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T	R	Q	P	DC1	DC2	DC3	RL. CMHD	PC. CMHD
0224.25	108	-022	376	0.039	0.632	0.781		
0227.50	107	-023	374	0.044	0.638	0.776	A7	7D
0229.75	107	-024	372	0.044	0.644	0.771		
0230.00	106	-024	370	0.044	0.650	0.766	A8	7D
0231.25	106	-025	368	0.044	0.656	0.761		
0232.50	106	-025	366	0.049	0.661	0.756	A9	7C
0233.75	106	-025	364	0.049	0.667	0.751		
0235.00	105	-026	362	0.049	0.673	0.746	AA	7C
0236.25	105	-027	360	0.049	0.679	0.741		
0237.50	105	-028	358	0.054	0.684	0.736	AA	7C
0238.75	104	-028	356	0.054	0.690	0.730		
0240.00	104	-029	354	0.054	0.690	0.730	AB	7C
0241.25	103	-029	352	0.054	0.695	0.725		
0242.50	103	-030	350	0.060	0.701	0.720	AB	7C
0243.75	103	-030	348	0.060	0.706	0.714		
0245.00	102	-031	346	0.065	0.712	0.708	AC	7B
0246.25	102	-031	344	0.071	0.717	0.703		
0247.50	102	-032	342	0.071	0.722	0.698	AD	7B
0248.75	101	-032	340	0.071	0.727	0.692		
0250.00	101	-033	338	0.071	0.727	0.692	AD	7B
0251.25	101	-033	338	0.076	0.732	0.686		
0252.50	101	-034	338	0.076	0.737	0.681	AE	7B
0253.75	101	-035	339	0.076	0.743	0.675		
0255.00	101	-035	339	0.076	0.748	0.669	AE	7B
0256.25	101	-036	339	0.082	0.752	0.663		
0257.50	101	-036	339	0.082	0.752	0.663	AF	7A
0258.75	101	-037	339	0.082	0.757	0.658		
0260.00	100	-037	340	0.087	0.762	0.651	AF	7A
0261.25	100	-038	340	0.093	0.767	0.645		
0262.50	100	-039	340	0.093	0.772	0.639	BO	7A
0263.75	100	-039	340	0.093	0.777	0.633		
0265.00	100	-040	340	0.093	0.781	0.627	B1	7A
0266.25	100	-040	340	0.099	0.781	0.627		
0267.50	100	-041	341	0.099	0.786	0.621	B1	79
0268.75	100	-041	341	0.099	0.790	0.615		
0270.00	100	-042	341	0.099	0.795	0.609	B1	79
0271.25	100	-042	341	0.105	0.799	0.603		
0272.50	100	-043	341	0.109	0.804	0.596	B2	78
0273.75	100	-043	342	0.109	0.808	0.590		
0275.00	100	-044	342	0.109	0.808	0.590	B2	78
0276.25	100	-044	343	0.116	0.812	0.584		
0277.50	101	-045	343	0.116	0.816	0.577	B3	78
0278.75	101	-046	344	0.116	0.821	0.571		
0280.00	102	-046	345	0.116	0.825	0.565	B3	78
0281.25	102	-047	345	0.122	0.828	0.558		
0282.50	103	-048	346	0.122	0.833	0.552	B4	78
0283.75	103	-048	347	0.126	0.833	0.551		
0285.00	104	-049	347	0.126	0.837	0.545	B4	77
0286.25	104	-049	348	0.133	0.840	0.538		
0287.50	105	-050	349	0.133	0.844	0.532	B5	77
0288.75	106	-051	349	0.133	0.848	0.525		
0290.00	106	-051	350	0.133	0.852	0.518	B5	77
0291.25	106	-052	350	0.139	0.855	0.512		
0292.50	107	-052	351	0.139	0.859	0.505	B5	77
0293.75	107	-053	352	0.143	0.859	0.504		
0295.00	108	-053	352	0.143	0.863	0.498	B5	76
0296.25	108	-054	353	0.150	0.865	0.491		
0297.50	109	-055	354	0.150	0.869	0.484	B6	75
0298.75	109	-055	354	0.150	0.873	0.478		
0300.00	110	-056	355	0.157	0.875	0.471	B7	75

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T	R	Q	P	DC1	DC2	DC3	RL CMD	PC. 0000
0301.25	110	-056	353	0.157	0.879	0.464		
0302.50	110	-057	351	0.160	0.882	0.456	B7	75
0303.75	110	-057	349	0.160	0.886	0.449		
0305.00	109	-058	348	0.167	0.885	0.449	B7	75
0306.25	109	-058	346	0.167	0.888	0.442		
0307.50	109	-059	344	0.167	0.891	0.435	B8	75
0308.75	109	-059	342	0.167	0.895	0.428		
0310.00	109	-060	340	0.174	0.897	0.422	B8	74
0311.25	109	-060	338	0.177	0.900	0.413		
0312.50	109	-061	336	0.177	0.903	0.406	B8	74
0313.75	109	-062	334	0.184	0.902	0.406		
0315.00	109	-062	333	0.184	0.905	0.399	B8	74
0316.25	109	-063	331	0.184	0.908	0.392		
0317.50	108	-063	329	0.184	0.911	0.385	B9	74
0318.75	108	-064	327	0.194	0.912	0.377		
0320.00	108	-064	325	0.194	0.915	0.370	B9	73
0321.25	108	-064	323	0.194	0.915	0.370		
0322.50	108	-065	321	0.194	0.918	0.363	B9	73
0323.75	108	-065	320	0.201	0.919	0.356		
0325.00	108	-066	318	0.201	0.922	0.349	B9	73
0326.25	107	-067	316	0.201	0.924	0.341		
0327.50	107	-067	314	0.211	0.923	0.340	BA	72
0328.75	107	-068	312	0.211	0.925	0.333		
0330.00	106	-069	310	0.211	0.928	0.326	BA	72
0331.25	106	-070	309	0.211	0.930	0.318		
0332.50	106	-070	307	0.218	0.931	0.311	BA	72
0333.75	105	-071	305	0.221	0.931	0.310		
0335.00	105	-072	303	0.221	0.933	0.302	BA	71
0336.25	104	-073	301	0.221	0.936	0.295		
0337.50	104	-074	299	0.228	0.936	0.288	BA	71
0338.75	104	-074	298	0.228	0.936	0.288		
0340.00	103	-075	296	0.228	0.938	0.281	BB	71
0341.25	103	-076	294	0.230	0.940	0.272		
0342.50	102	-076	292	0.237	0.940	0.264	BB	70
0343.75	102	-077	290	0.237	0.940	0.264		
0345.00	102	-078	288	0.237	0.942	0.257	BB	70
0346.25	101	-079	287	0.237	0.944	0.250		
0347.50	101	-079	285	0.246	0.942	0.248	BB	70
0348.75	100	-080	283	0.246	0.944	0.241		
0350.00	100	-081	281	0.246	0.946	0.233	BB	70
0351.25	100	-082	282	0.246	0.948	0.226		
0352.50	101	-083	284	0.254	0.946	0.226	BB	6F
0353.75	101	-083	285	0.255	0.947	0.217		
0355.00	102	-084	287	0.255	0.949	0.209	BB	6F
0356.25	102	-085	288	0.263	0.947	0.209		
0357.50	103	-086	289	0.263	0.948	0.202	BB	6F
0358.75	103	-086	291	0.263	0.950	0.195		
0360.00	104	-087	292	0.264	0.951	0.185	BB	6F
0361.25	104	-088	294	0.271	0.949	0.185		
0362.50	105	-089	295	0.271	0.951	0.178	BB	6E
0363.75	105	-090	296	0.271	0.952	0.171		
0365.00	105	-091	298	0.272	0.953	0.161	BC	6E
0366.25	106	-091	299	0.280	0.951	0.161		
0367.50	106	-092	301	0.280	0.952	0.154	BB	6E
0368.75	107	-093	302	0.280	0.953	0.147		
0370.00	107	-094	303	0.280	0.954	0.139	BC	6E
0371.25	107	-095	305	0.288	0.952	0.137		
0372.50	108	-095	306	0.288	0.953	0.130	BC	6D
0373.75	108	-096	308	0.288	0.954	0.122		
0375.00	109	-097	309	0.288	0.955	0.115	BC	6D

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T	R	Q	P	DC1	DC2	DC3	RL. CMND	PC. CMND
0374.25	110	-097	309	0.296	0.953	0.113		
0377.50	111	-093	309	0.296	0.953	0.105	BC	6D
0379.75	112	-099	309	0.296	0.954	0.098		
0380.00	114	-099	308	0.304	0.953	0.091	BB	6C
0381.25	115	-100	308	0.304	0.953	0.081		
0382.50	116	-100	308	0.304	0.953	0.081	BC	6C
0383.75	117	-101	308	0.304	0.954	0.074		
0385.00	118	-101	308	0.312	0.952	0.066	BB	6C
0386.25	119	-102	308	0.312	0.952	0.057		
0387.50	120	-103	308	0.312	0.952	0.057	BB	6C
0388.75	122	-103	307	0.319	0.950	0.049		
0390.00	123	-104	307	0.319	0.950	0.042	BB	6B
0391.25	124	-104	307	0.319	0.951	0.032		
0392.50	125	-105	307	0.327	0.948	0.032	BB	6B
0393.75	126	-105	307	0.327	0.948	0.025		
0395.00	127	-106	307	0.327	0.948	0.018	BB	6B
0396.25	128	-106	306	0.334	0.946	0.008		
0397.50	130	-107	306	0.334	0.946	0.000	BB	6A
0398.75	131	-107	306	0.334	0.946	0.000		
0400.00	132	-108	306	0.334	0.946	-0.009	C2	6A
0401.25	131	-108	303	0.341	0.943	-0.017		
0402.50	130	-109	301	0.341	0.943	-0.024	C2	6A
0403.75	130	-109	298	0.341	0.943	-0.024		
0405.00	129	-109	296	0.348	0.940	-0.034	C2	69
0406.25	128	-110	294	0.348	0.940	-0.041		
0407.50	127	-110	291	0.348	0.939	-0.049	C2	69
0408.75	127	-110	289	0.355	0.936	-0.049		
0410.00	126	-111	286	0.355	0.936	-0.058	C3	69
0411.25	125	-111	284	0.355	0.935	-0.066		
0412.50	124	-111	281	0.362	0.933	-0.066	C3	68
0413.75	124	-112	279	0.362	0.932	-0.076		
0415.00	123	-112	277	0.362	0.931	-0.083	C3	68
0416.25	122	-112	274	0.369	0.928	-0.090		
0417.50	121	-113	272	0.369	0.928	-0.090	C3	68
0418.75	121	-113	269	0.368	0.927	-0.100		
0420.00	120	-113	267	0.375	0.923	-0.107	C3	67
0421.25	119	-114	264	0.375	0.923	-0.107		
0422.50	118	-114	262	0.374	0.922	-0.117	C3	68
0423.75	117	-115	259	0.374	0.921	-0.125		
0425.00	117	-115	257	0.381	0.918	-0.125	C4	67
0426.25	117	-115	256	0.381	0.917	-0.132		
0427.50	116	-116	255	0.380	0.916	-0.142	C4	67
0428.75	116	-117	254	0.387	0.913	-0.142		
0430.00	116	-117	253	0.387	0.912	-0.149	C4	67
0431.25	116	-118	252	0.386	0.912	-0.152		
0432.50	115	-118	250	0.386	0.911	-0.159	C4	67
0433.75	115	-119	249	0.393	0.906	-0.166		
0435.00	115	-119	248	0.393	0.906	-0.166	C4	66
0436.25	115	-120	247	0.391	0.905	-0.176		
0437.50	114	-120	246	0.393	0.900	-0.183	C5	66
0438.75	114	-121	245	0.393	0.900	-0.183		
0440.00	114	-122	244	0.397	0.899	-0.193	C5	66
0441.25	114	-122	243	0.404	0.896	-0.193		
0442.50	113	-123	242	0.404	0.894	-0.200	C5	66
0443.75	113	-123	241	0.402	0.892	-0.210		
0445.00	113	-124	239	0.402	0.891	-0.210	C5	66
0446.25	113	-124	238	0.409	0.888	-0.217		
0447.50	112	-125	237	0.407	0.888	-0.220	C6	66
0448.75	112	-126	236	0.407	0.886	-0.227		
0450.00	112	-126	236	0.407	0.884	-0.234	C6	66

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T	R	O	P	DC1	DC2	DC3	PL. CMD	PC. CMD
0451.25	112	-127	236	0.414	0.831	-0.234		
0452.50	113	-127	237	0.412	0.879	-0.244	C6	65
0453.75	114	-127	239	0.412	0.879	-0.244		
0455.00	114	-128	240	0.419	0.874	-0.250	C7	65
0456.25	115	-123	241	0.417	0.872	-0.260		
0457.50	115	-129	242	0.417	0.872	-0.260	C7	65
0458.75	116	-129	243	0.417	0.869	-0.267		
0460.00	116	-129	245	0.421	0.866	-0.270	C7	65
0461.25	117	-130	246	0.421	0.864	-0.277		
0462.50	117	-130	247	0.421	0.862	-0.284	C7	65
0463.75	118	-131	248	0.426	0.859	-0.287		
0465.00	118	-131	249	0.426	0.856	-0.293	C8	64
0466.25	119	-132	251	0.426	0.854	-0.300		
0467.50	120	-132	252	0.430	0.850	-0.303	C8	64
0468.75	120	-133	253	0.430	0.848	-0.310		
0470.00	121	-133	254	0.430	0.848	-0.310	C8	64
0471.25	121	-134	255	0.427	0.845	-0.320		
0472.50	122	-134	256	0.434	0.840	-0.326	C9	64
0473.75	122	-134	258	0.434	0.840	-0.326		
0475.00	123	-135	259	0.431	0.837	-0.336	C9	64
0476.25	123	-135	257	0.437	0.831	-0.343		
0477.50	123	-135	255	0.437	0.831	-0.343	C9	64
0478.75	123	-134	252	0.435	0.828	-0.352		
0480.00	123	-134	250	0.441	0.822	-0.359	CA	63
0481.25	123	-134	248	0.441	0.822	-0.359		
0482.50	123	-134	246	0.438	0.819	-0.368	CA	63
0483.75	123	-134	244	0.444	0.816	-0.368		
0485.00	122	-134	241	0.444	0.813	-0.375	CA	63
0486.25	122	-134	239	0.441	0.810	-0.385		
0487.50	122	-134	237	0.441	0.810	-0.385	CB	63
0488.75	122	-133	235	0.448	0.803	-0.391		
0490.00	122	-133	233	0.444	0.803	-0.394	CB	63
0491.25	122	-133	230	0.444	0.800	-0.400		
0492.50	122	-133	228	0.450	0.793	-0.406	CC	63
0493.75	122	-133	226	0.447	0.793	-0.410		
0495.00	122	-133	224	0.447	0.790	-0.416	CC	63
0496.25	122	-133	222	0.453	0.786	-0.416		
0497.50	122	-132	219	0.450	0.783	-0.426	CC	63
0498.75	122	-132	217	0.450	0.783	-0.426		
0500.00	122	-132	215	0.456	0.776	-0.432	CD	62
0501.25	121	-132	212	0.452	0.776	-0.435		
0502.50	120	-132	209	0.452	0.773	-0.441	CD	63
0503.75	119	-132	205	0.452	0.769	-0.447		
0505.00	118	-132	202	0.455	0.766	-0.451	CD	62
0506.25	117	-132	199	0.455	0.762	-0.457		
0507.50	116	-131	196	0.455	0.762	-0.457	CE	62
0508.75	115	-131	193	0.457	0.755	-0.466		
0510.00	114	-131	190	0.457	0.755	-0.466	CE	62
0511.25	113	-131	187	0.457	0.751	-0.472		
0512.50	112	-131	183	0.453	0.751	-0.475	CE	62
0513.75	111	-131	180	0.459	0.748	-0.475		
0515.00	110	-131	177	0.459	0.744	-0.481	CF	62
0516.25	109	-131	174	0.455	0.744	-0.485		
0517.50	108	-131	171	0.461	0.736	-0.490	CF	62
0518.75	108	-130	168	0.461	0.736	-0.490		
0520.00	107	-130	165	0.457	0.732	-0.500	DO	62
0521.25	106	-130	161	0.457	0.732	-0.500		
0522.50	105	-130	158	0.463	0.729	-0.500	DO	62
0523.75	104	-130	155	0.458	0.725	-0.509		
0525.00	103	-130	152	0.458	0.725	-0.509	DO	62

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T	R	Q	P	DC1	DC2	DC3	RL. CMHD	PC. CMHD
0526.25	103	-130	151	0.458	0.721	-0.514		
0527.50	102	-130	150	0.460	0.717	-0.518	D1	62
0528.75	102	-130	150	0.460	0.717	-0.518		
0530.00	102	-130	149	0.460	0.713	-0.523	D1	62
0531.25	102	-130	149	0.456	0.713	-0.527		
0532.50	102	-130	148	0.461	0.710	-0.527	D1	62
0533.75	101	-130	147	0.461	0.705	-0.532		
0535.00	101	-130	146	0.457	0.705	-0.536	D1	62
0536.25	101	-130	146	0.457	0.701	-0.542		
0537.50	101	-130	145	0.462	0.698	-0.542	D2	62
0538.75	101	-130	144	0.458	0.698	-0.545		
0540.00	100	-130	143	0.458	0.693	-0.550	D2	62
0541.25	100	-130	143	0.458	0.693	-0.550		
0542.50	100	-130	142	0.459	0.690	-0.554	D2	62
0543.75	100	-130	141	0.459	0.685	-0.559		
0545.00	100	-130	141	0.459	0.685	-0.559	D3	62
0546.25	099	-130	140	0.454	0.685	-0.563		
0547.50	099	-130	139	0.460	0.677	-0.568	D3	62
0548.75	099	-130	138	0.460	0.677	-0.568		
0550.00	099	-130	138	0.460	0.673	-0.573	D3	62
0551.25	100	-129	139	0.455	0.673	-0.577		
0552.50	101	-129	141	0.460	0.669	-0.577	D4	62
0553.75	101	-128	143	0.460	0.664	-0.582		
0555.00	102	-128	145	0.456	0.664	-0.586	D4	62
0556.25	103	-127	147	0.456	0.664	-0.586		
0557.50	104	-126	149	0.461	0.656	-0.591	D4	62
0558.75	105	-126	150	0.456	0.656	-0.594		
0560.00	106	-125	152	0.456	0.656	-0.594	D4	62
0561.25	106	-125	154	0.461	0.648	-0.599		
0562.50	107	-124	156	0.456	0.648	-0.603	D5	62
0563.75	108	-123	158	0.456	0.643	-0.608		
0565.00	109	-123	160	0.456	0.643	-0.608	D5	62
0566.25	110	-122	161	0.456	0.640	-0.611		
0567.50	111	-122	163	0.456	0.635	-0.616	D6	62
0568.75	112	-121	165	0.456	0.635	-0.616		
0570.00	112	-120	167	0.451	0.630	-0.625	D6	63
0571.25	113	-120	169	0.456	0.626	-0.625		
0572.50	114	-119	170	0.456	0.626	-0.625	D6	62
0573.75	115	-118	172	0.456	0.621	-0.630		
0575.00	116	-118	174	0.456	0.618	-0.633	D7	62
0576.25	116	-117	171	0.456	0.613	-0.638		
0577.50	115	-117	168	0.456	0.613	-0.638	D7	62
0578.75	115	-116	165	0.451	0.608	-0.646		
0580.00	115	-116	161	0.456	0.604	-0.646	D8	62
0581.25	114	-115	159	0.456	0.604	-0.646		
0582.50	114	-114	155	0.456	0.599	-0.651	D8	62
0583.75	114	-114	152	0.455	0.596	-0.654		
0585.00	113	-113	149	0.455	0.590	-0.659	D9	62
0586.25	113	-113	146	0.455	0.590	-0.659		
0587.50	113	-112	143	0.450	0.590	-0.662	D9	63
0588.75	113	-111	140	0.454	0.582	-0.667		
0590.00	112	-111	137	0.454	0.582	-0.667	D9	62
0591.25	112	-110	134	0.454	0.582	-0.667		
0592.50	112	-109	130	0.453	0.573	-0.675	DA	62
0593.75	111	-109	128	0.453	0.573	-0.675		
0595.00	111	-108	124	0.453	0.573	-0.675	DA	62
0596.25	111	-108	121	0.448	0.568	-0.683		
0597.50	110	-107	118	0.453	0.564	-0.683	DA	63
0598.75	110	-106	115	0.453	0.564	-0.683		
0600.00	110	-105	112	0.453	0.559	-0.687	DB	63

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T	R	Q	P	DC1	DC2	DC3	HL. CMD	PL. CMD
0601.25	109	-105	108	0.451	0.555	-0.691		
0602.50	108	-105	105	0.451	0.555	-0.691	DB	63
0603.75	106	-104	101	0.451	0.555	-0.691		
0605.00	105	-104	097	0.451	0.550	-0.695	DB	63
0606.25	104	-103	094	0.450	0.546	-0.698		
0607.50	103	-103	090	0.450	0.546	-0.698	DC	63
0608.75	102	-102	087	0.450	0.546	-0.698		
0610.00	101	-102	083	0.450	0.541	-0.703	DC	63
0611.25	100	-101	079	0.448	0.537	-0.706		
0612.50	098	-101	076	0.448	0.537	-0.706	DC	63
0613.75	097	-100	072	0.448	0.537	-0.706		
0615.00	096	-100	069	0.448	0.537	-0.706	DC	63
0616.25	095	-099	065	0.447	0.534	-0.709		
0617.50	094	-099	062	0.447	0.528	-0.714	DD	63
0618.75	093	-098	058	0.447	0.528	-0.714		
0620.00	092	-098	054	0.447	0.528	-0.714	DD	63
0621.25	090	-097	051	0.445	0.525	-0.717		
0622.50	089	-097	047	0.445	0.525	-0.717	DD	63
0623.75	088	-096	043	0.445	0.525	-0.717		
0625.00	087	-096	040	0.445	0.525	-0.717	DD	63
0626.25	087	-096	042	0.440	0.519	-0.724		
0627.50	088	-096	044	0.444	0.516	-0.724	DD	63
0628.75	088	-096	045	0.444	0.516	-0.724		
0630.00	088	-096	047	0.444	0.516	-0.724	DD	63
0631.25	089	-096	049	0.438	0.516	-0.728		
0632.50	089	-096	051	0.442	0.512	-0.728	DE	63
0633.75	089	-096	053	0.442	0.512	-0.728		
0635.00	090	-096	055	0.442	0.512	-0.728	DE	63
0636.25	090	-096	057	0.436	0.507	-0.735		
0637.50	090	-096	059	0.436	0.507	-0.735	DE	64
0638.75	091	-096	061	0.440	0.503	-0.735		
0640.00	091	-096	063	0.440	0.503	-0.735	DE	63
0641.25	091	-096	064	0.434	0.503	-0.739		
0642.50	092	-096	066	0.434	0.503	-0.739	DE	64
0643.75	092	-096	068	0.438	0.500	-0.739		
0645.00	092	-096	070	0.438	0.494	-0.743	DF	63
0646.25	093	-096	072	0.432	0.494	-0.746		
0647.50	093	-096	074	0.432	0.494	-0.746	DF	64
0648.75	094	-096	076	0.436	0.491	-0.746		
0650.00	094	-096	078	0.436	0.491	-0.746	DF	64
0651.25	095	-096	080	0.436	0.485	-0.750		
0652.50	096	-095	082	0.430	0.485	-0.753	DF	64
0653.75	097	-094	083	0.430	0.485	-0.753		
0655.00	098	-094	085	0.434	0.482	-0.753	EO	64
0656.25	099	-093	087	0.434	0.482	-0.753		
0657.50	100	-092	089	0.428	0.476	-0.760	EO	64
0658.75	101	-092	090	0.428	0.476	-0.760		
0660.00	102	-091	092	0.431	0.472	-0.760	EO	64
0661.25	103	-091	094	0.431	0.472	-0.760		
0662.50	104	-090	096	0.425	0.472	-0.763	EO	64
0663.75	105	-089	098	0.425	0.466	-0.767		
0665.00	106	-089	099	0.429	0.463	-0.767	E1	64
0666.25	107	-088	101	0.429	0.463	-0.767		
0667.50	108	-087	103	0.429	0.463	-0.767	E1	64
0668.75	109	-087	105	0.426	0.454	-0.774		
0670.00	110	-086	107	0.426	0.454	-0.774	E1	64
0671.25	111	-086	108	0.426	0.454	-0.774		
0672.50	112	-085	110	0.426	0.448	-0.777	E2	64
0673.75	113	-085	112	0.424	0.444	-0.781		
0675.00	114	-084	114	0.424	0.444	-0.781	E2	64

T	R	Q	P	DC1	DC2	DC3	RL.CMHD	PC.CMHD
0676.25	113	-083	110	0.424	0.444	-0.781		
0677.50	112	-082	106	0.427	0.435	-0.784	E3	64
0678.75	112	-082	103	0.427	0.435	-0.784		
0680.00	111	-081	099	0.421	0.435	-0.787	E3	65
0681.25	110	-080	096	0.421	0.435	-0.787		
0682.50	110	-079	092	0.424	0.425	-0.791	E3	64
0683.75	109	-079	088	0.424	0.425	-0.791		
0685.00	108	-078	085	0.424	0.425	-0.791	E3	64
0686.25	107	-077	081	0.418	0.425	-0.794		
0687.50	107	-076	077	0.421	0.416	-0.797	E4	65
0688.75	106	-075	074	0.421	0.416	-0.797		
0690.00	106	-075	070	0.421	0.416	-0.797	E4	65
0691.25	105	-074	066	0.424	0.413	-0.797		
0692.50	104	-073	063	0.418	0.413	-0.801	E4	65
0693.75	103	-073	059	0.418	0.413	-0.801		
0695.00	103	-072	055	0.418	0.406	-0.804	E4	65
0696.25	102	-071	052	0.421	0.403	-0.804		
0697.50	101	-070	048	0.421	0.403	-0.804	98	1A
0698.75	101	-070	044	0.421	0.403	-0.804		
0700.00	100	-069	041	0.415	0.403	-0.807	98	1A
0701.25	099	-068	038	0.413	0.400	-0.807		
0702.50	098	-068	035	0.413	0.400	-0.807	98	1A
0703.75	097	-067	032	0.413	0.400	-0.807		
0705.00	096	-067	030	0.418	0.400	-0.807	98	1A
0706.25	095	-066	027	0.421	0.390	-0.810		
0707.50	093	-066	024	0.414	0.390	-0.813	97	1A
0708.75	092	-065	021	0.414	0.390	-0.813		
0710.00	091	-065	019	0.414	0.390	-0.813	97	1A
0711.25	090	-064	016	0.414	0.390	-0.813		
0712.50	089	-064	013	0.417	0.387	-0.813	97	1A
0713.75	088	-063	010	0.417	0.387	-0.813		
0715.00	087	-063	007	0.411	0.387	-0.816	97	1A
0716.25	086	-062	005	0.411	0.387	-0.816		
0717.50	085	-062	002	0.414	0.384	-0.816	97	1A
0718.75	084	-061	-001	0.414	0.384	-0.816		
0720.00	082	-061	-004	0.414	0.384	-0.816	97	1A
0721.25	081	-060	-007	0.414	0.384	-0.816		
0722.50	080	-060	-009	0.407	0.384	-0.819	97	1A
0723.75	079	-059	-012	0.410	0.381	-0.819		
0725.00	078	-059	-015	0.410	0.381	-0.819	97	1A
0726.25	078	-059	-013	0.410	0.381	-0.819		
0727.50	079	-059	-011	0.410	0.381	-0.819	97	1A
0728.75	079	-059	-008	0.410	0.381	-0.819		
0730.00	080	-059	-006	0.413	0.378	-0.819	97	1A
0731.25	080	-059	-004	0.407	0.378	-0.823		
0732.50	081	-059	-001	0.407	0.378	-0.823	97	1A
0733.75	081	-059	001	0.407	0.378	-0.823		
0735.00	082	-059	003	0.407	0.378	-0.823	97	1A
0736.25	082	-059	005	0.409	0.375	-0.823		
0737.50	083	-059	008	0.409	0.375	-0.823	96	1A
0738.75	083	-059	010	0.409	0.375	-0.823		
0740.00	083	-059	012	0.403	0.375	-0.826	96	1A
0741.25	084	-050	014	0.403	0.375	-0.826		
0742.50	084	-050	016	0.406	0.371	-0.826	96	1A
0743.75	085	-050	017	0.406	0.371	-0.826		
0745.00	085	-050	021	0.406	0.371	-0.826	96	1A
0746.25	085	-050	023	0.406	0.371	-0.826		
0747.50	085	-050	025	0.402	0.368	-0.829	96	1A
0748.75	086	-050	028	0.402	0.368	-0.829		
0750.00	087	-050	030	0.402	0.368	-0.829	96	1A

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T	R	O	P	DC1	DC2	DC3	ML. CHIP	PC. CHIP
0751.25	088	-059	032	0.402	0.368	-0.829	96	19
0752.50	089	-059	034	0.402	0.368	-0.829	96	19
0753.75	090	-059	036	0.405	0.365	-0.829	96	19
0755.00	092	-058	038	0.405	0.365	-0.829	96	19
0756.25	093	-058	040	0.398	0.359	-0.835	95	19
0757.50	094	-057	042	0.398	0.359	-0.835	95	19
0758.75	095	-057	044	0.401	0.356	-0.835	95	19
0760.00	096	-057	046	0.401	0.356	-0.835	95	19
0761.25	097	-056	048	0.401	0.356	-0.835	95	19
0762.50	098	-056	050	0.401	0.356	-0.835	95	19
0763.75	100	-055	052	0.404	0.353	-0.835	95	19
0765.00	101	-055	054	0.397	0.353	-0.838	95	19
0766.25	102	-055	056	0.397	0.353	-0.838	95	19
0767.50	103	-054	059	0.397	0.346	-0.840	95	19
0768.75	104	-054	061	0.400	0.343	-0.840	94	19
0770.00	105	-053	063	0.400	0.343	-0.840	94	19
0771.25	106	-053	065	0.400	0.343	-0.840	94	19
0772.50	108	-053	067	0.400	0.343	-0.840	94	19
0773.75	109	-052	069	0.402	0.340	-0.840	94	19
0775.00	110	-052	071	0.395	0.333	-0.846	94	19
0776.25	109	-051	068	0.395	0.333	-0.846	94	19
0777.50	109	-051	065	0.395	0.333	-0.846	94	19
0778.75	108	-050	062	0.398	0.330	-0.846	94	19
0780.00	108	-049	059	0.398	0.330	-0.846	94	19
0781.25	107	-049	056	0.398	0.330	-0.846	93	19
0782.50	107	-048	053	0.398	0.323	-0.849	93	19
0783.75	106	-047	050	0.394	0.320	-0.852	93	19
0785.00	106	-047	047	0.394	0.320	-0.852	93	19
0786.25	106	-046	044	0.394	0.320	-0.852	93	19
0787.50	105	-045	041	0.396	0.317	-0.852	93	19
0788.75	104	-045	038	0.396	0.317	-0.852	93	19
0790.00	104	-044	035	0.396	0.317	-0.852	93	19
0791.25	103	-043	032	0.396	0.317	-0.852	93	19
0792.50	103	-043	029	0.399	0.314	-0.852	92	19
0793.75	102	-042	026	0.399	0.314	-0.852	92	19
0795.00	102	-042	023	0.392	0.308	-0.857	92	19
0796.25	101	-041	020	0.392	0.308	-0.857	92	19
0797.50	101	-040	017	0.394	0.305	-0.857	92	19
0798.75	100	-040	014	0.394	0.305	-0.857	92	19
0800.00	100	-039	011	0.394	0.305	-0.857	92	19
0801.25	099	-038	008	0.394	0.305	-0.857	92	19
0802.50	098	-038	006	0.396	0.302	-0.857	92	19
0803.75	098	-038	003	0.396	0.302	-0.857	92	19
0805.00	097	-037	000	0.396	0.302	-0.857	92	19
0806.25	096	-037	-003	0.396	0.302	-0.857	92	19
0807.50	095	-036	-006	0.399	0.298	-0.857	92	19
0808.75	095	-036	-008	0.392	0.298	-0.860	92	19
0810.00	094	-036	-011	0.392	0.298	-0.860	91	19
0811.25	093	-035	-014	0.392	0.298	-0.860	91	19
0812.50	092	-035	-017	0.394	0.295	-0.860	91	19
0813.75	092	-034	-019	0.394	0.295	-0.860	91	19
0815.00	091	-034	-022	0.394	0.295	-0.860	91	19
0816.25	090	-034	-025	0.394	0.295	-0.860	91	19
0817.50	089	-033	-028	0.394	0.295	-0.860	91	19
0818.75	089	-032	-030	0.396	0.292	-0.860	91	19
0820.00	088	-032	-033	0.396	0.292	-0.860	91	19
0821.25	087	-032	-036	0.396	0.292	-0.860	91	19
0822.50	086	-032	-039	0.390	0.292	-0.863	91	19
0823.75	085	-031	-041	0.392	0.289	-0.863	91	19
0825.00	085	-031	-044	0.392	0.289	-0.863	91	19

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	T	R	Q	P	DC1	DC2	DC3	RL. CORR	PC. CORR
0	0826.25	086	-031	-042	0.392	0.289	-0.863		
0	0827.50	087	-031	-040	0.392	0.289	-0.863	21	19
0	0828.75	088	-031	-037	0.392	0.289	-0.863		
0	0830.00	089	-031	-035	0.394	0.286	-0.863	21	19
0	0831.25	090	-031	-033	0.394	0.293	-0.861		
0	0832.50	090	-031	-031	0.394	0.293	-0.861	21	19
0	0833.75	091	-031	-028	0.394	0.293	-0.861		
0	0835.00	092	-031	-026	0.396	0.290	-0.861	21	19
0	0836.25	093	-031	-024	0.396	0.290	-0.861		
0	0837.50	094	-031	-021	0.396	0.290	-0.861	21	19
0	0838.75	095	-031	-019	0.389	0.290	-0.864		
0	0840.00	096	-031	-017	0.389	0.290	-0.864	21	19
0	0841.25	097	-031	-015	0.391	0.287	-0.864		
0	0842.50	098	-031	-012	0.391	0.287	-0.864	21	19
0	0843.75	099	-031	-010	0.391	0.287	-0.864		
0	0845.00	100	-031	-008	0.391	0.287	-0.864	21	19
0	0846.25	101	-031	-006	0.394	0.284	-0.864		
0	0847.50	102	-031	-003	0.394	0.284	-0.864	21	19
0	0848.75	103	-031	-001	0.394	0.284	-0.864		
0	0850.00	104	-031	001	0.394	0.284	-0.864	21	19
0	0851.25	105	-031	003	0.396	0.281	-0.864		
0	0852.50	106	-031	005	0.396	0.281	-0.864	21	19
0	0853.75	106	-030	007	0.396	0.281	-0.864		
0	0855.00	107	-030	009	0.391	0.278	-0.867	21	19
0	0856.25	108	-030	011	0.391	0.278	-0.867		
0	0857.50	109	-030	013	0.391	0.278	-0.867	21	19
0	0858.75	110	-030	015	0.391	0.278	-0.867		
0	0860.00	111	-030	017	0.393	0.275	-0.867	21	19
0	0861.25	112	-030	019	0.393	0.275	-0.867		
0	0862.50	112	-029	021	0.393	0.275	-0.867	21	19
0	0863.75	113	-029	023	0.393	0.275	-0.867		
0	0865.00	114	-029	025	0.395	0.272	-0.867	21	19
0	0866.25	115	-029	023	0.395	0.272	-0.867		
0	0867.50	116	-029	030	0.395	0.272	-0.867	21	19
0	0868.75	117	-029	032	0.397	0.269	-0.867		
0	0870.00	117	-028	034	0.397	0.269	-0.867	21	19
0	0871.25	118	-028	036	0.397	0.269	-0.867		
0	0872.50	119	-028	038	0.392	0.266	-0.870	21	19
0	0873.75	120	-028	040	0.392	0.266	-0.870		
0	0875.00	121	-028	042	0.392	0.266	-0.870	21	19
0	0876.25	120	-028	039	0.392	0.266	-0.870		
0	0877.50	120	-027	037	0.394	0.263	-0.870	BF	19
0	0878.75	119	-027	035	0.394	0.263	-0.870		
0	0880.00	119	-027	032	0.394	0.263	-0.870	BF	19
0	0881.25	118	-027	030	0.396	0.260	-0.870		
0	0882.50	118	-026	028	0.396	0.260	-0.870	BF	19
0	0883.75	117	-026	025	0.396	0.260	-0.870		
0	0885.00	117	-026	023	0.396	0.253	-0.872	BF	19
0	0886.25	116	-026	020	0.398	0.250	-0.872		
0	0887.50	116	-025	018	0.398	0.250	-0.872	BE	19
0	0888.75	115	-025	016	0.398	0.250	-0.872		
0	0890.00	114	-025	013	0.400	0.247	-0.872	BE	19
0	0891.25	114	-025	011	0.393	0.247	-0.875		
0	0893.50	113	-024	009	0.393	0.247	-0.875	BE	19
0	0894.75	113	-024	007	0.395	0.244	-0.875		
0	0896.00	112	-024	004	0.395	0.244	-0.875	BE	19
0	0897.25	112	-024	001	0.395	0.244	-0.875		
0	0899.50	111	-023	-001	0.395	0.244	-0.875	BE	19
0	0900.75	110	-023	-003	0.397	0.241	-0.875		
0	0902.00	110	-023	-005	0.397	0.241	-0.875	BE	19

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T	R	Q	P	FC1	FC2	FC3	AL.CAND	PC.
0901.25	109	-023	-008	0.397	0.241	-0.875		
0902.50	109	-023	-010	0.397	0.241	-0.875	8E	19
0903.75	108	-023	-012	0.399	0.238	-0.875		
0905.00	107	-023	-014	0.399	0.238	-0.875	8E	19
0906.25	107	-023	-016	0.399	0.237	-0.875		
0907.50	106	-023	-018	0.400	0.235	-0.875	8E	19
0908.75	105	-023	-020	0.400	0.235	-0.875		
0910.00	105	-023	-022	0.400	0.235	-0.875	8E	19
0911.25	104	-023	-024	0.400	0.235	-0.875		
0912.50	104	-023	-026	0.395	0.232	-0.875	8D	19
0913.75	103	-023	-028	0.395	0.232	-0.875		
0915.00	102	-023	-030	0.395	0.232	-0.875	8D	19
0916.25	102	-023	-032	0.395	0.232	-0.875		
0917.50	101	-023	-034	0.397	0.229	-0.878	8D	19
0918.75	100	-023	-036	0.397	0.229	-0.878		
0920.00	100	-023	-038	0.397	0.229	-0.878	8D	19
0921.25	099	-023	-040	0.397	0.229	-0.878		
0922.50	098	-023	-042	0.399	0.225	-0.878	8D	19
0923.75	098	-023	-044	0.399	0.225	-0.878		
0925.00	097	-023	-046	0.399	0.225	-0.878	8D	19
0926.25	098	-023	-044	0.399	0.232	-0.877		
0927.50	098	-023	-042	0.400	0.229	-0.877	8D	19
0928.75	099	-023	-040	0.400	0.229	-0.877		
0930.00	100	-023	-038	0.400	0.229	-0.877	8D	19
0931.25	100	-023	-036	0.400	0.229	-0.877		
0932.50	101	-023	-034	0.402	0.226	-0.877	8D	19
0933.75	102	-023	-032	0.395	0.226	-0.880		
0935.00	103	-023	-030	0.395	0.226	-0.880	8D	19
0936.25	103	-023	-027	0.395	0.226	-0.880		
0937.50	104	-023	-025	0.397	0.223	-0.880	8D	19
0938.75	105	-023	-023	0.397	0.223	-0.880		
0940.00	105	-023	-021	0.397	0.223	-0.880	8D	19
0941.25	106	-023	-019	0.397	0.230	-0.878		
0942.50	107	-023	-017	0.398	0.227	-0.878	8D	19
0943.75	107	-023	-015	0.398	0.227	-0.878		
0945.00	108	-023	-013	0.398	0.227	-0.878	8D	19
0946.25	109	-023	-011	0.398	0.227	-0.878		
0947.50	109	-023	-009	0.400	0.224	-0.878	8D	19
0948.75	110	-023	-007	0.400	0.224	-0.878		
0950.00	111	-023	-005	0.400	0.224	-0.878	8D	19
0951.25	112	-023	-003	0.402	0.221	-0.878		
0952.50	112	-023	-002	0.402	0.221	-0.878	8D	19
0953.75	113	-023	-000	0.402	0.221	-0.878		
0955.00	114	-023	001	0.395	0.221	-0.881	8D	19
0956.25	114	-023	003	0.396	0.218	-0.881		
0957.50	115	-023	005	0.396	0.218	-0.881	8C	19
0958.75	116	-023	006	0.396	0.218	-0.881		
0960.00	117	-023	008	0.398	0.215	-0.881	8C	19
0961.25	117	-023	010	0.398	0.215	-0.881		
0962.50	118	-023	011	0.398	0.215	-0.881	8C	19
0963.75	118	-023	013	0.398	0.215	-0.881		
0965.00	119	-023	014	0.400	0.212	-0.881	8C	19
0966.25	120	-023	016	0.400	0.212	-0.881		
0967.50	121	-023	017	0.400	0.212	-0.881	8C	19
0968.75	121	-023	019	0.401	0.209	-0.881		
0970.00	122	-023	021	0.401	0.209	-0.881	8C	19
0971.25	123	-023	022	0.401	0.209	-0.881		
0972.50	123	-023	024	0.403	0.206	-0.881	8C	19
0973.75	124	-023	025	0.403	0.206	-0.881		
0975.00	125	-023	027	0.403	0.206	-0.881	8C	19

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T	R	Q	P	DC1	DC2	DC3	RL.C.MID	PC.C.MID
0976.25	125	-023	026	0.404	0.203	-0.881		
0977.50	125	-022	025	0.397	0.203	-0.884	8B	19
0978.75	124	-022	024	0.397	0.203	-0.884		
0980.00	124	-022	022	0.397	0.203	-0.884	8B	19
0981.25	124	-022	021	0.399	0.200	-0.884		
0982.50	124	-022	020	0.399	0.200	-0.884	8B	19
0983.75	124	-021	019	0.399	0.200	-0.884		
0985.00	124	-021	018	0.400	0.197	-0.884	8B	19
0986.25	124	-021	017	0.400	0.197	-0.884		
0987.50	123	-021	016	0.400	0.197	-0.884	8B	19
0988.75	123	-021	015	0.402	0.194	-0.884		
0990.00	123	-021	014	0.402	0.194	-0.884	8B	19
0991.25	123	-020	013	0.402	0.194	-0.884		
0992.50	123	-020	011	0.403	0.191	-0.884	8B	19
0993.75	123	-020	011	0.403	0.191	-0.884		
0995.00	122	-020	009	0.403	0.191	-0.884	8B	19
0996.25	122	-020	008	0.403	0.184	-0.885		
0997.50	122	-019	007	0.405	0.181	-0.885	8A	19
0998.75	122	-019	006	0.405	0.181	-0.885		
1000.00	122	-019	005	0.405	0.181	-0.885	8A	19
1001.25	121	-019	004	0.399	0.177	-0.889		
1002.50	120	-019	002	0.399	0.177	-0.889	8A	19
1003.75	120	-019	001	0.399	0.177	-0.889		
1005.00	119	-019	-000	0.400	0.174	-0.889	8A	19
1006.25	118	-019	-002	0.400	0.174	-0.889		
1007.50	118	-019	-003	0.400	0.174	-0.889	8A	19
1008.75	117	-019	-005	0.401	0.171	-0.889		
1010.00	116	-018	-006	0.401	0.171	-0.889	89	19
1011.25	116	-018	-007	0.401	0.171	-0.889		
1012.50	115	-018	-009	0.401	0.171	-0.889	89	19
1013.75	114	-018	-010	0.403	0.168	-0.889		
1015.00	114	-018	-011	0.403	0.168	-0.889	89	19
1016.25	113	-018	-013	0.403	0.168	-0.889		
1017.50	112	-018	-014	0.404	0.165	-0.889	89	19
1018.75	111	-018	-015	0.404	0.165	-0.889		
1020.00	111	-018	-017	0.404	0.165	-0.889	89	19
1021.25	110	-018	-018	0.404	0.165	-0.889		
1022.50	109	-018	-019	0.405	0.162	-0.889	89	19
1023.75	109	-018	-021	0.405	0.162	-0.889		
1025.00	108	-018	-022	0.405	0.162	-0.889	89	19
1026.25	108	-018	-022	0.405	0.162	-0.889		
1027.50	108	-018	-021	0.406	0.159	-0.889	89	1A
1028.75	107	-018	-021	0.399	0.159	-0.892		
1030.00	107	-018	-021	0.399	0.159	-0.892	89	19
1031.25	107	-018	-021	0.400	0.156	-0.892		
1032.50	107	-018	-021	0.400	0.156	-0.892	8B	19
1033.75	107	-018	-021	0.400	0.156	-0.892		
1035.00	107	-018	-020	0.400	0.156	-0.892	8B	19
1036.25	106	-018	-020	0.401	0.153	-0.892		
1037.50	106	-018	-020	0.401	0.153	-0.892	8B	19
1038.75	106	-018	-020	0.401	0.153	-0.892		
1040.00	106	-018	-020	0.401	0.153	-0.892	8B	19
1041.25	106	-018	-019	0.403	0.157	-0.891		
1042.50	106	-018	-019	0.403	0.157	-0.891	8B	19
1043.75	105	-018	-019	0.403	0.157	-0.891		
1045.00	105	-018	-019	0.403	0.157	-0.891	8B	19
1046.25	105	-018	-019	0.404	0.154	-0.891		
1047.50	105	-018	-018	0.404	0.154	-0.891	8B	19
1048.75	105	-018	-018	0.404	0.154	-0.891		
1050.00	105	-018	-018	0.405	0.151	-0.891	8B	19

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T	R	Q	P	DC1	DC2	DC3	ML. CORR'D	PG. CORR'D
1051.25	105	-018	-017	0.405	0.151	-0.891		
1052.50	106	-018	-016	0.405	0.151	-0.891	88	19
1053.75	106	-018	-016	0.405	0.151	-0.891		
1055.00	106	-018	-015	0.406	0.148	-0.891	88	19
1056.25	106	-018	-014	0.399	0.148	-0.894		
1057.50	107	-018	-014	0.399	0.148	-0.894	88	19
1058.75	107	-018	-013	0.399	0.143	-0.894		
1060.00	107	-013	-012	0.400	0.145	-0.894	88	19
1061.25	107	-018	-011	0.400	0.145	-0.894		
1062.50	108	-018	-011	0.400	0.145	-0.894	88	19
1063.75	108	-018	-010	0.400	0.145	-0.894		
1065.00	108	-018	-010	0.401	0.142	-0.894	88	19
1066.25	109	-018	-009	0.401	0.142	-0.894		
1067.50	109	-018	-008	0.401	0.142	-0.894	88	19
1068.75	109	-018	-007	0.402	0.139	-0.894		
1070.00	110	-018	-007	0.402	0.139	-0.894	87	19
1071.25	110	-018	-006	0.402	0.139	-0.894		
1072.50	110	-018	-005	0.402	0.139	-0.894	87	19
1073.75	111	-018	-005	0.403	0.136	-0.894		
1075.00	111	-018	-004	0.403	0.136	-0.894	87	19
1076.25	111	-018	-004	0.403	0.136	-0.894		
1077.50	111	-018	-004	0.403	0.136	-0.894	87	19
1078.75	111	-018	-004	0.404	0.133	-0.894		
1080.00	110	-017	-003	0.404	0.133	-0.894	87	19
1081.25	110	-017	-003	0.404	0.133	-0.894		
1082.50	110	-017	-003	0.405	0.130	-0.894	87	19
1083.75	110	-017	-003	0.398	0.130	-0.897		
1085.00	110	-017	-003	0.398	0.130	-0.897	87	19
1086.25	110	-017	-003	0.398	0.130	-0.897		
1087.50	110	-017	-003	0.399	0.126	-0.897	87	19
1088.75	110	-017	-003	0.399	0.126	-0.897		
1090.00	110	-017	-003	0.399	0.126	-0.897	87	19
1091.25	110	-017	-003	0.400	0.130	-0.896		
1092.50	109	-016	-002	0.400	0.130	-0.896	87	19
1093.75	109	-016	-002	0.400	0.130	-0.896		
1095.00	109	-016	-002	0.400	0.130	-0.896	87	19
1096.25	109	-016	-002	0.401	0.127	-0.896		
1097.50	109	-016	-002	0.401	0.127	-0.896	87	19
1098.75	109	-016	-002	0.401	0.127	-0.896		
1100.00	109	-016	-002	0.401	0.127	-0.896	87	19
1101.25	109	-016	-002	0.401	0.124	-0.896		
1102.50	109	-016	-002	0.401	0.124	-0.896	86	19
1103.75	108	-016	-002	0.401	0.124	-0.896		
1105.00	108	-016	-003	0.402	0.121	-0.896	86	19
1106.25	108	-016	-003	0.402	0.121	-0.896		
1107.50	108	-016	-003	0.402	0.121	-0.896	86	19
1108.75	108	-016	-003	0.402	0.121	-0.896		
1110.00	108	-015	-003	0.403	0.118	-0.896	86	19
1111.25	107	-015	-004	0.403	0.118	-0.896		
1112.50	107	-015	-004	0.403	0.118	-0.896	86	19
1113.75	107	-015	-004	0.403	0.118	-0.896		
1115.00	107	-015	-004	0.397	0.115	-0.899	86	19
1116.25	107	-015	-004	0.397	0.115	-0.899		
1117.50	107	-015	-005	0.397	0.115	-0.899	86	19
1118.75	106	-015	-005	0.398	0.112	-0.899		
1120.00	106	-015	-005	0.398	0.112	-0.899	86	19
1121.25	106	-015	-005	0.398	0.112	-0.899		
1122.50	106	-015	-005	0.398	0.112	-0.899	86	19
1123.75	106	-015	-006	0.399	0.109	-0.899		
1125.00	106	-015	-006	0.399	0.109	-0.899	85	19

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T	R	Q	P	DC1	DC2	DC3	HL.CMND	PC.CMND
1126.25	106	-015	-006	0.399	0.109	-0.399		
1127.50	106	-015	-006	0.399	0.109	-0.399	35	19
1128.75	105	-015	-006	0.399	0.106	-0.399		
1130.00	105	-015	-007	0.399	0.106	-0.399	35	19
1131.25	105	-015	-007	0.399	0.106	-0.399		
1132.50	105	-015	-007	0.399	0.106	-0.399	35	19
1133.75	105	-016	-007	0.400	0.103	-0.399		
1135.00	105	-016	-007	0.400	0.103	-0.399	35	19
1136.25	105	-016	-008	0.400	0.103	-0.399		
1137.50	104	-016	-008	0.400	0.103	-0.399	35	19
1138.75	104	-016	-008	0.401	0.100	-0.399		
1140.00	104	-016	-008	0.401	0.100	-0.399	35	19
1141.25	104	-016	-008	0.401	0.100	-0.399		
1142.50	104	-016	-009	0.401	0.097	-0.399	35	19
1143.75	104	-016	-009	0.401	0.097	-0.399		
1145.00	103	-016	-009	0.401	0.097	-0.399	35	19
1146.25	103	-017	-009	0.401	0.097	-0.399		
1147.50	103	-017	-009	0.395	0.094	-0.902	35	19
1148.75	103	-017	-010	0.395	0.094	-0.902		
1150.00	103	-017	-010	0.395	0.094	-0.902	35	19
1151.25	103	-017	-010	0.395	0.094	-0.902		
1152.50	103	-017	-010	0.396	0.091	-0.902	84	19
1153.75	103	-017	-010	0.396	0.091	-0.902		
1155.00	103	-018	-010	0.396	0.091	-0.902	84	19
1156.25	103	-018	-011	0.396	0.091	-0.902		
1157.50	103	-018	-011	0.396	0.088	-0.902	84	19
1158.75	103	-018	-011	0.396	0.088	-0.902		
1160.00	103	-018	-011	0.396	0.088	-0.902	84	19
1161.25	103	-019	-011	0.396	0.088	-0.902		
1162.50	103	-019	-011	0.397	0.085	-0.902	84	19
1163.75	103	-019	-011	0.397	0.085	-0.902		
1165.00	103	-019	-011	0.397	0.085	-0.902	84	19
1166.25	104	-019	-011	0.397	0.085	-0.902		
1167.50	104	-020	-011	0.398	0.082	-0.902	84	19
1168.75	104	-020	-012	0.398	0.089	-0.901		
1170.00	104	-020	-012	0.398	0.089	-0.901	84	19
1171.25	104	-020	-012	0.398	0.086	-0.901		
1172.50	104	-020	-012	0.398	0.086	-0.901	84	19
1173.75	104	-021	-012	0.398	0.086	-0.901		
1175.00	104	-021	-012	0.391	0.086	-0.904	84	19
1176.25	104	-021	-012	0.392	0.083	-0.904		
1177.50	104	-021	-012	0.392	0.083	-0.904	84	19
1178.75	104	-021	-012	0.392	0.083	-0.904		
1180.00	104	-021	-012	0.392	0.083	-0.904	84	19
1181.25	104	-022	-013	0.392	0.080	-0.904		
1182.50	104	-022	-013	0.392	0.080	-0.904	84	19
1183.75	104	-022	-013	0.392	0.080	-0.904		
1185.00	104	-022	-013	0.392	0.080	-0.904	84	19
1186.25	104	-023	-013	0.393	0.077	-0.904		
1187.50	104	-023	-013	0.393	0.077	-0.904	83	19
1188.75	104	-023	-013	0.393	0.077	-0.904		
1190.00	104	-023	-013	0.393	0.077	-0.904	83	19
1191.25	104	-023	-013	0.393	0.073	-0.904		
1192.50	104	-024	-013	0.393	0.073	-0.904	83	19
1193.75	104	-024	-013	0.393	0.073	-0.904		
1195.00	104	-024	-014	0.393	0.073	-0.904	83	19
1196.25	104	-024	-014	0.397	0.070	-0.907		
1197.50	104	-024	-014	0.397	0.070	-0.907	83	19
1198.75	104	-025	-014	0.397	0.070	-0.907		
1200.00	104	-025	-014	0.397	0.070	-0.907	83	19

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T	R	Q	P	DC1	DC2	DC3	RL. GRID	PG. OF 19
1201.25	104	-025	-014	0.387	0.068	-0.907		
1202.50	104	-025	-014	0.387	0.068	-0.907	83	18
1203.75	104	-025	-014	0.387	0.068	-0.907		
1205.00	104	-026	-014	0.388	0.065	-0.907	83	18
1206.25	104	-026	-014	0.388	0.072	-0.907		
1207.50	104	-026	-014	0.388	0.072	-0.907	83	18
1208.75	104	-026	-015	0.388	0.072	-0.907		
1210.00	103	-026	-015	0.388	0.069	-0.907	83	18
1211.25	103	-027	-015	0.388	0.069	-0.907		
1212.50	103	-027	-015	0.388	0.069	-0.907	83	18
1213.75	103	-027	-015	0.388	0.069	-0.907		
1215.00	103	-027	-015	0.389	0.066	-0.907	83	18
1216.25	103	-027	-015	0.381	0.066	-0.910		
1217.50	103	-028	-015	0.381	0.066	-0.910	83	18
1218.75	103	-028	-015	0.381	0.066	-0.910		
1220.00	103	-028	-015	0.382	0.063	-0.910	83	18
1221.25	103	-028	-016	0.382	0.063	-0.910		
1222.50	103	-028	-016	0.382	0.063	-0.910	83	18
1223.75	103	-029	-016	0.382	0.063	-0.910		
1225.00	103	-029	-016	0.382	0.060	-0.910	82	18
1226.25	103	-029	-016	0.382	0.060	-0.910		
1227.50	103	-029	-016	0.382	0.060	-0.910	82	18
1228.75	103	-030	-016	0.382	0.060	-0.910		
1230.00	102	-030	-016	0.383	0.057	-0.910	82	18
1231.25	102	-030	-016	0.383	0.057	-0.910		
1232.50	102	-030	-016	0.383	0.057	-0.910	82	18
1233.75	102	-031	-017	0.375	0.057	-0.913		
1235.00	102	-031	-017	0.376	0.054	-0.913	82	18
1236.25	102	-031	-017	0.376	0.054	-0.913		
1237.50	102	-032	-017	0.376	0.054	-0.913	82	18
1238.75	102	-032	-017	0.376	0.061	-0.912		
1240.00	102	-032	-017	0.376	0.058	-0.912	82	13
1241.25	102	-032	-017	0.376	0.058	-0.912		
1242.50	101	-032	-017	0.376	0.058	-0.912	82	18
1243.75	101	-033	-017	0.376	0.058	-0.912		
1245.00	101	-033	-017	0.376	0.056	-0.912	82	18
1246.25	101	-033	-018	0.376	0.056	-0.912		
1247.50	101	-033	-018	0.376	0.056	-0.912	82	18
1248.75	101	-034	-018	0.370	0.053	-0.915		
1250.00	101	-034	-018	0.370	0.053	-0.915	82	17
1251.25	101	-034	-018	0.370	0.053	-0.915		
1252.50	101	-034	-018	0.370	0.053	-0.915	82	17
1253.75	101	-035	-019	0.370	0.050	-0.915		
1255.00	101	-035	-019	0.370	0.050	-0.915	82	17
1256.25	102	-035	-019	0.370	0.050	-0.915		
1257.50	102	-035	-019	0.370	0.050	-0.915	82	17
1258.75	102	-036	-019	0.370	0.047	-0.915		
1260.00	102	-036	-020	0.370	0.047	-0.915	82	17
1261.25	102	-036	-020	0.370	0.047	-0.915		
1262.50	102	-036	-020	0.370	0.047	-0.915	82	17
1263.75	103	-037	-020	0.363	0.044	-0.918		
1265.00	103	-037	-020	0.363	0.044	-0.918	81	17
1266.25	103	-037	-021	0.363	0.051	-0.918		
1267.50	103	-037	-021	0.363	0.051	-0.918	82	17
1268.75	103	-038	-021	0.364	0.049	-0.918		
1270.00	103	-038	-021	0.364	0.049	-0.918	82	17
1271.25	103	-038	-021	0.364	0.049	-0.918		
1272.50	104	-039	-021	0.364	0.046	-0.918	82	17
1273.75	104	-039	-022	0.364	0.046	-0.918		
1275.00	104	-039	-022	0.364	0.046	-0.918	81	17

REPORT NO. NADC-79240-60

T	R	Q	P	DC1	DC2	DC3	RL.CMID	PC.CMID
1276.25	104	-039	-022	0.357	0.046	-0.921		
1277.50	104	-040	-022	0.357	0.046	-0.921	81	16
1279.75	104	-040	-023	0.357	0.043	-0.921		
1280.00	104	-040	-023	0.357	0.043	-0.921	81	16
1281.25	104	-040	-023	0.357	0.043	-0.921		
1282.50	104	-041	-023	0.357	0.043	-0.921	81	16
1283.75	105	-041	-024	0.357	0.040	-0.921		
1285.00	105	-041	-024	0.357	0.040	-0.921	81	16
1286.25	105	-042	-024	0.357	0.040	-0.921		
1287.50	105	-042	-024	0.358	0.038	-0.921	81	16
1288.75	105	-042	-025	0.350	0.045	-0.923		
1290.00	105	-043	-025	0.350	0.045	-0.923	81	16
1291.25	105	-043	-025	0.350	0.045	-0.923		
1292.50	105	-043	-025	0.350	0.042	-0.923	81	16
1293.75	105	-043	-026	0.350	0.042	-0.923		
1295.00	105	-044	-026	0.350	0.042	-0.923	81	16
1296.25	106	-044	-026	0.350	0.042	-0.923		
1297.50	106	-044	-026	0.351	0.040	-0.923	81	16
1298.75	106	-045	-027	0.351	0.040	-0.923		
1300.00	106	-045	-027	0.343	0.040	-0.926	81	15
1301.25	106	-045	-027	0.343	0.040	-0.926		
1302.50	106	-046	-027	0.344	0.037	-0.926	81	15
1303.75	106	-046	-028	0.344	0.037	-0.926		
1305.00	106	-046	-028	0.344	0.037	-0.926	81	15
1306.25	106	-047	-028	0.344	0.037	-0.926		
1307.50	107	-047	-028	0.344	0.042	-0.926	81	16
1308.75	107	-048	-029	0.344	0.042	-0.926		
1310.00	107	-048	-029	0.344	0.042	-0.926	81	16
1311.25	107	-048	-029	0.337	0.039	-0.928		
1312.50	107	-049	-030	0.337	0.039	-0.928	81	15
1313.75	107	-049	-030	0.337	0.039	-0.928		
1315.00	108	-050	-030	0.337	0.039	-0.928	81	15
1316.25	108	-050	-030	0.337	0.037	-0.928		
1317.50	108	-050	-031	0.337	0.037	-0.928	81	15
1318.75	108	-051	-031	0.337	0.037	-0.928		
1320.00	108	-051	-031	0.337	0.037	-0.928	81	15
1321.25	108	-052	-031	0.330	0.034	-0.931		
1322.50	109	-052	-032	0.330	0.034	-0.931	81	15
1323.75	109	-052	-032	0.330	0.041	-0.931		
1325.00	109	-053	-032	0.330	0.039	-0.931	81	15
1326.25	109	-053	-032	0.330	0.039	-0.931		
1327.50	109	-053	-032	0.330	0.039	-0.931	81	15
1328.75	109	-053	-033	0.330	0.039	-0.931		
1330.00	109	-054	-033	0.330	0.036	-0.931	81	15
1331.25	110	-054	-033	0.323	0.036	-0.933		
1332.50	110	-054	-033	0.323	0.036	-0.933	81	14
1333.75	110	-054	-034	0.323	0.036	-0.933		
1335.00	110	-055	-034	0.323	0.034	-0.933	81	14
1336.25	110	-055	-034	0.323	0.034	-0.933		
1337.50	110	-055	-035	0.323	0.034	-0.933	81	14
1338.75	111	-055	-035	0.324	0.039	-0.933		
1340.00	111	-055	-035	0.316	0.039	-0.935	81	14
1341.25	111	-055	-035	0.316	0.039	-0.935		
1342.50	111	-055	-036	0.316	0.039	-0.935	81	14
1343.75	111	-057	-036	0.317	0.036	-0.935		
1345.00	111	-057	-036	0.317	0.036	-0.935	81	14
1346.25	111	-057	-036	0.317	0.036	-0.935		
1347.50	112	-057	-037	0.317	0.034	-0.935	81	14
1348.75	112	-057	-037	0.309	0.034	-0.938		
1350.00	112	-058	-037	0.309	0.034	-0.938	81	13

REPORT NO. NADC-79240-60

T	R	Q	P	LC1	LC2	LC3	REL. DATA	PC. NO.
1351.25	112	-058	-037	0.309	0.034	-0.938		
1352.50	112	-058	-038	0.310	0.039	-0.938	81	13
1353.75	112	-059	-038	0.310	0.039	-0.938		
1355.00	112	-059	-038	0.310	0.039	-0.938	81	13
1356.25	113	-059	-038	0.310	0.039	-0.938		
1357.50	113	-059	-039	0.302	0.037	-0.940	81	13
1358.75	113	-060	-039	0.302	0.037	-0.940		
1360.00	113	-060	-039	0.302	0.037	-0.940	81	13
1361.25	113	-060	-039	0.303	0.034	-0.940		
1362.50	113	-060	-040	0.303	0.034	-0.940	81	13
1363.75	114	-061	-040	0.303	0.034	-0.940		
1365.00	114	-061	-040	0.295	0.034	-0.942	81	12
1366.25	114	-061	-040	0.295	0.040	-0.942		
1367.50	114	-061	-040	0.295	0.040	-0.942	81	12
1368.75	114	-062	-041	0.295	0.040	-0.942		
1370.00	114	-062	-041	0.296	0.037	-0.942	81	12
1371.25	114	-062	-041	0.296	0.037	-0.942		
1372.50	115	-062	-041	0.296	0.037	-0.942	81	12
1373.75	115	-063	-042	0.288	0.037	-0.944		
1375.00	115	-063	-042	0.288	0.035	-0.944	81	12
1376.25	115	-063	-042	0.288	0.035	-0.944		
1377.50	115	-063	-043	0.288	0.043	-0.944	81	12
1378.75	115	-064	-043	0.289	0.040	-0.944		
1380.00	116	-064	-043	0.289	0.040	-0.944	81	12
1381.25	116	-064	-044	0.281	0.040	-0.946		
1382.50	116	-064	-044	0.281	0.040	-0.946	81	12
1383.75	116	-064	-044	0.281	0.038	-0.946		
1385.00	116	-065	-045	0.281	0.038	-0.946	81	12
1386.25	116	-065	-045	0.281	0.038	-0.946		
1387.50	117	-065	-046	0.282	0.036	-0.946	81	12
1388.75	117	-065	-046	0.274	0.043	-0.948		
1390.00	117	-065	-046	0.274	0.043	-0.948	81	11
1391.25	117	-066	-047	0.275	0.041	-0.948		
1392.50	117	-066	-047	0.275	0.041	-0.948	81	11
1393.75	117	-067	-047	0.275	0.041	-0.948		
1395.00	117	-067	-048	0.275	0.041	-0.948	81	11
1396.25	117	-067	-048	0.267	0.039	-0.950		
1397.50	118	-067	-049	0.267	0.039	-0.950	81	11
1398.75	118	-068	-049	0.267	0.039	-0.950		
1400.00	118	-068	-049	0.268	0.045	-0.950	81	11
1401.25	118	-068	-050	0.268	0.045	-0.950		
1402.50	118	-068	-050	0.268	0.045	-0.950	81	11
1403.75	118	-068	-050	0.260	0.045	-0.952		
1405.00	118	-068	-050	0.260	0.043	-0.952	81	10
1406.25	118	-068	-051	0.260	0.043	-0.952		
1407.50	118	-068	-051	0.260	0.043	-0.952	81	10
1408.75	119	-069	-051	0.261	0.041	-0.952		
1410.00	119	-069	-051	0.261	0.048	-0.952	82	10
1411.25	119	-069	-052	0.253	0.048	-0.954		
1412.50	119	-069	-052	0.253	0.046	-0.954	81	10
1413.75	119	-069	-052	0.253	0.046	-0.954		
1415.00	119	-069	-052	0.253	0.046	-0.954	81	10
1416.25	119	-069	-052	0.253	0.046	-0.954		
1417.50	119	-069	-053	0.254	0.044	-0.954	81	10
1418.75	119	-069	-053	0.246	0.052	-0.955		
1420.00	119	-069	-053	0.246	0.052	-0.955	82	0F
1421.25	120	-070	-053	0.246	0.050	-0.955		
1422.50	120	-070	-053	0.246	0.050	-0.955	82	0F
1423.75	120	-070	-054	0.246	0.050	-0.955		
1425.00	120	-070	-054	0.247	0.048	-0.955	82	0F

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T	R	Q	P	DC1	DC2	DC3	RL.CMND	PC.CMND
1425.25	120	-070	-054	0.239	0.043	-0.957		
1427.50	120	-070	-054	0.239	0.048	-0.957	82	OF
1428.75	120	-070	-055	0.239	0.056	-0.957		
430.00	120	-070	-055	0.240	0.054	-0.957	82	OF
1431.25	121	-071	-055	0.240	0.054	-0.957		
1432.50	121	-071	-055	0.232	0.054	-0.959	82	OE
1433.75	121	-071	-056	0.232	0.052	-0.959		
1435.00	121	-071	-056	0.232	0.052	-0.959	82	OE
1435.25	121	-071	-056	0.232	0.052	-0.959		
1437.50	121	-071	-056	0.233	0.058	-0.958	82	OE
1438.75	122	-072	-057	0.233	0.058	-0.958		
1440.00	122	-072	-057	0.225	0.058	-0.960	82	OE
1441.25	122	-072	-057	0.225	0.058	-0.960		
1442.50	122	-072	-057	0.225	0.056	-0.960	82	OE
1443.75	122	-072	-058	0.225	0.056	-0.960		
1445.00	122	-072	-058	0.225	0.056	-0.960	82	OE
1446.25	122	-072	-058	0.218	0.062	-0.961		
1447.50	123	-073	-058	0.218	0.062	-0.961	82	OD
1448.75	123	-073	-059	0.218	0.062	-0.961		
1450.00	123	-073	-059	0.219	0.061	-0.961	82	OD
1451.25	123	-073	-059	0.219	0.061	-0.961		
1452.50	123	-073	-059	0.219	0.061	-0.961	82	OD
1453.75	123	-073	-060	0.211	0.059	-0.963		
1455.00	123	-073	-060	0.211	0.067	-0.963	83	OD
1456.25	124	-073	-060	0.211	0.067	-0.963		
1457.50	124	-074	-060	0.211	0.067	-0.963	83	OD
1458.75	124	-074	-061	0.212	0.065	-0.963		
1460.00	124	-074	-061	0.204	0.065	-0.964	83	OD
1461.25	124	-074	-061	0.204	0.065	-0.964		
1462.50	124	-074	-062	0.205	0.063	-0.964	83	OD
1463.75	125	-074	-062	0.205	0.071	-0.964		
1465.00	125	-074	-062	0.205	0.071	-0.964	83	OD
1466.25	125	-074	-062	0.205	0.069	-0.964		
1467.50	125	-074	-063	0.193	0.069	-0.965	83	OC
1468.75	125	-074	-063	0.193	0.069	-0.965		
1470.00	125	-074	-063	0.193	0.068	-0.965	83	OC
1471.25	125	-075	-063	0.193	0.076	-0.965		
1472.50	126	-075	-064	0.193	0.075	-0.965	83	OC
1473.75	126	-075	-064	0.191	0.074	-0.966		
1475.00	126	-075	-064	0.191	0.074	-0.966	83	OC
1476.25	126	-075	-064	0.191	0.074	-0.966		
1477.50	126	-075	-064	0.192	0.073	-0.966	83	OC
1478.75	127	-075	-065	0.192	0.080	-0.966		
1480.00	127	-075	-065	0.184	0.080	-0.967	84	OB
1481.25	127	-075	-065	0.184	0.080	-0.967		
1482.50	127	-075	-065	0.185	0.079	-0.967	84	OB
1483.75	128	-076	-066	0.185	0.079	-0.967		
1485.00	128	-076	-066	0.185	0.085	-0.967	84	OB
1486.25	128	-076	-066	0.178	0.085	-0.967		
1487.50	129	-076	-067	0.178	0.085	-0.968	84	OB
1488.75	129	-076	-067	0.173	0.084	-0.968		
1491.25	129	-076	-067	0.178	0.084	-0.968	84	OB
1492.50	129	-076	-067	0.178	0.084	-0.968		
1493.75	130	-076	-068	0.171	0.080	-0.969	84	OB
1495.00	130	-076	-068	0.171	0.080	-0.969		
1496.25	130	-077	-068	0.171	0.089	-0.969	84	OB
1497.50	130	-077	-068	0.172	0.089	-0.969		
1498.75	131	-077	-069	0.172	0.089	-0.969	84	OB
1500.00	131	-077	-069	0.164	0.089	-0.970	84	OB

A.3 Program Listing - PRINTOUT

```

0100
0100 00      NOP
0101 83      DI
0102 218F37  LXI SP,HEED30
0103 75 002901 CALL INZPRNTR
0104 005601  CALL INZDSP
0105 007408  CALL CHOICE
0106 001A0C  CALL PRNTRDR
0111 002E0C  CALL PRINTINFLH
0114 003E01  CALL INZDSK
0117 009E01  CALL INZVRBLS
011A 000002  CALL INZRDATA
011D 009F05  CALL INZDRFTM
0120 005601  CALL INZDSP
0123 003107  CALL INZDEMO
0126 003407  JMP EJKEY
    
```

INZPRNTR:

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0129 21827D  LXI H,7DB2H
012C 3613    MVI M,13H
012E 21897D  LXI H,7DB9H
0131 3612    MVI M,12H
;SET UP BAUD RATE
0133 3E40    MVI A,40H
0135 03F3    OUT 0F3H
0137 2103D1  LXI H,0D103H
013A 3636    MVI M,36H
013C 2100D1  LXI H,0D100H
013F 3668    MVI M,68H
0141 3600    MVI M,0
0143 AF     XRA A
0144 D313    OUT 13H
0146 D313    OUT 13H
0148 D313    OUT 13H
014A 3E40    MVI A,40H
014C D313    OUT 13H
014E 3ECA    MVI A,0CAH
0150 D313    OUT 13H
0152 3E37    MVI A,37H
0154 D313    OUT 13H
    
```

INZDSP:

;CLEAR SCREEN, USE 40 CLMNS.,
;USE UPPER AND LOWER CASE

```

0156 0000F3  CALL OF800H
0159 3E18    MVI A,18H
015B 0003F8  CALL OF803H ; 40 COLUMNS
015E 3E43    MVI A,43H
0160 0003F8  CALL OF803H
0163 3E18    MVI A,18H
0165 0003F8  CALL OF803H
0168 3E55    MVI A,55H
016A 0003F8  CALL OF803H
016D 00      RET
    
```

INZDSK:

;INITIALIZE FILE CONTROL BLOCKS
;AND OPEN ALL FILES

```

016E 210042  LXI H,FC3DD1
    
```

PRINTOUT. PRT

0171 3670	MVI M,0
0173 019000	LXI B,12
0175 1693	MVI E,3
73 1616	MVI D,22
	LPM:
017A 09	DAD B
	LPC:
0175 3670	MVI M,0
017D 23	INX H
017E 15	DCR D
017F C27B01	JNZ LPS
0182 1616	MVI D,22
0184 2B	DCX H
0185 1D	DCR E
0186 C27A01	JNZ LPM
0189 0E0F	MVI C,OPEN
018B 110042	LXI D,FCBRD1
018E C00500	CALL BDOS
0191 112142	LXI D,FCBDRFTM
0194 C00500	CALL BDOS
0197 114242	LXI D,FCBDEMO
019A C00500	CALL BDOS
019D 09	RET
	IIIZVRBLS:
019E AF	XRA A
019F 210000	LXI H,0
01A2 32F841	STA DCCT
01A5 32F441	STA SEQINDX
A3 22EA41	SHLD YAWR
01AB 22E041	SHLD P1CHR
01AE 22EE41	SHLD ROLLR
01B1 220441	SHLD YSUM1-2
01B4 22D041	SHLD YSUM2-2
01B7 220841	SHLD PSUM1-2
01BA 220441	SHLD PSUM2-2
01BD 220041	SHLD RSUM1-2
01C0 220841	SHLD RSUM2-2
01C3 220641	SHLD YSUM1
01C6 22D241	SHLD YSUM2
01C9 220A41	SHLD PSUM1
01CC 220641	SHLD PSUM2
01CF 220E41	SHLD RSUM1
01D2 22DA41	SHLD RSUM2
01D5 32DE41	STA YAINC
01D8 32DE41	STA PCINC
01DB 32DE41	STA RLINC
01DE 32F541	STA TOGGL
01E1 210038	LXI H,300H
01E4 22FA41	SHLD SOPTR
01E7 21B03C	LXI H,300H
01EA 22FC11	SHLD TLEPTR
01ED 21E04A	LXI H,4A0H
1B0 22E041	SHLD VSPTR
1B3 21000C	LXI H,0000H
01F5 22F041	SHLD DPOS
01F8 2140B3	LXI H,0F40H
01FB 22F041	SHLD DIBG
01FE 09	RET

INZDATA:

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;
; READ FILE WITH END POINTS
; AND INTERPOLATE TO GET
; 1200 PIECES OF DATA EACH FOR
; YAW, PITCH AND ROLL RATES
;

```

```

0200 210036      LXI H,3600H
0203 22E237      SHLD MOVPTB
0206 0603        MVI B,3

```

SETUPIPS:

```

0209 0E14        MVI C,READ
020A 110042      LXI D,FCBMD1
020D CD0500      CALL BDOS

```

```

;
; MOVE 80H BYTES TO INT PTS. STORAGE
;

```

```

0210 2AE237      LHL MOVPTB
0213 118000      LXI D,80H

```

MOVLOOP:

```

0216 1A          LDAX D
0217 77          MOV M,A
0218 13          INX D
0219 23          INX H
021A AF          XRA A
021B 3A          CMP D
021C CA1602      JZ MOVLOOP
021F 22E237      SHLD MOVPTB
0222 05          DCR B
0223 C20802      JNZ SETUPIPS

```

```

;
; SET UP TO INTERPOLATE YAW RATE DATA
;

```

```

0226 210036      LXI H,BEGYIP
0229 22EA37      SHLD STRIPT
022C 21E04A      LXI H,YRDATA
022F 22E837      SHLD STRLOC
0232 CD5402      CALL LINT

```

```

;
; SET UP TO INTERPOLATE PITCH RATE DATA
;

```

```

0235 217A36      LXI H,BEGPIP
0238 22EA37      SHLD STRIPT
023B 21E24A      LXI H,PRDATA
023E 22E837      SHLD STRLOC
0241 CD5402      CALL LINT

```

```

;
; SET UP TO INTERPOLATE ROLL RATE DATA
;

```

```

0244 21F436      LXI H,BEGRIP
0247 22EA37      SHLD STRIPT
024A 21E44A      LXI H,RDDATA
024D 22E837      SHLD STRLOC
0250 CD5402      CALL LINT
0253 C9          RET

```

LINT:

```

;
; F(XI)=(F0XI-FIX0) + (F1-F0)*XI/(X1-X0)

```

PRINTOUT.PRI

PAGE 4

```

;
0254 210000 LXI H,0
0257 39 DAD SP
0258 22F637 SHLD LIQVSP
0259 31F637 LXI SP,LIJUNK
025E 210000 LXI B,0000
0261 110100 LXI D,1
0264 C5 PUSH B
0265 D5 PUSH D
0266 C5 PUSH B
0267 2AEA37 LHLD STRTPT
026A F9 SPHL

LILoop:
0263 E1 POP H ;FO
026C 22C137 SHLD MLTP2
026F 22F837 SHLD FZERO ;FOR LATER
0272 2AF437 LHLD XZERO
0275 3E14 MVI A,20
0277 85 ADD L
0278 6F MOV L,A ;GET X1
0279 7C MOV A,H
027A CE00 ACI 0
027C 67 MOV H,A
027D 22C737 SHLD MLTP1 ;FO X X1
0280 210000 LXI H,0
0283 39 DAD SP
0284 22E637 SHLD TMPSP

;
;SAVE STACK PTR BEFORE CALL MULT
;
0287 31CF37 LXI SP,SCRATCH
028A CD9603 CALL MULT

;
;PRODUCT OF MULT = FO X X1
;
028D 2AC137 LHLD ANSL
0290 22FC37 SHLD FOXIL
0293 2AC337 LHLD ANSM
0296 22FE37 SHLD FOXIM
0299 2AE637 LHLD TMPSP
029C F9 SPHL
029D E1 POP H ;GET F1
029E 3B DCX SP
029F 3B DCX SP ;=NXT FO
02A0 22C137 SHLD MLTP2
02A3 22FA37 SHLD FONE
02A6 2AF437 LHLD XZERO
02A9 22C737 SHLD MLTP1

;
;NEXT XO = CURRENT XO + 20
;
02AC 111400 LXI D,20
02AF 19 DAD D
02B0 22F437 SHLD XZERO
02B3 210000 LXI H,0
02B6 39 DAD SP
02B7 22E637 SHLD TMPSP
02BA 31CF37 LXI SP,SCRATCH

```

025D CD9603

CALL MULT

```

;
;PRODUCT FROM MULT = F1 X X0
;
;NOW COMPUTE FOXI - FIXO
;

```

```

02C0 2AFC37      LHLD FOXIL
02C3 E3          XCHG
02C4 2AFE37      LHLD FOXIM
02C7 4D          MOV C,L
02C8 44          MOV B,H

```

```

;
;BCDE - FOXI
;

```

```

02C9 2AC137      LHLD ANGL
02CC 7D          MOV A,L
02CD 2F          CMA
02CE C601        ADI 1
02D0 6F          MOV L,A
02D1 7C          MOV A,H
02D2 2F          CMA
02D3 CE00        ACI 0
02D5 67          MOV H,A
02D6 22C137      SHLD ANSL
02D9 2AC337      LHLD ANSM
02DC 7D          MOV A,L
02DD 2F          CMA
02DE CE00        ACI 0
02E0 6F          MOV L,A
02E1 7C          MOV A,H
02E2 2F          CMA
02E3 CE00        ACI 0
02E5 67          MOV H,A
02E6 22C337      SHLD ANSM

```

```

;
;ANSM/L = -FIXO
;

```

```

02E9 2AC137      LHLD ANSL
02EC 19          DAD D
02ED 22EC37      SHLD ALST
02F0 2AC337      LHLD ANSM
02F3 D2F702      JNC LICN1
02F6 23          INX H

```

LICN1:

```

02F7 09          DAD B
02F8 22EE37      SHLD AMST

```

```

;
;COMPUTE F1 - FO
;

```

```

02F8 2AF837      LHLD FZERO
02FE 7D          MOV A,L
02FF 2F          CMA
0300 4F          MOV C,A
0301 7C          MOV A,H
0302 2F          CMA
0303 47          MOV B,A
0304 03          INX B
0305 2AFA37      LHLD FONE

```

PRINTOUT.PRN

```

0300 00          DAD B
0301 220437     SHLD FIMFO
                LISUBLP:
                ;
                ; COMPUTE (F1-F0) X X(I)
                ;
0302 2AE437     LHLD FIMFO
0303 22C737     SHLD MLTP1
0304 2AF237     LHLD IVAL
0305 22C137     SHLD MLTP2
0306 23         INX H
0307 22F237     SHLD IVAL
0308 CD9603     CALL MULT
                ;
                ; COMP. (FOX1-FIX0)+(F1-F0)X X(I)
                ;
0309 2AEC37     LHLD ALST
0310 EB         XCHG
0311 2AC137     LHLD ANSL
0312 19         DAD D
0313 22D037     SHLD DVNDL
0314 2AEE37     LHLD AMST
0315 EB         XCHG
0316 2AC337     LHLD ANSM
0317 D23503     JNC LICN2
0318 23         INX H
                LICN2:
0319 19         DAD D
0320 22D237     SHLD DVNDM
0321 211400     LXI H,20
0322 22D437     SHLD DVSRL
0323 210000     LXI H,0
0324 22D637     SHLD DVSRM
0325 CD8004     CALL DIVIDE
                ;
                ; QUOT. = (FOX1-FIX0)+(F1-F0)X X(I) / 20
                ; WHERE 20 = X1-X0
                ;
0326 2AD237     LHLD QUOTL
0327 EB         XCHG
                ;
                ; STORE INTERPOLATED DATA POINT
                ;
0328 2AE837     LHLD STRLOC
0329 73         MOV M,E
0330 23         INX H
0331 72         MOV M,D
                ;
                ; INX BY 5 TO STORE NEXT DATA POINT
                ;
0332 110500     LXI D,5
0333 19         DAD D
0334 22E837     SHLD STRLOC
                ; 19 PTS?
0335 3AF037     LDA CTR20
0336 3C         INR A
0337 32D037     STA CTR20
0338 FE13       CPI 19

```

PRINTOUT.PRN

```

0362 C20C03      JNZ LISUBLP
0365 AF          XRA A
0366 32F037     STA CTR20
0369 2AFA37     LHL D FONE
036C EB         XCHG
036D 2AE837     LHL D STRLOC

```

```

;
;STORE FI AS 20TH POINT
;

```

```

0370 73         MOV M,E
0371 23         INX H
0372 72         MOV M,D
0373 110500     LXI D,5
0376 19         DAD D
0377 22E837     SHLD STRLOC

```

```

;
;RESTORE STACK PTR TO GET NEW
;END POINTS
;

```

```

037A 2AE637     LHL D TMPSP
037D F9         SPHL
037E 2AF237     LHL D IVAL
0381 23         INX H
0382 22F237     SHLD IVAL

```

```

;
;HAVE 60X20 PTS BEEN GENERATED?
;

```

```

0385 3AF137     LDA CTR60
0388 3C         INR A
0389 32F137     STA CTR60
038C FE3C      CPI 60
038E C26B02     JNZ LILCOOP
0391 2AF637     LHL D LISVSP
0394 F9         SPHL
0395 C9         RET

```

MULT:

```

;
;ZERO OUT MST 1/2 ANS AND CARRY SAVE
;

```

```

0396 210000     LXI H,0000
0399 22C337     SHLD ANSM
039C 22C537     SHLD CARYSV

```

```

;
;DETERMINE SIGN OF ANSWER
;

```

```

039F 2AC737     LHL D MLTP1
03A2 7C         MOV A,H
03A3 2AC137     LHL D MLTP2
03A6 AC         XRA H
03A7 32CF37     STA SIGN
03AA 3E80      MVI A,80H

```

```

;
;IF MLTP2<0, MLTP2=-MLTP2
;

```

```

03AC A4         ANA H
03AD FC6B04     CM TC16
03B0 CD7304     CALL CHKZERO
03B3 22C137     SHLD MLTP2

```

PRINTOUT.PRN

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```

03B6 2A0737      LHLD MLTP1
03B9 3E80        MVI A,80H
;
; IF MLTP1<0, MLTP1=-MLTP1
;
03BB A4         ANA H
03BC FC6E04      CM TC16
03BF CD7304      CALL CHKZERO
03C2 22C737      SHLD MLTP1
;
; SAVE SP FOR RETURN
;
03C5 210000      LXI H,0
03C8 39         DAD SP
03C9 22C937      SHLD MSVSP
;
; SET UP BIT COUNT
;
03CC 3E11        MVI A,17
03CE 32C037      STA CNT
03D1 31C137      LXI SP,MLTP2
MLTLP:
03D4 21FFFF      LXI H,0FFFFH
03D7 39         DAD SP
03D8 35         DCR M
03D9 CA4804      JZ MLPDONE
;
; PUT TEST BIT INTO CARRY
;
03DC F1         POP PSW
03DD D23C04      JNC BIT0
BIT1:
03E0 D1         POP D
03E1 C1         POP B
03E2 E1         POP H
; D=MST 1/2 AMS
; B=CARRY SAVE
; H=1ST MULTIPLIER
;
; GET SUM WITHOUT CARRIES
;
03E3 78         MOV A,B
03E4 AA         XRA D
03E5 AC         XRA H
03E6 47         MOV B,A
03E7 79         MOV A,C
03E8 AB         XRA E
03E9 AD         XRA L
03EA 4F         MOV C,A
03EB 21FAFF      LXI H,0FFFAH
03EE 39         DAD SP
03EF F9         SPHL
;
; COMPUTE NEW CARRY SAVE
;
03F0 E1         POP H
03F1 7C         MOV A,H
03F2 E1         POP H

```

PRNTOUT.PRM

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```

03F3 A4      ANA H
03F4 57      MOV D,A
03F5 7C      MOV A,H
03F6 E1      POP H
03F7 A4      ANA H
03F8 B2      ORA D
03F9 57      MOV D,A
03FA 7C      MOV A,H
03FB 21FAFF  LXI H,OFFFAH
03FE 39      DAD SP
03FF F9      SPHL
0400 E1      POP H
0401 A4      ANA H
0402 B2      ORA D
0403 57      MOV D,A
0404 7D      MOV A,L
0405 E1      POP H
0406 A5      ANA L
0407 5F      MOV E,A
0408 7D      MOV A,L
0409 E1      POP H
040A A5      ANA L
040B B3      ORA E
040C 5F      MOV E,A
040D 7D      MOV A,L
040E 21FAFF  LXI H,OFFFAH
0411 39      DAD SP
0412 F9      SPHL
0413 E1      POP H
0414 A5      ANA L
0415 B3      ORA E
0416 5F      MOV E,A
0417 E1      POP H

```

MSTR:

```

;
;STORE NEW PS(I)
;STORE NEW CS(I)
;

```

```

0418 D5      PUSH D
0419 C5      PUSH B
041A 3B      DCX SP
041B 3B      DCX SP
041C D1      POP D
041D C1      POP B

```

```

;
;BCDE=PS(I)--MUST BE SHIFTED RIGHT
;BY 1
;

```

SHFT:

```

041E AF      XRA A
041F 76      MOV A,B
0420 1F      RAR
0421 47      MOV B,A
0422 79      MOV A,C
0423 1F      RAR
0424 4F      MOV C,A
0425 7A      MOV A,D
0426 1F      RAR

```

PRINTOUT.PRN

```

0427 57      MOV D,A
0428 78      MOV A,E
0429 1F      RAR
042A 5F      MOV E,A
042B C5      PUSH B
042C 55      PUSH D
042D C3D403  JMP MLTLP

```

BITO:

```

;
; COMPUTE PS(I)
;

```

```

0430 D1      POP D
0431 C1      POP B
0432 78      MOV A,B
0433 AA      XRA D
0434 47      MOV B,A
0435 79      MOV A,C
0436 AB      XRA E
0437 4F      MOV C,A
0438 3B      DCX SP
0439 3B      DCX SP
043A 33      DCX SP
043B 33      DCX SP

```

```

;
; COMPUTE CS(I)
;

```

```

043C E1      POP H
043D 7C      MOV A,H
043E 5D      MOV E,L
043F E1      POP H
0440 A4      ANA H
0441 57      MOV D,A
0442 78      MOV A,E
0443 A5      ANA L
0444 5F      MOV E,A
0445 C31304  JMP MSTR

```

MLPDONE:

```

;
; COMPUTE PS(N) + CS(N)
;

```

```

0448 33      INX SP
0449 33      INX SP
044A E1      POP H
044B C1      POP B
044C 09      DAD B
044D C5      PUSH B
044E E5      PUSH H
044F 2AC937  LHLD MSVSP
0450 F9      SPHL

```

```

;
; DETERMINE PROPER SIGN OF PRODUCT
;

```

```

0453 3ACF37  LDA SIGN
0454 F50C    ANI 30H
0455 F0      RP
0456 2AC937  LHLD ANSP
0457 F0      XCHG
0458 2AC137  LHLD ANSL

```

PRINTOUT.PRG

```

0460 C00405      CALL TWOSCOMP
0463 22C137      SHLD ANSL
0466 EB          XCHG
0467 22C337      SHLD ANSM
046A C9          RET

```

TC16:

```

;
;SUBROUTINE TO TAKE TWOS COMPLEMENT
;OF 16 BIT WORD HL
;

```

```

046B 7D          MOV A,L
046C 2F          CMA
046D 6F          MOV L,A
046E 7C          MOV A,H
046F 2F          CMA
0470 67          MOV H,A
0471 23          INX H
0472 C9          RET

```

CHKZERO:

```

0473 AF          XRA A
0474 BC          CMP H
0475 C0          RNZ
0476 BD          CMP L
0477 C0          RNZ
0478 210000      LXI H,0
047B 22C137      SHLD ANSL
047E C1          POP B
047F C9          RET

```

DIVIDE:

```

;
;DIVIDE BY REPEATED SUBTRACTIONS
;THEN ROUND QUOTIENT TO NEAREST
;INTEGER
;

```

```

0480 21FFFF      LXI H,0FFFFH
0483 22D837      SHLD QUOTL
0486 22DA37      SHLD QUOTM

```

```

;
;DETERMINE SIGN OF QUOTIENT
;

```

```

0489 2AD637      LHLD DVSRM
048C 7C          MOV A,H
048D 2AD237      LHLD DVNDM
0490 AC          XRA H
0491 32CF37      STA SIGN

```

```

;
; IF DVND<0, DVND=|DVND|
;

```

```

0494 7C          MOV A,H
0495 E680        ANI 80H
0497 F2A904      JP CKDVSr
049A EB          XCHG
049B 2AD037      LHLD DVNDL
049E C00405      CALL TWOSCOMP
04A1 22D037      SHLD DVNDL
04A4 EB          XCHG
04A5 22D237      SHLD DVNDM

```

CKDVSr:

```

;
; IF DVSR<0, DVSR=1-DVSR;
;

```

```

04A3 2AD637      LHL DVS RM
04A4 7C          MOV A, H
04A5 E630       ANI 80H
04A6 F2BF04     JP DOCKS
04A7 EB        XCHG
04A8 2AD437     LHL DVS RL
04A9 CD0405     CALL TWOSCOMP
04AA 22D437     SHLD DVS RL
04AB EB        XCHG
04AC 22D637     SHLD DVS RM

```

DOCKS:

```

;
; IS DVSR 0 OR 1?
;

```

```

04BF EB        XCHG
04C0 2AD437     LHL DVS RL
04C1 EB        XCHG
04C2 AF        XRA A
04C3 B4        ORA H
04C4 B5        ORA L
04C5 B2        ORA D
04C6 C2D404    JNZ CKDNO
04C7 B3        ORA E
04C8 CA0305    JZ DIVZERO
04C9 FE01      CPI 1
04CA CAED04    JZ DIVONE

```

CKDNO:

```

;
; IV DVND=0, QUOT = 0
;

```

```

04D4 AF        XRA A
04D5 2AD237     LHL DVNDM
04D6 EB        XCHG
04D7 2AD037     LHL DVNDL
04D8 B2        ORA D
04D9 B3        ORA E
04DA B4        ORA H
04DB B5        ORA L
04DC C23605    JNZ SETUP

```

QUOTO:

```

04E3 210000    LXI H, 0
04E4 22DA37    SHLD QUOTM
04E5 22D837    SHLD QUOTL
04E6 C9        RET

```

DIVONE:

```

;
; IF DVSR=1, QUOT=DVND
;

```

```

04ED 2AD237     LHL DVNDM
04EE EB        XCHG
04EF 2AD037     LHL DVNDL
04F0 3ACF37     LDA SIGN
04F1 AA        XRA D
04F2 CD0405     CALL TWOSCOMP
04F3 22D837     SHLD QUOTL

```

PRINTOUT.PRN

```

04FE EB          XCHG
04FF 22DA37      SHLD QUOTM
0502 C9          RET

```

DIVZERO:

0503 76

HLT

TROSCOMP:

```

;
; SUBROUTINE TAKES 2'S COMP.
; OF 32 BITS IN DEHL
;

```

```

0504 7D          MOV A,L
0505 2F          CMA
0506 C601        ADI 1
0508 6F          MOV L,A
0509 7C          MOV A,H
050A 2F          CMA
050B CE00        ACI 0
050D 67          MOV H,A
050E 7B          MOV A,E
050F 2F          CMA
0510 CE00        ACI 0
0512 6F          MOV E,A
0513 7A          MOV A,D
0514 2F          CMA
0515 CE00        ACI 0
0517 67          MOV D,A
0518 C9          RET

```

INCCQUOT:

```

;
; INCR. QUOT WITH EACH SUCCESSFUL
; SUBTRACTION
;

```

```

0519 2AD837      LHLD QUOTL
051C 7D          MOV A,L
051D C601        ADI 1
051F 6F          MOV L,A
0520 7C          MOV A,H
0521 CE00        ACI 0
0523 67          MOV H,A
0524 22D837      SHLD QUOTL
0527 2ADA37      LHLD QUOTM
052A 7D          MOV A,L
052B CE00        ACI 0
052D 6F          MOV L,A
052E 7C          MOV A,H
052F CE00        ACI 0
0531 67          MOV H,A
0532 22DA37      SHLD QUOTM
0535 C9          RET

```

SETUP:

```

;
; SET DVSR= -DVSR TO DO SUBTRACTION
;

```

```

0536 2AD637      LHLD DVSRM
0539 EB          XCHG
053A 2AD437      LHLD DVSNL
053D C9D405      CALL TROSCOMP
0540 14          MOV B,H

```

PRINTOUT. PRR

0541 4D	MOV C,L
0542 001905	CALL INCOJOT
0545 2AD037	LHLD DVNDL
054F 22DC37	SHLD REML
054B 12	DAD B
054C 22D037	SHLD DVNDL
054F 2AD237	LHLD DVNDM
0552 22DE37	SHLD REMM
0555 7D	MOV A,L
0556 8B	ADC E
0557 6F	MOV L,A
0558 7C	MOV A,H
0559 8A	ADC D
055A 67	MOV H,A
055B 22D237	SHLD DVNDM
055E 0A4205	JC DIVLP
0561 2ADC37	LHLD REML
0564 7D	MOV A,L
0565 17	RAL
0566 6F	MOV L,A
0567 7C	MOV A,H
0568 17	RAL
0569 67	MOV H,A
056A 22DC37	SHLD REML
0567 2ADE37	LHLD REMM
0570 7D	MOV A,L
0571 17	RAL
0572 6F	MOV L,A
0573 7C	MOV A,H
0574 17	RAL
0575 67	MOV H,A
0576 22DE37	SHLD REMM
0579 2AJC37	LHLD REML
057C 09	DAD B
0577 2ADE37	LHLD REMM
0580 7D	MOV A,L
0581 8B	ADC E
0582 7C	MOV A,H
0583 8A	ADC D
0584 001905	CC INCOJOT
0587 2ADCF37	LDA SIGN
058A E58C	ANI SIGN
058C F0	RP
058D 2ADA37	LHLD QUOTA
0590 EB	XCHG
0591 2AD837	LHLD QUOTE
0594 000405	CALL TWOSCOMP
0597 22D837	SHLD QUOTE
059A EB	XCHG
059B 22DA37	SHLD QUOTA
059E 09	RET

INDRPT:

;
 ;GET INITIAL ALTITUDE AND SPEED
 ;FROM CRT AND DATA FILE
 ;PARAMETER PUSHER-TIME
 ;VI C, 000

0597 22D837

PRNTOUT.PRII

05A1 112142
05A4 CD0500LXI D,PCBDRFTM
CALL BDOS

GETALT:

05A7 118000
05AA 0E09
05AC CD0500LXI D,BOH
MVI C,PRINT
CALL BDOS

RDALT:

05AF 0E0A
05B1 116041
05B4 CD0500
05B7 216141
05BA 7E
05BB FE06
05BD 4F
05BE D22107
05C1 23
05C2 CD8906
05C5 DA2107
05C8 116141
05CB 1A
05CC 13
05CD D605
05CF 0E05
05D1 217441
05D4 CDCA06
05D7 217441
05DA 110000
05DD CDE106
05E0 223641
05E3 01AFB9
05E6 09
05E7 DA2107MVI C,INLINE
LXI D,INBUF
CALL BDOS
LXI H,INBUF+1
MOV A,M
CPI 6
MOV C,A
JNC AINVENT
INX H
CALL ASBCD
JC AINVENT
LXI D,INBUF+1
LDAX D
INX D
SUI 5
MVI C,5
LXI H,INBUF+20
CALL PREP
LXI H,INBUF+20
LXI D,0
CALL TINTHOS
SHLD ALT
LXI B,-18001
DAD B
JC AINVENT

;GET SPEED

05EA 0E09
05EC 11AE00
05EF CD0500MVI C,PRINT
LXI D,0AEH
CALL BDOS

RDSPEED:

05F2 116041
05F5 0E0A
05F7 CD0500
05FA 216141
05FD 7E
05FE FE04
0600 4F
0601 D22907
0604 23
0605 CD8906
0608 DA2907
060B 116141
060E 1A
060F 13
0610 D603
0612 D603
0617 217441
0618 CDCA06
0619 217441
061A 110000
061B CD0500LXI D,INBUF
MVI C,INLINE
CALL BDOS
LXI H,INBUF+1
MOV A,M
CPI 4
MOV C,A
JNC SINVENT
INX H
CALL ASBCD
JC SINVENT
LXI D,INBUF+1
LDAX D
INX D
SUI 3
MVI C,3
LXI H,INBUF+20
CALL PREP
LXI H,INBUF+20
LXI D,0
CALL HURDS

PRINTOUT. PRN

0623	22B841	SHLD SPEED
0626	01A7FD	LXI B,-601
0629	09	DAD B
062A	0A2907	JC SINVENT
062B	2AB641	LHLD ALI
0630	0150C9	LXI B,-14000
0633	09	DAD B
0634	DAB206	JC T4PT5
0637	2AB641	LHLD ALT
063A	0190E8	LXI B,-6000
063D	09	DAD B
063E	D2AB06	JNC TIPT5
0641	2AB841	LHLD SPEED
0644	0110FF	LXI B,-240
0647	09	DAD B
0648	D2AB06	JNC TIPT5
064B	211600	LXI H,22
064E	22C737	SHLD MLTP1
0651	2AB841	LHLD SPEED
0654	22C137	SHLD MLTP2
0657	CD9603	CALL MULT
065A	2AB841	LHLD SPEED
065D	29	DAD H ; 2X S
065E	22D037	SHLD DVNDL
0661	210000	LXI H,0
0664	22D237	SHLD DVNDM
0667	22D637	SHLD DVSRM
066A	210A00	LXI H,10
066D	22D437	SHLD DVSRM
0670	CD8004	CALL DIVIDE
;QUOT = .2XS		
;CALC. 22.2XS		
0673	2AD837	LHLD QUOTL
0676	EB	XCHG
0677	2AC137	LHLD ANSL
067A	19	DAD D
067D	22C137	SHLD ANSL
067E	2AB841	LHLD SPEED
0681	29	DAD H
0682	22D037	SHLD DVNDL
0685	210000	LXI H,0
0688	22D237	SHLD DVNDM
068B	22D637	SHLD DVSRM
068E	215400	LXI H,100
0691	22D437	SHLD DVSRM
0694	CD8004	CALL DIVIDE
0697	2AJS37	LHLD QUOTL
069A	EB	XCHG
069D	2AC137	LHLD ANSL
069E	19	DAD D
;HL = 22.2XSPEED		
069F	1178B4	LXI D,-19333
06A2	19	DAD D
06A3	EB	XCHG
06A6	2AB641	LHLD ALT
06A7	19	DAD D
06A8	DAB206	JC T4PT5

TIP5:

PENTOUT.PRII

06AB 215802 LXI H,600
 06AE 22B441 SHLD PDRPTM
 06BI C9 RET

T4PTS:

06B2 210807 LXI H,1800
 06B5 22B441 SHLD PDRPTM
 06B8 C9 RET

;CONVERT ASCII-8 BIT BCD
ASBCD:

06B9 7E MOV A,M
 06BA FE30 CPI 30H
 06BC D8 RC
 06BD FE3A CPI 3AH
 06BF 3F CMC
 06C0 D8 RC

;OK IF BETWEEN 0,9

06C1 D630 SUI 30H
 06C3 77 MOV M,A
 06C4 23 INX H
 06C5 0D DCR C
 06C6 C2B906 JNZ ASBCD
 06C9 C9 RET

PREP:

06CA FE00 CPI 0
 06CC CAD806 JZ PREP2
 06CF 3600 MVI M,0
 06D1 23 INX H
 06D2 3C INR A
 06D3 0D DCR C
 06D4 C2CA06 JNZ PREP
 06D7 C9 RET

PREP2:

06D8 1A LDAX D
 06D9 77 MOV M,A
 06DA 13 INX D
 06DB 23 INX H
 06DC 0D DCR C
 06DD C2D806 JNZ PREP2
 06E0 C9 RET

;CONVERT 8 BIT BCD TO HEX

;TNTHOUS:

06E1 7E MOV A,M
 06E2 23 INX H
 06E3 FE02 CPI 2
 06E5 DAEC06 JC TNTCNT
 06E8 E1 POP H
 06E9 C32107 JMP AINVENT

TNTCNT:

06EC FE01 CPI 1
 06EE C2F406 JNZ THOUS
 06F1 111027 LXI D,10000

THOUS:

06F4 7E MOV A,M
 06F5 23 INX H
 06F6 018803 LXI B,1000
 06F9 CD1807 CALL BCDHEX

PRINTOUT.PRN

```

05FC EB          XCHG
                HLDS:  MOV A,M
                   INX H
                   LXI B,100
                   CALL BCDHEX
                   XCHG
                TENS:  MOV A,M
                   INX H
                   LXI B,10
                   CALL BCDHEX
                   XCHG
                UNITS: MOV A,M
                   INX H
                   LXI B,1
                   CALL BCDHEX
                   RET
                BCDHEX: XCHG
                BHLP:  CPI 0
                   RZ
                   DAD B
                   DCR A
                   JMP BHLP
                AINVENT:
                ;
                ; INVALID ALTITUDE ENTERED
                ;
0721 3E04          MVI A,4
0723 CD03F8        CALL OF803H
0725 C3AF05        JMP RDALT
                SINVENT:
                ;
                ; INVALID SPEED ENTERED
                ;
0729 3E04          MVI A,4
072B CD03F8        CALL OF803H
072E C3F205        JMP RDSPEED
                INZDEMO:
                MVI B,4
                INZDMLP:
                MVI C,READ
                LXI D,FCBDEMO
                CALL BDOS
                MVI C,PRINT
                LXI D,8CH
                CALL BDOS
                DCR B
                JNZ INZDMLP
                RET
                BUKEY:  MVI C,CONIN
                CALL BDOS
                CPI 'E'
                JZ BUKEY

```

PRINTOUT. PRH

0752 3E7F
 0754 CD03F8
 0757 C34807

MVI A,7FH
 CALL OF803H
 JMP EJKLY

WAITING:

075A 00

NOP

HERE:

075B 00

NOP ;WAIT FOR INTERRUPT

SEQSRT:

075C 2A8A41
 075F 23
 0760 228A41
 0763 228E42
 0766 318F37
 0769 217607
 076C 3AF441
 076F 4F
 0770 0600
 0772 09
 0773 09
 0774 09
 0775 E9

LHLD INTCONTR
 INX H
 SHLD INTCONTR
 SHLD PREPRINT
 LXI SP,NEED30
 LXI H,JMPSTRT
 LDA SEQINDX
 MOV C,A
 MVI B,0
 DAD B
 DAD B
 DAD B
 PCHL

JMPSTRT:

0776 C3A407
 0779 C3AC07
 077C C38903
 077F C38A0A

JMP EJECTRTN
 JMP CTPLTRTN
 JMP RKTSEQ
 JMP PARSEP

EJECT:

0782 318F37
 0785 3E04
 0787 CD03F8
 078A 3E1B
 078C CD03F8
 078F 3E3D
 0791 CD03F8
 0794 3E21
 0796 CD03F8
 0799 3E47
 079B CD03F8
 079E 210000
 07A1 228A41

LXI SP,NEED30
 MVI A,4
 CALL OF803H
 MVI A,ESC
 CALL OF803H
 MVI A,'='
 CALL OF803H
 MVI A,21H
 CALL OF803H
 MVI A,47H
 CALL OF803H
 LXI H,0
 SHLD INTCONTR

EJCTRTN:

07A4 0E06
 07A6 CDB407
 07A9 C3C907

MVI C,6
 CALL SQUIB
 JMP DRIVER

CTPLTRTN:

07AC 0E02
 07AE CDB407
 07B1 C3C907

MVI C,2
 CALL SQUIB
 JMP DRIVER

SQUIB:

07B4 3E0A
 07B6 CD03F8
 07B9 3E08
 07BB CD03F8
 07BE 3E2A
 07C0 CD03F8
 07C3 0D
 07C4 CDB407
 07C7 09

MVI A,0AH
 CALL OF803H
 MVI A,BS
 CALL OF803H
 MVI A,LOT
 CALL OF803H
 DCR C
 JNZ SQUIB
 RET

PRINTOUT.PRI

```

0708 09          SIM:      RET
0709 3AF441     DRIVER:   LDA SEQINDX
070C 4F         MOV C,A
070D 0500       MVI B,0
070F 21D607     LXI H,DRVRCK
07D2 09         DAD B
07D3 09         DAD B
07D4 09         DAD B
07D5 E9        PCHL

07D6 C3DF07     DRVRCK:   JMP DRCKA
07D9 C30208     JMP DRCKB
07DC C33508     JMP DRCKC

07DF 2ABA41     DRCKA:   LHLD INTCONTR
07E2 01F5FF     LXI B,OFFF5H
07E5 09         DAD B
07E6 DA0008     JC SSQB
07E9 3E1B       MVI A,1BH
07EB CD03F8     CALL OF803H
07EE 3E3D       MVI A,'='
07F0 CD03F8     CALL OF803H
07F3 3E21       MVI A,21H
07F5 CD03F8     CALL OF803H
07F8 3E47       MVI A,47H
07FA CD03F8     CALL OF803H
07FD C35A07     JMP WAITING

0800 3E01       SSQB:    MVI A,1
0802 32F441     STA SEQINDX
0805 C35A07     JMP WAITING

0808 2ABA41     DRCKB:   LHLD INTCONTR
080B 01EBFF     LXI B,OFFEBH
080E 09         DAD B
080F DA2908     JC SSQC
0812 3E1B       MVI A,1BH
0814 CD03F8     CALL OF803H
0817 3E3D       MVI A,'='
0819 CD03F8     CALL OF803H
081C 3E27       MVI A,27H
081E CD03F8     CALL OF803H
0821 3E47       MVI A,47H
0823 CD03F8     CALL OF803H
0826 C35A07     JMP WAITING

0829 3E01       SSQC:    MVI A,1
082B 32BC41     STA RKTFLG
082E 3C         INR A
082F 32F441     STA SEQINDX
0832 C35A07     JMP WAITING

0835 3ABC41     DRCKC:   LDA RKTFLG
0838 3E01       CPI 1
083A CAAE08     JZ ADJCTR
083D C05B0C     CALL PRINTLN

```

PRINTOUT.PRN

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```

0840 CDB30C      CALL PRNTH2
0843 3A8642      LDA LCNTR
0846 3D          OCR A
0847 3D          OCR A
0848 328642      STA LCNTR
084E F25403      JP FIXCONT
084E CDCE0D      CALL TOF
0851 CD1A0C      CALL PRNTHDR
                FIXCONT:
0854 2ABA41      LHLD INTCNTR
0857 01A8FD      LXI B,-600
085A 09          DAD B
085B DA6103      JC SSQD
085E C35A07      JMP WAITING
                SSQD:
0861 3E03        MVI A,3
0863 32F441      STA SEQINDX
0866 0E01        MVI C,1
0869 CDB407      CALL SQUIB
086B C38A0A      JMP PARSEP
                ADJCNTR:
086E 2ABA41      LHLD INTCNTR
0871 22BE41      SHLD TWNTYFV
0874 210000      LXI H,0
0877 22BA41      SHLD INTCNTR
087A AF          XRA A
087B 325C41      STA RKTFLG
087E C35A07      JMP WAITING
                RKFSTM:
0881 0E02        MVI C,2
0883 CDB407      CALL SQUIB
0886 C3C907      JMP DRIVER
                RKTSEQ:
0889 3ABC41      LDA RKTFLG
088C FE01        CPI 1
088E CA8108      JZ RKFSTM
                CKPCEM:
0891 2ABA41      LHLD INTCNTR
0894 110802      LXI D,520
0897 7A          MOV A,D
0898 BC          CMP H
0899 C2A303      JNZ INRATDTA
089C 0E01        MVI C,1
089E 7B          MOV A,E
089F BD          CMP L
08A0 CC5407      CZ SQUIB
                INRATDTA:
08A3 3E06        MVI A,6
08A5 010000      LXI B,0
08A8 210341      LXI H,41C3H
08AB 22BC41      SHLD VSINP
                INLCOP:
08AE 2AB241      LHLD VSPTR
08B1 09          DAD B
08B2 03          INX B
08B3 0E          MOV E,M
08B4 23          INX H
08B5 06          MOV D,M

```

PRINTOUT.PRN

0785	2AB041	LHLD VSINP
0889	F9	SPHL
088A	210200	LXI H,2
088D	39	DAD SP
089E	22B041	SHLD VSIIP
08C1	2B	DCX H
08C2	2B	DCX H
08C3	09	DAD B
08C4	03	INX B
08C5	F9	SPHL
08C6	E3	XTHL
08C7	19	DAD D
08C8	E8	XCHG
08C9	E3	XTHL
08CA	23	INX H
08CB	23	INX H
08CC	73	MOV M,E
08CD	23	INX H
08CE	72	MOV M,D
08CF	3D	DCR A
08D0	02AE08	JNZ INLOOP
08D3	2AB241	LHLD VSPTR
08D6	09	DAD B
08D7	22B241	SHLD VSPTR
08DA	2AC441	LHLD YSUM1-2
08DD	223A42	SHLD PREPRINT+2
08E0	2AC841	LHLD PSUM1-2
08E3	223C42	SHLD PREPRINT+4
08E6	2ACC41	LHLD RSUM1-2
08E9	228E42	SHLD PREPRINT+6
08EC	2AD041	LHLD YSUM2-2
08EF	229042	SHLD PREPRINT+8
08F2	2AD441	LHLD PSUM2-2
08F5	229242	SHLD PREPRINT+10
08F8	2AD841	LHLD RSUM2-2
08FB	229442	SHLD PREPRINT+12
08FE	318F37	LXI SP,NEED30
RKTCONT:		
0901	0D0A09	CALL UPDAT
0904	0DF609	CALL CNTRLAW
0907	03C907	JMP DRIVER
UPDAT:		
090A	210000	LXI H,0
090D	39	DAD SP
090E	22F641	SHLD SAVE
0911	31C641	LXI SP,YSUM1
RESID:		
0914	D1	POP D
0915	2AEA41	LHLD YANR
0918	0B3D09	CALL UPLOG
091D	22EA41	SHLD YANR
091E	32DD41	STA YAINC
0921	D1	POP D
0922	D1	POP D
0923	2A6C41	LHLD PICIR
0925	0B3D09	CALL UPLOG
0928	2A6C41	SHLD PICIR
0929	32DE41	STA PCINC

PRINTOUT.PRI

092F D1	POP D
0930 D1	POP D
0931 2AEE41	LHLD ROLLR
0934 CDDDO9	CALL UPLOG
0937 22EE41	SHLD ROLLR
093A 32DF41	STA RLINC
093D 31E241	LXI SP,D31
0940 C1	POP B
0941 E1	POP H
0942 3ADD41	LDA YAINC
0945 2F	CMA
0946 3C	INR A
0947 CDDFO9	CALL INDIS
094A E3	XTHL
094E 3ADE41	LDA PCINC
094E CDDFO9	CALL INDIS
0951 E3	XTHL
0952 E5	PUSH H
0953 C1	POP B
0954 E1	POP H
0955 3ADF41	LDA RLINC
0958 2F	CMA
0959 3C	INR A
095A CDDFO9	CALL INDIS
095D E5	PUSH H
095E 2AE241	LHLD D31
0961 3ADD41	LDA YAINC
0964 CDDFO9	CALL INDIS
0967 C5	PUSH B
0968 E3	XTHL
0969 D1	POP D
096A C1	POP B
096B 3ADF41	LDA RLINC
096E CDDFO9	CALL INDIS
0971 C5	PUSH B
0972 3B	DCX SP
0973 3B	DCX SP
0974 E3	XTHL
0975 3ADE41	LDA PCINC
0978 2F	CMA
0979 3C	INR A
097A CDDFO9	CALL INDIS
097D E5	PUSH H
097E 3AFB41	LDA TOGGL
0981 FE01	CPI 1
0983 D2A209	JNC UPDON
0985 2AE241	LHLD D31
0989 229642	SHLD PREPRINT+14
098C 2AE441	LHLD D32
098F 229642	SHLD PREPRINT+15
0992 2AE641	LHLD D33
0995 229A42	SHLD PREPRINT+18
0998 3C	INR A
0999 32FB41	STA TOGGL
099C 31D241	LXI SP,YSUMP
099F C31409	JMP RESID
09A2 2AE241	LHLD D31

UPDON:

LIMIT. PRT

```

09A5 227042      SHLD PREPRINT+20
09A5 2AE441      LHL D32
09A5 229E42      SHLD PREPRINT+22
09AE 2AE641      LHL D33
09B1 22A042      SHLD PREPRINT+24
09B4 AF          XRA A
09B5 32F541      STA TOGGL
09B8 2AF641      LHL SAVE
09B3 F9          SPHL
09BC C9          RET

```

UPLOG:

```

09BD 19          DAD D
09BE 3E80        MVI A,80H
09C0 A4          ANA H
09C1 EB          XCHG
09C2 C2D209      JNZ NEGRS
09C5 2AF241      LHL QNEG
09C8 19          DAD D
09C9 3E80        MVI A,80H
09CB A4          ANA H
09CC 3E01        MVI A,1
09CE C3          RZ
09CF EB          XCHG
09D0 AF          XRA A
09D1 C9          RET

```

NEGRS:

```

09D2 2AF041      LHL QPOS
09D5 19          DAD D
09D6 3E80        MVI A,80H
09D8 A4          ANA H
09D9 3E0F        MVI A,OFFH
09DB C0          RNZ
09DC EB          XCHG
09DD AF          XRA A
09DE C9          RET

```

INDIS:

```

09DF FE00        CPI 0
09E1 C3          RZ
09E2 73          MOV A,B
09E3 F2E809      JP LABEL
09E6 2F          CMA
09E7 3C          INR A

```

LABEL:

```

09E8 3F          MOV E,A
09E9 E680        ANI 80H
09EB F2F309      JP POSBY
09EE 16FF        MVI D,OFFH
09F0 19          DAD D
09F1 19          DAD D
09F2 C9          RET

```

POSBY:

```

09F3 1600        MVI D,0
09F5 19          DAD D
09F6 19          DAD D
09F7 C9          RET

```

OVERLAW:

```

09F8 1A0711      LDA D33+1
09F9 17          RAL

```

PRNTOUT.PRI

09FC DA1COA
09FF 3AE341
0A02 EE7F
0A04 67

JC D33LO
LDA D31+1
XRI 7FH
MOV H,A

NEGD2:

0A05 3AE541
0A08 2F
0A09 3C
0A0A EE7F
0A0C 6F
0A0D C3470A

LDA D32+1
CMA
INR A
XRI 7FH
MOV L,A
JMP OUTPUT

D33LO:

0A10 3AE341
0A13 CD7COA
0A16 4F
0A17 5A
0A18 3AE541
0A1B CD7COA
0A1E B9
0A1F D2330A
0A22 3E7F
0A24 91
0A25 4F
0A26 7B
0A27 FE80
0A29 79
0A2A CC370A
0A2D EE7F
0A2F 67
0A30 C3050A

LDA D31+1
CALL ABS
MOV C,A
MOV E,D
LDA D32+1
CALL ABS
CMP C
JNC D32G
MVI A,7FH
SUB C
MOV C,A
MOV A,E
CPI 80H
MOV A,C
CZ CHS
XRI 7FH
MOV H,A
JMP NEGD2

D32G:

0A33 3E7F
0A35 90
0A36 47
0A37 7A
0A38 FE80
0A3A 78
0A3B C4370A
0A3E EE7F
0A40 6F
0A41 3AE341
0A44 EE7F
0A46 67

MVI A,7FH
SUB B
MOV B,A
MOV A,D
CPI 80H
MOV A,B
CNZ CHS
XRI 7FH
MOV L,A
LDA D31+1
XRI 7FH
MOV H,A

OUTPUT:

0A47 22A242
0A4A EB
0A4B 2AFA41
0A4E 73
0A4F 23
0A50 72
0A51 23
0A52 22FA41
0A55 21E241
0A58 1600
0A5A 3AF841
0A5D 5F
0A5E 19
0A5F 3C

SHLD PREPRINT+26
XCHG
LHLD SCPTR
MOV M,E
INX H
MOV M,D
INX H
SHLD SCPTR
LXI H,D31
MVI D,0
LDA DCCT
MOV E,A
DAD D
INR A

PRINTOUT.PRN

```

0A60 3C          INR A
0A61 FE05       CPI 5
0A63 DA670A     JC LABEL2
0A65 AF         XRA A
                LABEL2:
0A67 32F841     STA DCCT
0A6A EB         XCHG
0A6B 1A         LDAX D
0A6C 6F         MOV L,A
0A6D 13         INX D
0A6E 1A         LDAX D
0A6F 67         MOV H,A
0A70 EB         XCHG
0A71 2AFC41     LHLD TLMPTR
0A74 73         MOV M,E
0A75 23         INX H
0A76 72         MOV M,D
0A77 23         INX H
0A78 22FC41     SHLD TLMPTR
0A7B C9         RET
                ABS:
0A7C 47         MOV B,A
0A7D 3E30       MVI A,80H
0A7F A0         ANA B
0A80 57         MOV D,A
0A81 78         MOV A,B
0A82 F0         RP
0A83 2F         CMA
0A84 3C         INR A
0A85 47         MOV B,A
0A86 C9         RET
                CHS:
0A87 2F         CMA
0A88 3C         INR A
0A89 C9         RET
                PARSEP:
0A8A 2ABA41     LHLD INTCNTR
0A8D EB         XCHG
0A8E 2AB441     LHLD PDRFTM
0A91 7C         MOV A,H
0A92 3A         CMP D
0A93 C25A07     JNZ WAITING
0A96 7D         MOV A,L
0A97 B3         CMP E
0A98 C25A07     JNZ WAITING
0A9B DE02       MVI C,2
0A9D CD3407     CALL SQUIB
                FINISHUP:
0AA0 313F37     LXI SP,NEED30
0AA7 115243     LXI D,FDISP1
0AB5 DE12       MVI C,PRINT
0AB7 115B00     CALL B00S
0AB8 115742     LXI H,FRNT
0ABE 3631       MVI M,31H
0AC1 115E0A     CALL FILLP
0AC4 115241     LXI H,D31
0AC6 115B0F     CALL CHVRFCBS
0AC9 11570A     CALL DISPT

```

PRNTOUT.PRN

```

OABC CDE00A      CALL FINLP
OABF 21E441      LXI H,D32
OAC2 CD050B      CALL CNVRTDCS
OAC5 CDD70A      CALL DISPIT
OACB CDE00A      CALL FINLP
OACB 21E641      LXI H,D33
OACE CD050B      CALL CNVRTDCS
OAD1 CDD70A      CALL DISPIT
OAD4 C30000      JMP 0

```

DISPIT:

```

OAD7 0E09        MVI C,PRINT
OAD9 114243      LXI D,FDISP
OADC CD0500      CALL BDOS
OADF C9          RET

```

FINLP:

```

OAE0 21EFOA      LXI H,ROW+1
OAE3 34          INR M
OAE4 3E1B        MVI A,ESC
OAE6 CD03FB      CALL OF803H
OAE9 3E3D        MVI A,'='
OAEB CD03FB      CALL OF803H
OAEF 3E31        ROW: MVI A,31H
OAF0 CD03FB      CALL OF803H
OAF3 3E37        MVI A,37H
OAF5 CD03FB      CALL OF803H
OAFB 21B742      LXI H,FCNT
OAFB 7E          MOV A,M
OAFD 34          INR M
OAFD 214443      LXI H,FDISP+2
OBC0 77          MOV M,A
OBD1 014843      LXI B,FDISP+6
OB04 C9          RET

```

CNVRTDCS:

```

;COMING IN,HL=ADDRESS OF DC TO BE CONVERTED
;FOR DISPLAY OR PRINT
;BC=STORAGE BUFFER ADD. FOR CONVERTED VALUE

```

```

OB05 5E          MOV E,M
OB06 23          INX H
OB07 56          MOV D,M
OB08 EB          XCHG
OB09 3E80        MVI A,80H
OB0B A4          ANA H
OB0C 3E20        MVI A,'/'
OB0E F2160B      JP CNVCONT1
OB11 CD6B04      CALL TC16 ;IF <0,TAKE 2'S COMP
OB14 3E2D        MVI A,'-'

```

CNVCONT1:

```

OB16 02          STAX B ;STORE SIGN OF VALUE (+ OR -)
OB17 03          INX B
OB18 C5          PUSH B ;SAVE BEFORE CALL TO MULT AND DIVIDE
;DECIMAL VALUE OF DC = HEX VALUE/4000H
;=> 1000*DEC.VAL=1000*HEX VAL/4000H
;(ELIMINATES NEED FOR FRACTIONAL DIVISION)
OB19 22C737      SHLD MLTP1
OB1C 21E003      LXI H,1000
OB1F 22C137      SHLD MLTP2
OB22 CD9603      CALL MULT
OB25 2AC137      LHLD ANSL

```

PROLOG.PRI

```

0B21 225037 SHLD DVNDL
0B22 2A0337 LHLD ANSM
0B2E 220237 SHLD DVNDL
0B31 210040 LXI H,4000H
0B34 220437 SHLD DVNDL
0B37 210000 LXI H,0
0B3A 220637 SHLD DVSRM
0B3D 0D8004 CALL DIVIDE
0B40 C1 POP B
0B41 3E31 MVI A,'1'
0B43 2AD837 LHLD QUOTL
0B46 1118FC LXI D,-1000
0B49 19 DAD D
0B4A DA530B JC CNVCONT2
0B4D 3E30 MVI A,'0'
0B4F 11E803 LXI D,1000
0B52 19 DAD D

```

CNVCONT2:

```

0B53 02 STAX B
0B54 03 INX B
0B55 3E2E MVI A,'.'
0B57 02 STAX B
0B58 03 INX B
0B59 0D5D0B CALL HTOA
0B5C 09 RET

```

HTOA:

```

0B5D 119CFF LXI D,-100
0B60 0D6E0B CALL GETASC
0B63 11F6FF LXI D,-10
0B66 0D6E0B CALL GETASC
0B69 7D MOV A,L
0B6A 0630 ADI 30H
0B6C 02 STAX B
0B6D 09 RET

```

GETASC:

```

0B6E 362F MVI A,2FH

```

GETASCLP:

```

0B70 19 DAD D
0B71 30 INR A
0B72 0A7C0B JC GETASCLP
0B75 02 STAX B
0B76 03 INX B
0B77 8D XCHG
0B78 0D6B04 CALL TC16
0B7B 8D XCHG
0B7C 19 DAD D
0B7D 09 RET

```

CHOICE:

```

0B7E AF XRA A
0B7F 115F42 LXI D,FCBMENU+12
0B82 116342 LXI H,FCBMENU
0B85 77 MOV M,A
0B88 8B XCHG
0B8F 0315 MVI B,21

```

GILP:

```

0B92 77 MOV M,A
0B95 03 INX H
0B98 09 DCR B

```

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PRNTOUT.PRI

```

088C C2090B      JNZ CHLP
088F 0E0F        MVI C,OPEN
0891 CD0500      CALL BDOS
0894 0E14        MVI C,READ
0896 CD0500      CALL BDOS
0899 118000      LXI D,80H
089C 0E09        MVI C,PRINT
089E CD0500      CALL BDOS

```

GETTSTN:

```

0BA1 0E01        MVI C,CONIN
0BA3 CD0500      CALL BDOS
0BA6 320642      STA FCBRD1+6
0BA9 FE31        CPI 31H
0BAB CAB0B      JZ TEST1
0BAE FE32        CPI 32H
0BB0 CAC10B      JZ TEST2
0BB3 3E04        MVI A,4
0BB5 CD03F8      CALL OF803H
0BB8 C3A10B      JMP GETTSTN

```

TEST1:

```

LXI D,INTLDCS
JMP SETINORIEN

```

TEST2:

```

LXI D,INTLDCS+6

```

SETINORIEN:

```

0BC4 0E06        MVI C,6
0BC6 21E241      LXI H,D31
0BC9 CDD30B      CALL MOVABUF
0BCC CDDC0B      CALL SETPRNDOS
0BCF CDF20B      CALL SETFDISP1
0BD2 C9          RET

```

MOVABUF:

;MOVE 'C' CHARS. FROM 'D' BUFF TO 'H' BUFF

```

0BD3 1A          LDAX D
0BD4 77          MOV M,A
0BD5 13          INX D
0BD6 23          INX H
0BD7 0D          DCR C
0BD8 C2D30B      JNZ MOVABUF
0BDB C9          RET

```

SETPRNDOS:

```

0BDC 21E241      LXI H,D31
0BDF 01C042      LXI B,PRNTBUF+28
0BE2 CD050B      CALL CNVRTDCS
0BE5 21E441      LXI H,D32
0BE8 01C842      LXI B,PRNTBUF+36

```

```

0BEB CD050B      CALL CNVRTDCS
0BEE 21E641      LXI H,D33
0BF1 01D042      LXI B,PRNTBUF+44
0BF4 CD050B      CALL CNVRTDCS
0BF7 C9          RET

```

SETFDISP1:

```

0BF8 11C042      LXI D,PRNTBUF+28
0BFB 21B44B      LXI H,FLISP1+50
0BFE 0E0C        MVI C,6
0C00 CDD30B      CALL MOVABUF
0C03 11C842      LXI D,PRNTBUF+36

```

PR: TO IT. PRM

```

0C06 212243 LXI H,FDISP1+64
0C07 3E36 MVI C,6
0C08 0D330B CALL MOVABUF
0C0E 110042 LXI D,PRNTBUF+44
0C11 21A043 lxi h,fdisp1+78
0C14 3E36 MVI C,6
0C15 0D330B call movabuf
0C19 C9 RET

```

PRNTHDR:

```

0C1A 21E842 LXI H,PRHDR
0C1D 3E46 MVI A,70
0C1F 328542 STA CHARCNTR
0C22 0D3D0C CALL PRINTIT
0C25 0DE80D call tcout
0C28 3E3B MVI A,59
0C2A 328642 STA LNCNTR
0C2D C9 RET

```

PRNTINTLN:

```

0C2E 21A442 LXI H,PRNTBUF
0C31 3E45 MVI A,69
0C33 328542 STA CHARCNTR
0C35 0D3D0C CALL PRINTIT
0C39 0DE80D call tcout
0C3C C9 RET

```

PRINTIT:

```

0C3D 0E05 MVI C,LIST

```

PRNTLP:

```

0C3F 5E MOV E,M
0C40 23 INX H
0C41 0D0500 CALL BDOS
0C44 3A8542 LDA CHARCNTR
0C47 3D DCR A
0C48 328542 STA CHARCNTR
0C4B C23F0C JNZ PRNTLP
0C4E C9 RET

```

CLRPRBUF:

;ROUTINE TO CLEAR PRINT BUFFER

```

0C4F 0E41 MVI C,65
0C51 21A442 LXI H,PRNTBUF
0C54 3E20 MVI A,20h

```

PRCLRPL:

```

0C55 77 MOV M,A
0C57 23 INX H
0C58 0D DCR C
0C59 02560C JNZ PRCLRPL
0C5C C9 RET

```

PRNTLN1:

```

0C5D 0D4F0C CALL CLRPRBUF
0C60 3E01 MVI A,1
0C62 0D720D CALL INTX2PT5
;GET R(1.25)
0C65 2A3A42 LHLD PREPRINT+2
0C67 21A242 LXI B,PRNTBUF+10
0C6B 0D330B CALL CNVRDATA
;GET Q(1.25)
0C6E 2A3A42 LHLD PREPRINT+4
0C71 21A242 LXI B,PRNTBUF+16
0C74 0D330B CALL CNVRDATA

```

PRINTOUT.PRN

PAGE 1

```

;GET P(1.25)
OC77 2A8E42      LHLD PREPRINT+6
OC7A 01BA42      LXI B,PRNTBUF+22
OC7D CD330D      CALL CNVRDATA
;GET D31(1.25)
OC80 219642      LXI H,PREPRINT+14
OC83 01C042      LXI B,PRNTBUF+28
OC86 CD050B      CALL CNVRTDCS
;GET D32(1.25)
OC89 219842      LXI H,PREPRINT+16
OC8C 01C842      LXI B,PRNTBUF+36
OC8F CD050B      CALL CNVRTDCS
;GET D33(1.25)
OC92 219A42      LXI H,PREPRINT+18
OC95 01D042      LXI B,PRNTBUF+44
OC98 CD050B      CALL CNVRTDCS
OC9B 212020      LXI H,2020H
OC9E 22DB42      SHLD PRNTBUF+55      ;NO ROLL CMND
OCA1 22E442      SHLD PRNTBUF+64      ;NO PCH CMND
OCA4 3E45        MVI A,69
OCA6 328542      STA CHARCNTR
OCA9 21A442      LXI H,PRNTBUF
OCAC CD3D0C      CALL PRINTIT
OCAF CD880D      call tmout
OCB2 C9         RET
PRN1LN2:
OCB3 CD4F0C      CALL CLRPRBUF
OCB6 AF         XRA A
OCB7 CD720D      CALL INTX2PT5
;GET R(2.5)
OCBA 2A9042      LHLD PREPRINT+8
OCBD 01AE42      LXI B,PRNTBUF+10
OCCE CD330D      CALL CNVRDATA
;GET Q(2.5)
OCC3 2A9242      LHLD PREPRINT+10
OCC6 01B442      LXI B,PRNTBUF+16
OCC9 CD330D      CALL CNVRDATA
;GET P(2.5)
OCCC 2A9442      LHLD PREPRINT+12
OCCF 01BA42      LXI B,PRNTBUF+22
OCD2 CD330D      CALL CNVRDATA
;GET D31(2.5)
OCD5 219C42      LXI H,PREPRINT+20
OCD8 01C042      LXI B,PRNTBUF+28
OCD6 CD050B      CALL CNVRTDCS
;GET D32(2.5)
OCDE 219E42      LXI H,PREPRINT+22
CEE1 01C842      LXI B,PRNTBUF+36
CEE4 CD050B      CALL CNVRTDCS
;GET D33(2.5)
CEE7 21A042      LXI H,PREPRINT+24
CEEA 01D042      LXI B,PRNTBUF+44
CEED CD050B      CALL CNVRTDCS
;GET ROLL CMND
OCE0 2AA242      LHLD PREPRINT+26
OCE3 CD1B0D      CALL GETLST
OCE6 32DB42      STA PRNTBUF+55
OCE9 CD2B0D      CALL GETLST

```

PRINTOUT.PRI

00FC 320042
 00FF 6C
 0100 0D1E0D
 0102 32E442
 0105 0D257D
 0109 32E542
 010C 3E45
 010E 32B542
 0111 21A442
 0114 0D3D0C
 0117 0DE80D
 011A C9

```

STA PRINTBUF+56
;GET PC: CMD
MOV L,H
CALL GETMST
STA PRINTBUF+64
CALL GETLST
STA PRINTBUF+65
MVI A,69
STA CHARCNTR
LXI H,PRINTBUF
CALL PRINTIT
call tmout
RET
    
```

0118 3EF0
 011D A5
 011E 1F
 011F 1F
 0120 1F
 0121 1F
 0122 C3280D

```

GETMST:
MVI A,0F0H
ANA L
RAR
RAR
RAR
RAR
RAR
RAR
JMP GETCMN
    
```

0125 3E0F
 0127 A5

```

GETLST:
MVI A,0FH
ANA L
    
```

0128 FE0A
 012A DA300D
 012D C637
 012F C9

```

GETCMN:
CPI 10
JC LT10
ADI 37H
RET
    
```

0130 C630
 0132 C9

```

LT10:
ADI 30H
RET
    
```

```

CNVRDATA:
;HL = VALUE TO BE CONVERTED WHEN CALLED
;BC=BEG ADD. OF STORAGE FOR CNVRTD. VAL
MVI A,80H
    
```

0133 3E80
 0135 A4
 0136 3E20
 0138 F2400D
 013B 0D6804
 013E 3E20

```

ANA H
MVI A,' '
JP CNVRD1
CALL TC16
MVI A,'-'
    
```

0140 02
 0141 03
 0142 05
 0143 220737
 0145 21E803
 0149 220137
 014C 0D9603
 014F 2A0337
 0152 220237
 0155 2A0137
 0158 2E0037
 015B 21F80F
 015E 2E0437
 0161 110000
 0164 2E0437
 0167 1D0004

```

CNVRD1:
STAX B
INX B
PUSH B
SHLD MLTP1
LXI H,1000
SHLD MLTP2
CALL MULT
LHLD ANSA
SHLD DVNDM
LHLD ANSL
SHLD DVNDL
LXI H,4024
SHLD DVSRL
LXI H,0
SHLD DVSRL
CALL DIVIDE
    
```

PRNFOUT.PRN

OD6A 2AD837
 OD6D C1
 OD6E CD5D0B
 OD71 C9

LHLD OQOHL
 POP R
 CALL HTOA
 RET

INTX2PT5:

OD72 328442
 OD75 2ABA41
 OD78 22C737
 OD7B 210A00
 OD7E 22C137
 OD81 CD9603
 OD84 2AC137
 OD87 3A8442
 OD8A FE01
 OD8C CABF0D

STA X2PT5FLG
 LHLD INTCNTR
 SHLD MLTP1
 LXI H,10
 SHLD MLTP2
 CALL MULT
 LHLD ANSL
 LDA X2PT5FLG
 CPI 1
 JZ SUBTIPT25

ANDBITS:

OD8F EB
 OD90 3E03
 OD92 A3
 OD93 07
 OD94 213A43
 OD97 85
 OD98 6F
 OD99 D29D0D
 OD9C 24

XCHG
 MVI A,3
 ANA E
 RLC
 LXI H, TABLE
 ADD L
 MOV L, A
 JNC CONTINX2
 INR H

CONTINX2:

OD9D 22A10D

SHLD TBLLBL+1

TBLL3L:

ODA0 2A3A43
 ODA3 22AA42
 ODA6 3E2E
 ODA8 32A942
 ODAE EB
 ODAC CDC60D
 ODAF CDC60D
 ODB2 1118FC
 ODB5 01A542
 ODB8 CD6E0B
 ODBB CD5D0B
 ODBE C9

LHLD TABLE
 SHLD PRNTBUF+6
 MVI A, '.'
 STA PRNTBUF+5
 XCHG
 CALL ROTRGHT
 CALL ROTRGHT
 LXI D, -1000
 LXI B, PRNTBUF+1
 CALL GETASC
 CALL HTOA
 RET

SUBTIPT25:

ODBF 11FBFF
 ODC2 19
 ODC3 C38F0D

LXI D, -5
 DAD D
 JMP ANDBITS

ROTRGHT:

ODC6 AF
 ODC7 7C
 ODC8 1F
 ODC9 67
 ODCA 7D
 ODCB 1F
 ODCC 6F
 ODCD C9

XRA A ;CLR CARRY
 MOV A, H
 RAR
 MOV H, A
 MOV A, L
 RAR
 MOV L, A
 RET

TOF:

ODCE 3E05
 ODDE 328542
 ODD3 1EOA
 ODD5 0E05

MVI A, 5
 STA CHARCNTR
 MVI B, 0AH
 MVI C, LIST

PRINTOUT.PRN

TOFLP:

```

0007 0D0500      CALL 8D03
000A 0DEB0D      call tmout
000C 3A8542      lda charcntr
000E 3D          dcr a
0011 328542      sta charcntr
0014 02D70D      jnz toflp
0017 09          ret
    
```

tmout:

```

00E3 2100F0      LXI H,0F000H
    
```

TMOUTLP:

```

00E3 2D          DCR L
00E4 C2EB0D      JNZ TMOUTLP
00E6 25          DCR H
00E7 C2EB0D      JNZ TMOUTLP
00E9 09          RET
    
```

; INITIALIZE SYS. CALL PRMTRS.

```

0010 =          ASSDRV: EQU 28
0005 =          BDOS: EQU 5
0010 =          CLOSE: EQU 16
0001 =          CONIN: EQU 1
0002 =          CONOUT: EQU 2
0008 =          CONRDY: EQU 11
0013 =          DELETE: EQU 19
001F =          DRVIN: EQU 31
0020 =          DRVOUT: EQU 32
0021 =          ERMSG: EQU 33
001B =          GETALO: EQU 27
0019 =          GETCUR: EQU 25
0007 =          GETIOB: EQU 7
0022 =          GETVOB: EQU 34
0000 =          INIT: EQU 13
000A =          INLINE: EQU 10
0006 =          LIST: EQU 5
0016 =          MAKE: EQU 22
0023 =          MOUNT: EQU 35
000F =          OPEN: EQU 15
001E =          PHYDRV: EQU 30
0009 =          PRINT: EQU 9
0014 =          READ: EQU 20
0017 =          RENAME: EQU 23
0011 =          SEARCH: EQU 17
000B =          SELECT: EQU 14
0012 =          SERCHN: EQU 18
001A =          SETBUF: EQU 26
0008 =          SETIOB: EQU 8
001D =          UNMONT: EQU 29
0015 =          WRITE: EQU 21
; END SYS. PRMTRS.
378F =          NEED30: EQU 378FH
3600 =          BEGYP: EQU 3600H
367A =          BEGYP: EQU 367AH
3644 =          BEGRIP: EQU 3644H
4A00 =          YRDATA: EQU 4A00H
4A01 =          PRDATA: EQU 4A01H
4A02 =          RRDATA: EQU 4A02H
378E =          LJUNK: EQU 378EH
3700 =          JMWAT01: EQU 3700H
    
```

PRINTOUT.PRN

001B =	ESC:	EQU 1BH	
0008 =	DS:	EQU 8	
002A =	LOT:	EQU 2AH	
37C0		ORG 37C0H	
37C0	CNT:	DS 1	
37C1	ANSL:	DS 2	
37C1		ORG 37C1H	
37C1	MLTP2:	DS 2	
37C3	ANSM:	DS 2	
37C5	CARYSV:	DS 2	
37C7	MLTPI:	DS 2	
37C9	MSVSP:	DS 2	
37CF		ORG 37CFH	
37CF	SIGN:	DS 1	
37D0	DVNDL:	DS 2	
37D2	DVNDM:	DS 2	
37D4	DVSHL:	DS 2	
37D6	DVSRM:	DS 2	
37D8	QUOTL:	DS 2	
37DA	QUOTM:	DS 2	
37DC	REML:	DS 2	
37DE	REMM:	DS 2	
37E2		ORG 37E2H	
37E2	MOVPT:	DS 2	
37E4	FIMFO:	DS 2	
37E6	IMPSP:	DS 2	
37E8	STRLOC:	DS 2	
37EA	STRPT:	DS 2	
37EC	ALST:	DS 2	
37EE	AMST:	DS 2	
37F0	CTR20:	DS 1	
37F1	CTR60:	DS 1	
37F2	IVAL:	DS 2	
37F4	XZERO:	DS 2	
37F6	LISVSP:	DS 2	
37F8	FZERO:	DS 2	
37FA	FONE:	DS 2	
37FC	FOXIL:	DS 2	
37FE	FOXIM:	DS 2	
4160		ORG 4160H	
4160 50	INBUF:	DB 80	
4161		DS 1	
4162		DS 80	
41B0		ORG 41B0H	
41B0	VSINP:	DS 2	
41B2	VSPTR:	DS 2	
41B4	PDRFTM:	DS 2	
41B6	ALT:	DS 2	
41B8	SPEED:	DS 2	
41BA	INTCTR:	DS 2	
41BC	EKTFLG:	DS 1	
41BD	FWNTYFV:	DS 2	
41C6		ORG 41C6H	
41C6	YSUM1:	DS 2	
41CA		ORG 41CAH	
41CA	PSUM1:	DS 2	
41CE		ORG 41CEH	
41CE	RSUM1:	DS 2	

PRINTOUT.PRII

42C6 2020 DB / /
 42C8 DS 6
 42CE 2020 DB / /
 .2D0 DS 6
 42D6 2020202020 DB / /
 42D8 2020 DB / /
 42ED 2020202020 DB / /
 42E4 2020 DB / /
 42E6 0A0D DB OAH, ODH

PRHDR:

42E8 2020202054 DB / T /
 42F2 2020522020 DB / R Q /
 42FC 2020202050 DB / P /
 4306 4443312020 DB /DC1 DC/
 4310 3220202020 DB /2 DC3 /
 431A 2020524C2E DB / RL.CMND /
 4324 2050432E43 DB / PC.CMND /
 432C 0A0D DB OAH, ODH

INFLDCS:

432E 0000 DB 00,00 ;90 DEG D31
 4330 0040 DB 00,40H ;90 DEG D32
 4332 0000 DB 00,00 ;90 DEG D33
 4334 0000 DE 00,00 ;180 DEG D31
 4336 0000 DB 00,00 ;180 DEG D32
 4338 0040 DB 00,40H ;180 DEG D33

TABLE:

433A 3030 DB '00'
 433C 3235 DB '25'
 33E 3530 DB '50'
 4340 3735 DB '75'
 4342 444320203D-FDISP: DB 'DC = . /
 434F 0A0C DB OAH, OCH
 4351 24 DB 's'
 4352 0A0A0D FDISP1: DB OAH, OAH, ODH
 4355 494E495449 DB 'INITIAL ORIENTATION'
 4368 20202020 DB / /
 436C 46494E414C DB 'FINAL ORIENTATION'
 437D 0D DB ODH
 437E 444331203D DB /DC1 = /
 438A 0A0D DB OAH, ODH
 438C 444332203D DB /DC2 = /
 4398 0A0D DB OAH, ODH
 439A 444333203D DB /DC3 = /
 43A6 24 DB 's'
 43A7 END 1 OCH

```

41D2          ORG 41D2H
41D2          YSUM2:  DS 2
41D6          ORG 41D6H
  1D6         PSUM2:  DS 2
  1DA         ORG 41DAH
41EA         RSUM2:  DS 2
41ED         ORG 41DDH
41ED         YAINC:  DS 1
41EE         PCINC:  DS 1
41EF         RLINC:  DS 1
41E2         ORG 41E2H
41E2         D31:    DS 2
41E4         D32:    DS 2
41E6         D33:    DS 2
41EA         ORG 41EAH
41EA         YAWR:   DS 2
41EC         PICHR:  DS 2
41EE         ROLLR:  DS 2
41FO         ORG 41FOH
41FO         QPOS:   DS 2
41F2         QNEG:   DS 2
41F4         SEQINDX:      DS 1
41F5         TOGGL:  DS 1
41F6         SAVE:   DS 2
41F8         DCCT:   DS 2
41FA         SCPTR:  DS 2
41FC         TLMPTR: DS 2
4200         ORG 4200H
  200         FCBRD1: DS 1
4201 5244415441 DB 'RDATA1 DAT'
420C         DS 21
4221         FCBDRTM:      DS 1
4222 445246546D DB 'DRFTMSG TXT'
422D         DS 21
4242         FCBDENO:      DS 1
4243 44454D4F44 DB 'DEMOSP TXT'
424E         DS 21
         FCBMENU:
4263         DS 1
4264 4D454E554D DB 'MENU MSG TXT'
426F         DS 21
4284         X2PT5FLG: DS 1
4285         CHARCNTR: DS 1
4286         LNCNTR:   DS 1
4287         FCNT:     DS 1
         PREPRINT:
4288         DS 28
         PRNTBUF:
42A4 20         DB ' '
42A5 202020302E DB ' ' 0.00'
42AC 2020         DB ' '
42AE 20202030   DB ' ' 0'
  2B2 2020         DB ' '
  2B4 20202030   DB ' ' 0'
42C1 2020         DB ' '
42C3 20202030   DB ' ' 0'
42C5 2020         DB ' '
42C7         DS 6
  
```

APPENDIX B

MULTIPLICATION ALGORITHM

The multiplication algorithm used in the program is based on a method which was actually designed for hardware implementation in digital systems known as the Carry-Save Multiplication. (See DIGITAL SYSTEMS: HARDWARE ORGANIZATION AND DESIGN, Frederick J. Hill and Gerald R. Peterson.)

BASIC DESCRIPTION

The process of multiplying two n-bit binary numbers (to obtain a 2n-bit product) can be viewed basically as forming a 'list' of n numbers (partial products, where each partial product (p_i , $i=1, N$) is equal to the multiplicand shifted $i-1$ places to the left if the i^{th} bit of the multiplier is 1; otherwise is equal to 0) to be added together, one at a time, generating n-1 partial sums, the final sum being the product. This process, with $n=4$, is illustrated in the example in Figure B-1. It is this concept of the multiplication process which provides the basis for the Carry-Save algorithm. There is a difference however in the way in which the partial sums are generated. In the carry-save addition process, each column is considered as essentially independent of the others so that the carry bits are not propagated, but saved as a separate value. This value is then shifted left by 1 and included in the next 'addition'. By this process, n partial sums are generated. The final carry-save value is then added (normal addition) to the n^{th} partial sum to get the product. Figure B-2 illustrates the basic Carry-Save multiplication process on the same problem illustrated in Figure B-1; Figure B-3 illustrates a 'computer form' of this example.

An analysis of this example shows that each partial sum is actually a MOD 2 sum of the 3 values. This can be effected logically by XORing the values, which gives the following equation:

$$PS_{i,i=1,n} = PS_{i-1} \oplus p_i \oplus CS_{i-1}; PS_0 = 0$$

Though not as obvious, it can be seen that the logic equation for the Carry-Save value generated with PS_i is:

$$CS_{i,i=1,n} = (CS_{i-1} \cdot PS_{i-1}) + (CS_{i-1} \cdot p_i) + (PS_{i-1} \cdot p_i); CS_0 = 0$$

where \cdot is logical AND, and $+$ is logical OR. Thus, to implement these equations in software then requires only that the machine provide the capability to perform the logic functions XOR, AND, OR.

IMPLEMENTATION

Two parameters (the multiplier and the multiplicand) are passed, in memory locations $37C1_{16}$, $37C2_{16}$ and $37C7_{16}$, $37C8_{16}$ respectively, when the MULTIPLY subroutine is CALLED. Each of these is a signed (mst bit = SIGN), 16 bit twos complement number. When the multiplication is complete, a signed 32 bit product is returned, in memory locations

$P = PS_3$	{	PS_2	{	PS_1	{	$\begin{array}{r} 1011 \\ \times 1101 \\ \hline 1011 \\ 0000 \\ 1011 \\ 1011 \\ \hline 10001111 \end{array}$	←	multiplicand	←	multiplier	←	}	partial	P_1
							←						products	P_2
							←							P_3
							←							P_4
							←							product

$PS_1 = P_1 + P_2 =$	*	$\begin{array}{r} 0000 \\ 1011 \\ +0000 \\ \hline 01011 \end{array}$
----------------------	---	--

$PS_2 = PS_1 + P_3 =$	*	$\begin{array}{r} 01000 \\ 01011 \\ +1011 \\ \hline 110111 \end{array}$
-----------------------	---	---

$P = PS_3 = PS_2 + P_4 =$	*	$\begin{array}{r} 1110000 \\ 110111 \\ 1011 \\ \hline 10001111 \end{array}$
---------------------------	---	---

*The superimposed bits indicate the carry bits generated by the previous column as they propagate through each addition

FIGURE B-1

```

    1011
    x1101
    -----
     1011
    0000
     1011
     1011
    -----
    10001111
  
```

0000	← PS ₀ (for uniformity)
0000	← CS ₀ (for uniformity)
+1011	← P ₁
1011	← PS ₁
0000	← CS ₀
0000	← CS ₀ (shifted left by 1)
1011	← PS ₁
+0000	← P ₂
01011	← PS ₂
0000	← CS ₂
0000	← CS ₂ (left shifted by 1)
01011	← PS ₂
+1011	← P ₃
1001111	← PS ₃
0010	← CS ₃
0010	← CS ₃ (left shifted by 1)
1001111	← PS ₃
+1011	← P ₄
11011111	← PS ₄
0010	← CS ₄
0010	← CS ₄ (left shifted by 1)
11011111	← PS ₄
100011111	← Product

FIGURE B-2

<u>Sig.</u>	<u>Reg. Val.</u>	<u>Reg.</u>
PS ₀	0000 1101)	AC ML
CS ₀	0000)	CS
P _i	1011)	MD·1
PS ₁	1011 1101	AC ML
CS ₁	0000)	CS
Shift	0101 1110	AC ML
P ₂	0000)	MD·0
PS ₂	0101 1110	AC ML
CS ₂	0000)	CS
Shift	0010 1111	AC ML
P ₃	1011)	MD·1
PS ₃	1001 1111	AC ML
CS ₃	0010)	CS
Shift	0100 1111	AC ML
P ₄	1011)	MD·1
PS ₄	1101 1111	AC ML
CS ₄	0010)	CS
Shift	0110 1111	AC ML
Add = prod	1000 1111	AC ML

Note: left shift of CS value is accomplished by right shift of PS_i.

FIGURE B-3

37C1₁₆ 37C2₁₆ 37C3₁₆ 37C4₁₆ to the CALLing routine.

Before proceeding to multiply the two numbers, the subroutine checks to see if either number is 0; if so, the product is set to 0 and returned to the CALLing routine.

Since, in order to multiply the numbers they must both be positive, the routine now checks the sign of both numbers and determines the sign of the product and sets a flag accordingly; then, the absolute value of each number is used. At the end of the multiplication, the sign flag is checked and the product is set accordingly.

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