DISPLAYS

MIT Instrumentation Laboratory

DG Memo No. 571

TO: Distribution

FROM: R. A. Larson, J. C. Dunbar

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SUBJECT: Preliminary DSKY Displays for Programs and Routines (AS204)

PRELIMINARY DSKY DISPLAYS FOR PROGRAMS AND ROUTINES (AS 204)

	DISPLAY	UNITS	REMARKS
P11	V N		
	R1 Gamma I	.01 DEG	Flight Path Angle
	R2 VI	.1 FPS	Velocity Inertial
	R3 H	.1 NM	Altitude above pad
P12	V N		
	R1 G Max	.1 G	
	R2 Delta V Ins	.1 FPS	Velocity reqd. for insertion
	R3 TFF	Min-sec.	
	V N		
	R1 Delta R	.1 NM	At SIVB shutdown
	R2 Delta V Ins	.1 FPS	
	R3 TFF	Min-sec.	
	DO R34		
	FL V N		Do orbit parameter ACK
	R1 Perigee alt.	.1 NM	
	R2 Apogee alt.	.1 NM	
	R3 TFF (if perigee less than 300000 ft)	Min-sec.	
	FL V N		Select Program 00
P21	FL V N		Load Pitch Angle
	R1 Pitch Angle	.01 DEG	X Axis Pitch Angle
Poss.	FL V N		Make decision to continue
	R1 TTE	Min-sec.	Time to Gimbal lock
	DO R1		
Poss.	FL V50 N R1 Code		Perform G&N att. control selection in SCS
	DO R21		
Poss.	FL V N		Align AGCU
	R1-OG CDU (present)	.01 DEG	CDU angle
	R2-IG	"	" "
	R3-MG	"	" "

	FL V N			Select G&N Att. Cont.
	R1-OG CDU (final)	.01	DEG	CDU Angle
	R2- IG		"	" "
	R3-MG		"	" "
Poss.	FL V N			Select G&N att. Cont.
P22	FL V50 N			Perform request auto optics positioning
	R1 Code			
Poss.	DO R28			
	FL V50 N			Perform entry of target data
	R1 Code			
Star:	V N			
	R1 Star code			
or LDMK:	V N			
	R1 Lat.	.01	DEG	
	R2 Long.	.01		
	R3 Alt.	.1	NM	Alt above equatorial radius
Poss.	FL V50 N			Perform OSS switch to AG mode
	R1 Code			
Poss.	FL N			Target beyond optics limits
	V N			
	R2 SA	.01	DEG	Required shaft angle
	R3 TA	.01	DEG	Required trunnion angle
DO	R27			
	FL V51			Please mark
	FL V21 N30			Load star code
or	FL V24 N36			Load landmark data

	FL V N				Do orbital parameter ACK
	R1				Orbital parameters
	R2				(undefined)
	R3				
P23	FL V51				Please mark
	FL V N				Do optics angles ACK
	R1	SA	.01	DEG	Shaft angle
	R2	TA	.01	DEG	Trunnion angle
	FL V N				Do time ACK
	R1	GET	Hrs.		Time of mark
	R2	GET	Min.		
	R3	GET	.01	Sec.	
P27	FL V 21N01				Do Data Load
	R3	Address			
	V N				
	R1	Pos., vel. or time. Octal			Pos., vel. and time in double precision. 14 loads of 5 digits reqd
	R3	Address			Specifies data load
	FL V50 N				Perform enter
	R1	Code			

P31 DO R35

FL	V N			For TIG ACK
R1	TIG	Hrs.	(Get)	Time to ignition
R2	TIG	Min.		
R3	TIG	.01	Sec.	
FL	V N			For Apogee/Perigee ACK
R1	Lat.	.01	DEG	
R2	Long	.01	DEG	
R3	Alt.	.1	NM	
FL	V N			For delta V ACK
R1	Delta V allow	.1	FPS	
R2	Delta V tail off	.1	FPS	
R3				
FL	V N			For trim angle ACK
R1	Pitch trim	.01	DEG	SPS trim angle
R2	Yaw trim	.01	DEG	SPS trim angle
FL	V N			Do data ACK
R1	Alt.	.1	NM	Alt. of apogee or perigee
R2	Delta V reqd.	.1	FPS	SPS Delta V reqd. for maneuver
R3	Miss	.1	NM	Miss distance to apogee or perigee
FL	V N			Set clocks
R1	TTE	Hrs.		Time to apogee or perigee
R2	TTE	Min.		
R3	TTE	Sec.		

	DO R31			
	FL V N			Set Delta V counter
	R1 Delta V	.1	FPS	
	FL V37 N51			Select program
	FL V N			Maneuver SC or DO IMU/CSM Al.
	R1 OG CDU	.01	DEG	CDU Angle
	R2 IG CDU	.01	DEG	
	R3 MG CDU	.01	DEG	
	DO R1			
Poss.	FL V50 N			Perform G&N att. control
	R1 Code			selection in SCS
	DO R21			
Poss.	FL V N			Align AGCU
	R1-OG CDU (present)	.o1	DEG	CDU angle
	R2-IG		"	" "
	R3-MG		"	" "
	FL V N			Select G&N Att. Cont.
	R1-OG CDU (final)	.01	DEG	CDU Angle
	R2-IG		"	" "
	R3-MG		"	" "
Poss.	FL V N			Select G&N Att. Cont.

P32 DO R36

FL V N			Do Lat-Long data ACK
R1 Lat	.01	DEG	Lat of splash point
R2 Long	.01	DEG	
FL V N			Do Delta V data ACK
R1 Delta V allow	.1	FPS	
R2 Delta V tail-off	.1	FPS	
FL V N			Do trim angle ACK
R1 Pitch trim	.01	DEG	SPS engine bell trim
R2 Yaw trim	.01	DEG	
FL V N			Do TIG ACK
R1 TIG	Hrs.		Time of SPS Ignition
R2 TIG	Min.		
R3 TIG	.01	Sec.	
FL V N			Do Data ACK
R1 Gamma	.01	DEG	Flight path angle
R2 Delta R	.1	NM	Miss distance
R3			
FL V N			Set clocks
R1 TTI	Hrs.		Time to ignition
R2 TTI	Min.		
R3 TTI	Sec.		

DO R31

FL V N			Set Delta V counter
R1 Delta V	.1	FPS	

FL V37 N51			Select program
FL V N			Maneuver SC or DO IMU/CSM align.
R1 OG CDU	.01	DEG	CDU angle
R2 IG CDU	.01	DEG	CDU angle
R3 MG CDU	.01	DEG	CDU angle
DO R1			
Poss FL V50 N R1 Code			Perform G&N att. control selection in SCS
DO R21			
Poss FL V N			Align AGCU
R1 OG CDU (present)	.01	DEG	CDU angle
R2 IG		"	" "
R3 MG		"	" "
FL V N			Select G&N att. control
R1 OG CDU (final)	.01	DEG	CDU angle
R2 IG		"	" "
R3 MG		"	" "
Poss FL V N			Select G&N att. control

P41 or P42

	DO R2		
Poss.	FL V50 N R1 Code		Perform Delta V mode selection in SCS
	FL V N		Align AGCU
	R1 OG CDU	.01 DEG	CDU Angle
	R2 IG CDU	.01 DEG	CDU Angle
	R3 MG CDU	.01 DEG	CDU Angle
	V N		
	R1 TTE	Min-sec.	Time to thrusting
	R2 VG	.1 FPS	Velocity to be gained
	DO R37		
	At TIG-20 Sec.		
	R3 Delta VM	.1 FPS	Meas. delta V along SC X axis
	FL V N		Set SPS engine ON
	V N		
	R1 TG	Min-sec.	Time to go to thrust cut-off
	R2 VG	.1 FPS	Velocity to be gained
	R3 TFF (P42 only)	Min-sec.	Time of free fall
	DO R24		
	None		
	DO R34		
	FL V N		Do orbit parameter ACK
	R1 Perigee Alt.	.1 NM	
	R2 Apogee Alt.	.1 NM	
	R3 TFF (if perigee less than 300000 ft)	Min-sec.	

P46	FL V50 N R1 Code	Perform prepare AGC for thrusting
	DO R24 None	
	FL V50 N R1 Code	Perform terminate program

P47	FL V50 N R1 Code	Perform prepare AGC for thrusting
	DO R24 None	
	FL V50 N R1 Code	Perform termination of program
P51	LEB Checkout of displays	
	DO R1	
Poss.	FL V50 N R1 Code	Perform G&N att. control selection in SCS
	FL V50 N R1 Code	Perform star acquisition
	DO R27	
	FL V51	Please mark
	FL V21 N30	Load star code
or	FL V24 N36	Load landmark data
	DO R27	
	FL V51	Please mark
	FL V21 N30	Load star code
or	FL V24 N36	Load landmark data
	DO R29	
	V N	Data good
	R1 - angle diff. .01 DEG	
or	FL V N	Data bad
	R1 - angle diff. .01 DEG	

P52

Poss.	V01 N31			Nav stars not visible
	R1 Code			
	DO R4			
Poss.	DO R25			
	None			
	DO R28			
Poss.	FL V50 N			Perform entry of target
	R1 Code			data
Star:	V N			
	R1 Star code			
or LDMK:	V N			
	R1 Lat.	.01	DEG	
	R2 Long.	.01	DEG	
	R3 Alt.	.1	NM	Alt above equatorial radius
Poss.	FL V50 N			Perform OSS switch to A
	R1 Code			mode
Poss.	FL N			Target beyond optics li
	V N			
	R2 SA	.01	DEG	Required shaft angle
	R3 TA	.01	DEG	Required trunnion angle
	DO R27			
	FL V51			Please mark
	FL V21 N30			Load star code
or	FL V24 N36			Load landmark data

DO R30

1.	FL V N			Accept or reject torquin angles
	R1 X GYRO	.01	DEG	
	R2 Y GYRO	.01	DEG	
	R3 Z GYRO	.01	DEG	
or 2.	V N			Indicates data good
	R1 X GYRO	.01	DEG	
	R2 Y GYRO	.01	DEG	
	R3 Z GYRO	.01	DEG	
	FL V50 N R1 Code			Perform fine align check request

DO R21 (if not in P52)

Poss.	FL V N			Align AGCU
	R1-OG CDU (present)	.01	DEG	CDU angle
	R2-IG		"	" "
	R3-MG		"	" "
	FL V N			Select G&N att. cont.
	R1-OG CDU (final)	.01	DEG	CDU angle
	R2-IG		"	" "
	R3-MG		"	" "
Poss.	FL V N			Select G&N att. cont.

P53 DO R1

Poss.	FL V50 N			Perform G&N att. control
	R1 Code			selection in SCS
	DO R25			
	None			
	DO R21			
Poss.	FL V N			Align AGCU
	R1-OG CDU (present)	.01	DEG	CDU angle
	R2-IG		"	" "
	R3-MG		"	" "
	FL V N			Select G&N att. control
	R1-OG CDU (final)	.01	DEG	CDU angle
	R2-IG		"	" "
	R3-MG		"	" "
Poss.	FL V N			Select G&N att. control
	DO R4			
Poss.	DO R25			
	None			
	DO R28			
Poss.	FL V50N			Perform entry of target
	R1 Code			data
Star:	V N			
	R1 Star Code			
or LDMK	V N			
	R1 Lat.	.01	DEG	
	R2 Long.	.01	DEG	
	R3 Alt.	.1	NM	Alt above equatorial radius
Poss.	FL V50 N			Perform OSS switch to AGC
	R1 Code			mode

Poss.	FL N			Target beyond optics limit
	V N			
	R2 SA	.01	DEG	Required shaft angle
	R3 TA	.01	DEG	Required trunnion angle
	DO R27			
	FL V51			Please mark
	FL V21 N30			Load star code
or	FL V24 N36			Load landmark data
	DO R28			
Poss.	FL V50 N R1 Code			Perform entry of target data
Star:	V N R1 Star code			
or LDMK:	V N			
	R1 Lat.	.01	DEG	
	R1 Long.	.01	DEG	
	R3 Alt.	.1	NM	Alt above equatorial radius
Poss.	FL V50 N R1 Code			Perform OSS switch to AGC mode
Poss.	FL N			Targets beyond optics limit
	V N			
	R2 SA	.01	DEG	Required shaft angle
	R3 TA	.01	DEG	Required trunnion angle
	DO R27			
	FL V51			Please mark
	FL V21 N30			Load star code
or	FL V24 N36			Load landmark data

DO R28

Poss.	FL V50 N R1 Code			Perform entry of target data
Star:	V N R1 Star code			
or LDMK:	V N			
	R1 Lat.	.01	DEG	
	R2 Long.	.01	DEG	
	R3 Alt.	.1	NM	Alt above equatorial radius
Poss.	FL V50 N R1 code			Perform OSS switch to AGC mode
Poss.	FL N			Target beyond optics limit
	V N			
	R2 SA	.01	DEG	Required shaft angle
	R3 TA	.01	DEG	Required trunnion angle

DO R27

	FL V51	Please mark
	FL V21 N30	Load star code
or	FL V24 N36	Load landmark data

DO R29

V N — Data good

R1 - angle diff. .01 DEG

or FL V N — Data bad
R1 - angle diff. .01 DEG

DO R30

1. FL V N — Accept or reject torquing angles

R1 X GYRO .01 DEG

R2 Y GYRO .01 DEG

R3 Z GYRO .01 DEG

or 2. V N — Indicates data good

R1 X GYRO .01 DEG

R2 Y GYRO .01 DEG

R3 Z GYRO .01 DEG

FL V50 N — Perform fine align check request
R1 Code

DO R21 (if not in P52)

Poss. FL V N — Align AGCU

R1-OG CDU (present) .01 DEG — CDU angle

R2-IG " " "

R3-MG " " "

FL V N — Select G&N att. control

R1-OG CDU (final) .01 DEG — CDU angle

R2-IG " " "

R3-MG " " "

Poss. FL V N — Select G&N att. control

P61	FL V N		Set clocks
	R1 G Max.	.1 G	
	R2 Delta R	.1 NM	Miss distance
	R3 TFF	Min-sec.	
	DO R1		
Poss.	FL V50 N R1 Code		Perform G&N att. control selection in SCS
	DO R21		
	FL V N		Align AGCU
	R1-OG CDU (present)	.01 DEG	CDU angle
	R2-IG	"	" "
	R3-MG	"	" "
	FL V N		Select G&N att. cont.
	R-OG CDU (final)	"	CDU angle
	R2-IG	"	" "
	R3-MG	"	" "
Poss.	FL V N		Select G&N att. cont.

P62	V N			
	R1 G Max.	.1	G	
	R2 Delta R	.1	NM	
	R3 TFF	Min-sec.		
	FL V50 N R1 Code			Perform CM/SM separation
	DO R3			
	FL V50 N R1 Code			Perform monitor mode selection in SCS
	FL V50 N R1 Code DO R21			Perform G&N entry mode selection in SCS
Poss.	FL V N			Align AGCU
	R1-OG CDU (present)	.01	DEG	CDU angle
	R2-IG		"	" "
	R3-MG		"	" "
	FL V N			Select G&N att.
	R1-OG CDU (final)	.01	DEG	CDU angle
	R2-IG		"	" "
	R3-MG		"	" "
Poss.	FL V N			Select G&N att. control
P63	V N			
	R1 Beta	.01	DEG	Commanded bank angle
	R2 Delta R (entry)	.1	NM	Predicted miss from aim point
	R3 G	.1	G	Present G

P71	V N			
	R1 G Max.	.1	G	
	R2 Delta V Ins	.1	FPS	
	R3 TFF	Min-sec.		
	DO R24			
	None			
	DO R1			
Poss.	FL V50 N R1 Code			Perform G&N att. control selection in SCS
	V N			
	R1 Delta R	.1	NM	
	R2 Delta V Ins	.1	FPS	
	R3 TFF	Min-sec.		
P72	V N			
	R1 Delta R	.1	NM	Flash if thrust to recovery area feasable
	R2 Delta V Ins	.1	FPS	Flash if contingency abort is feasable
	R3 TFF	Min-sec.		Updated every - sec.

P73	FL V N		Set clocks
	R1 TTI	Min-sec.	Time to ignition
	R2 VG	.1 FPS	Velocity to be gained
	R3 TFF	Min-sec.	Time of free fall
	DO R21		
Poss.	FL V N		Align AGCU
	R1-OG CDU (present)	.01 DEG	CDU angle
	R2-IG	"	" "
	R3-MG	"	" "
	FL V N		Select G&N att. cont.
	R1-OG CDU (final)	.01 DEG	CDU angle
	R2-IG	"	" "
	R3-MG	"	" "
	FL V N		Select G&N att. cont.
	V N		
	R1 TTI	Min-sec.	
	R2 VG	.1 FPS	
	R3 TFF	Min-sec.	
	DO R2		
Poss.	FL V50 N R1 Code		Perform Delta V mode selection in SCS
	DO R37		
	At TIG-20 Sec.		
	R3 Delta VM	.1 FPS	Meas. delta V along SC X axis.
	FL V N		Set SPS engine ON

	V N		
	R1 TG	Min-sec.	Time to go to cut-off
	R2		
	R3		
	DO R24		
	None		
	FL V37 N61		Select program
P74	FL V N		Set clocks
	R1 TTI	Min-sec.	Time to ignition
	R2 VG	.1 FPS	Velocity to be gained
	R3 TFF	Min-sec.	Time of free fall
	DO R21		
Poss.	FL V N		Align AGCU
	R1-OG CDU (present)	.01 DEG	CDU angle
	R2-IG	"	" "
	R3-MG	"	" "
	FL V N		Select G&N att. cont.
	R1-OG CDU (final)	.01 DEG	CDU angle
	R2-IG	"	" "
	R3-MG	"	" "
Poss.	FL V N		Select G&N att. cont.
	V N		
	R1 TTI		
	R2 VG		
	R3 TFF		

	DO R2		
Poss.	FL V50 N R1 Code		Perform Delta V mode selection in SCS
	DO R37		
	AT TIG-20 Sec.		
	R3 Delta VM	.1 FPS	Meas. delta V along SC X axis
	FL V N		Set SPS engine ON
	V N		
	R1 TG	Min-sec.	Time to cut-off
	DO R24		
	None		
	FL V N		Press enter
	DO R34		
	FL V N		Do orbit parameter ACK
	R1 Perigee Alt.	.1 NM	
	R2 Apogee Alt.	.1 NM	
	R3 TFF (if perigee less than 300000 ft)	Min-sec.	
	FL V37 N21		Select program

ROUTINE		UNITS	REMARKS
R1	Poss. FL V50 N R1 Code		Perform G&N att. control selection in SCS
	DO R22		
R2	Poss. FL V50 N R1 Code		Perform Delta V mode selection in SCS
	DO R22		
R3	FL V50 N R1 Code		Perform monitor mode selection in SCS
	Poss. FL V50 N R1 Code		Perform G&N entry mode selection in SCS
R4	Poss. DO R25		
	DO R28		
	DO R27		
	DO R28		
	DO R27		
	DO R29		
	DO R30		
	DO R21 (if not in P52)		
R21	Poss. FL V N		Align AGCU
	R1-OG CDU (present)	.01 DEG	CDU angle
	R2-IG	"	" "
	R3-MG	"	" "
	FL V N		Select G&N att. cont.
	R1-OG CDU (final)	.01 DEG	CDU angle
	R2-IG	"	" "
	R3-MG	"	" "
	Poss. FL V N		Select G&N att. cont.

R22 NONE

R23 Key in desired data display A, B or C

A.	Flash V50 N R1 - Code		Perform Long. entry
	R1 Long	.01 DEG	
	Flash V N		Do time ACK
	R1 Long	.01 DEG	
	R2 TTE	Min-sec.	
B.	Flash V50 N R1 - Code		Perform time entry
	R1 GET	Hrs.	
	R2 GET	Min.	
	R3 GET	Sec.	
	Flash V N		Do Lat-Long ACK
	R1 Lat.	.01 DEG	
	R2 Long.	.01 DEG	
	R3 Azimuth	.01 DEG	
C.	Flash V N		Do DEC and TTE ACK
	R1 DEC	.01 DEG	
	R2 TTE	Min-sec.	
	R3		

R24 NONE

R25 NONE

R27	FL V51			Please mark
	FL V21 N30			Load star code
	or FL V24 N36			Load landmark data
	Poss. FL V04 N31 - R1 Code			Less than min. or max. than max. marks
R28	Poss. FL V50 N R1 Code			Perform entry of target data
	Star: V N R1 Star Code			
	or LDMK: V N			
	R1 Lat.	.01	DEG	
	R2 Long.	.01	DEG	
	R3 Alt.	.1	NM	Alt. above equatorial radiu
	Poss. FL V50 N R1 Code			Perform OSS switch to AGC mode
	Poss. FL N			Target beyond optics limits
	V N			
	R2 SA	.01	DEG	Required shaft angle
	R3 TA	.01	DEG	Required trunnion angle
R29	V N			Data good
	R1 - angle diff.	.01	DEG	
	or FL V N			Data bad
	R1 - angle diff.	.01	DEG	
R30				
	1. FL V N			Accept or reject torquing angles
	R1 X GYRO	.01	DEG	
	R2 Y GYRO	.01	DEG	
	R3 Z GYRO	.01	DEG	

or 2.	V N			Indicates data good
	R1 X GYRO	.01	DEG	
	R2 Y GYRO	.01	DEG	
	R3 Z GYRO	.01	DEG	
	FL V50 N R1 Code			Perform fine align check request
R31	FL V N			Set Delta V Counter
	R1 Delta V	.1	FPS	
R34	FL V N			Do orbit parameter ACK
	R1 Perigee Alt.	.1	NM	
	R2 Apogee Alt.	.1	NM	
	R3 TFF (if perigee less than 300000 ft)	Min-sec.		
R35	FL V N			For TIG ACK
	R1 TIG	Hrs. (Get)		Time of ignition
	R2 TIG	Min.		
	R3 TIG	.01	Sec.	
	FL V N			For Apogee/Perigee ACK
	R1 Lat.	.01	DEG	
	R2 Long.	.01	DEG	
	R3 Alt.	.1	NM	
	FL V N			For delta V ACK
	R1 Delta V allow	.1	FPS	
	R2 Delta V tail off	.1	FPS	
	R3			
	FL V N			For trim angle ACK
	R1 Pitch trim	.01	DEG	SPS trim angle
	R2 Yaw trim	.01	DEG	SPS trim angle

R36	FL V N			Do Lat-Long data ACK
	R1 Lat	.01	DEG	Lat of splash point
	R2 Long	.01	DEG	
	FL V N			Do Delta V Data ACK
	R1 Delta V allow	.1	FPS	
	R2 Delta V tail off	.1	FPS	
	FL V N			Do trim angle ACK
	R1 Pitch trim	.01	DEG	SPS engine bell trim
	R2 Yaw trim	.01	DEG	
R37	At TIG-20 Sec.			
	R3 Delta VM	.1	FPS	Meas. delta V along SC X axis.
	FL V N			Set SPS engine ON
R38	FL V N			
	DO R24			

MIT Instrumentation Laboratory

DG MEMO NO. 571

Appendix I

DEFINITIONS* FOR

APOLLO COMPUTER LOGIC CHECKLIST INTERFACE

VI - Inertial velocity. In ft/sec to nearest .1 ft/sec.

VG - Velocity to be gained. In ft/sec to nearest .1 ft/sec.

DELTA V INS - Velocity required for insertion to a safe orbit. This value will be displayed whether such a delta V is within SPS capability or not. Update every sec. In ft/sec to nearest .1 ft/sec.

DELTA V REQUIRED - SPS Delta V required to accomplish maneuver. In ft/sec to nearest .1 ft/sec.

DELTA VM - Measured Delta V along SC + X axis starting from zero at start of display. In ft/sec to nearest .1 ft/sec.

DELTA V COUNTER - AGC calculated value of velocity to be set into Delta V remaining counter. In ft/sec to nearest .1 ft/sec.

DELTA V ALLOWABLE - Maximum amount of Delta V to be used in ft/sec to nearest .1 ft/sec.

DELTA V TAILOFF - SPS engine Delta V after receipt of engine off command. In ft/sec to nearest .1 ft/sec.

ALT - Altitude of apogee above equatorial radius if perigee is located over ground target or altitude of perigee if apogee is located over ground target. In nautical miles to nearest .1 nm.

* From MIT flight crew procedures work group.

H - Vehicle altitude above the launch pad. In nautical miles to nearest .1 nm.

LAT - Latitude in degrees to nearest .01 deg.

LONG - Longitude in degrees to nearest .01 deg.

DEC - Declination in degrees to nearest .01 deg.

AZ - Azimuth in degrees to nearest .01 deg.

DELTA R - Miss distance along ground track from discrete recovery area for free fall and entry. Assumes up lift equal to .17 times drag and no out of plane force during entry. Polarity indicates posigrade (+) or retrograde (-1) burn required to hit recovery area. In nautical miles to nearest .1 nm.

MISS - Minimum distance from computed ground track to stored desired lat and long of apogee or perigee whichever stored. + if track passes north of desired point. - if track passes south of desired point. In nautical miles to nearest .1 nm.

DELTA R (entry) - Predicted miss distance from aim point. Polarity indicates lift required (+ up, - down) to drive Delta R to zero. In nautical miles to nearest .1 nm.

TFF - Time of free fall to 300,000 ft altitude above equatorial radius. In minutes and seconds to nearest second. Max reading is 59 59.

TG - Time to go to engine cut off. In min and sec to nearest sec.

TTI - Time from now to ignition. In min and sec (1 register) or hrs, min, and sec (3 registers) dependent on program to nearest sec.

TIG - Time of SPS ignition (GET). In hrs, min, sec to nearest sec.

GET - Ground elapsed time measured from lift off. In hrs-min-sec to nearest sec.

GAMMA I - Flight path angle: angle between inertial velocity and the local horizontal. In degrees to nearest .01 degree.

BETA - Commanded bank angle. In degrees to nearest .01 deg.

PITCH ANGLE - Angle measured from the forward horizontal positively about the negative orbital angular momentum vector to the SC X axis. + for SC Y axis in direction of negative angular momentum vector and - for SC Y axis in direction of positive angular momentum vector. In degrees to nearest .01 degree.

SA - Optics shaft angle. In degrees to nearest .01 deg.

TA - Optics trunnion angle. In degrees to nearest .01 deg.

OG CDU - Outer gimbal angle. In degrees to nearest .01 deg.

IG CDU - Inner gimbal angle.

MG CDU - Middle gimbal angle.

PITCH TRIM -

YAW TRIM - SPS engine bell trim angles at ignition from data taken from fuel loading charts.

G - Present G. In G's to nearest .1G.

G MAX - Max predicted G for free fall and entry at bank angle of 60 deg (L/D max .34). In G's to nearest .1G.