MIT/CSDL PRESENTATION FOR THE

MISSION "H-3" APOLLO 14

FLIGHT SOFTWARE READINESS REVIEW

HELD AT NASA/MSC ON 8 DECEMBER 1970

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SECTION I

CSM PROGRAM

SUMMARY OF COLOSSUS 2E DEVELOPMENT

Establishment of a COLOSSUS 2E Assembly . . . . . 21 Oct. 1969

Release of COLOSSUS 2E for Rope Manufacture
COMANCHE Rev 108 . . . . . 28 May 1970

Completion of Mission "H-3" STG Testing . . . . . 13 Oct. 1970

Completion of Mission "H-3" Level 6 Testing . . . . . 8 Dec. 1970

Completion of Mission "H-3" RTCC Testing . . . . . 4 Nov. 1970

Total Number of PCR/PCNs Accomplished
in the COLOSSUS 2E Release 46

Total Number of Anomalies Fixed in the
COLOSSUS 2E Release 7

COLOSSUS 2E PCR/PCNs IMPLEMENTED

288	Final Phase Reference Table Change
289	Addition of MIN IMP from RHC
290	Modification of R21 and R22
292	Add Time Display to V79
295	AK's on Powered Downlist
302.1	Channel 77
315.1	Channel 77 Revision
821.1	Move AZO to Fixed Ephemeris Constants
822	Delete Stroke Test
857	Save 300 Performance Test Words
859	Modify Rate Drive in R61
860	Modify VECPOINT during P20
867	Make R64 Y Rotation Fix
868	P23 Changes
869	Rate Aided Optics Drive
872.1	Initiate TFI in P40's
874.1	Change Decimal Load Technique
916	Delete P17, P77
917	Delete P31
921	N38 and N06 on Downlist

COLOSSUS 2E PCR/PCNs IMPLEMENTED

956	Time of Longitude (PCR 1034 removed this capability)
970.1	Modify Gyro Torquing Routine
973	Move T6JOB to Fixed Memory
974	Reset RENDWFLAG During Pointing Vector Routine
978	Check OPTIMODES BIT 3 When V37 Requested
984	Avoid Coarse Align During Saturn
985	Delete P38/39 and P78/79
986.1	Update Constants for 1970-71 Ephemeris Year
987	Rate-aided Optics (P24)
991.1	Sum Uplink Data
993	P23 Auto-manuever Change
994	Elimination of Bit 1 of OPTMODES
* 995	Check ENGONFLAG Not SPS ENG-ON OUT Bit.
* 1002	GSOP Section 2 Rev 10 Editorial Changes
* 1003	GSOP Section 3 Rev 10 Editorial Changes
* 1004	GSOP Section 4 Rev 13 Editorial Changes
* 1005	GSOP Section 5 Rev 10 Editorial Changes
1020	Change Initial TVCEXEC Delay
1034	Deletion of Time of Longitude (P29)
* 1041	Add AVEGFLAG Check in Implementation of PCR 984

* PCN

COLOSSUS 2E PCR/PCNs IMPLEMENTED

*1046	Change time to perform IMUCDU Zero.
*1047	GSOP clarification of V56 logic
*1053	GSOP Section 2 Rev 11 editorial changes
*1101	Change GSOP Section 5 Rev 12
*1102	Section 2 Rev 12 GSOP changes
*1103	Section 3 Rev 12 GSOP changes

* PCN

ANOMALIES FIXED IN COLOSSUS 2E

COM	31	Clear RENDWFLAG
COM	32	Fix AUGEKUGEL
COM	33	Coding Error in KALCMANU Steering
COM	34	LONGCALL P00D00 Exit Errors
COM	35	Downlinked State Vector maybe $\bar{0}$ after Sphere Crossing
COM	36 (Rev. 1)	Integration Problems
COM	37	Waitlist Overflow in Targeting Programs.

COLOSSUS 2E PERFORMANCE TESTING

Boost Takeover during Polynomials.
Normal Boost to Orbit, P52, P15
DOI
CSM Active from Insertion (LM in 10 nm x 45 nm. Orbit), Concentric F. P.
CSM Passive from Insertion, Concentric F. P.
CSM Active from Insertion (LM in 10 nm x 45 nm Orbit) - Optics Only, Concentric F. P.
CSM Active from Insertion (LM in 10 nm x 45 nm Orbit) - VHF Only Concentric F. P.
CSM Active from Insertion (LM in 10 nm x 45 nm Orbit) - M = 1.
CSM Active from Insertion (LM in 10 nm x 45 nm Orbit) - Optics Only M = 1
CSM Active from Insertion (LM in 10 nm x 45 nm Orbit) - VHF Only M = 1
RTE (EI-30 Hours to Splash).
RTE (Post TEI-abort, No Comm., P23, P37/P40/P41 after Sphere Crossing to Splash).
Nominal Lunar Entry.
2500 N. M Lunar Entry.
Low Orbit P24 Landmark Tracking.
High Orbit P24 Landmark Tracking.

P24 RECOMMENDATIONS

1. PASSCNT = 0
   NO. PASS = POSMAX

   } one, and only one, update occurring after first mark.

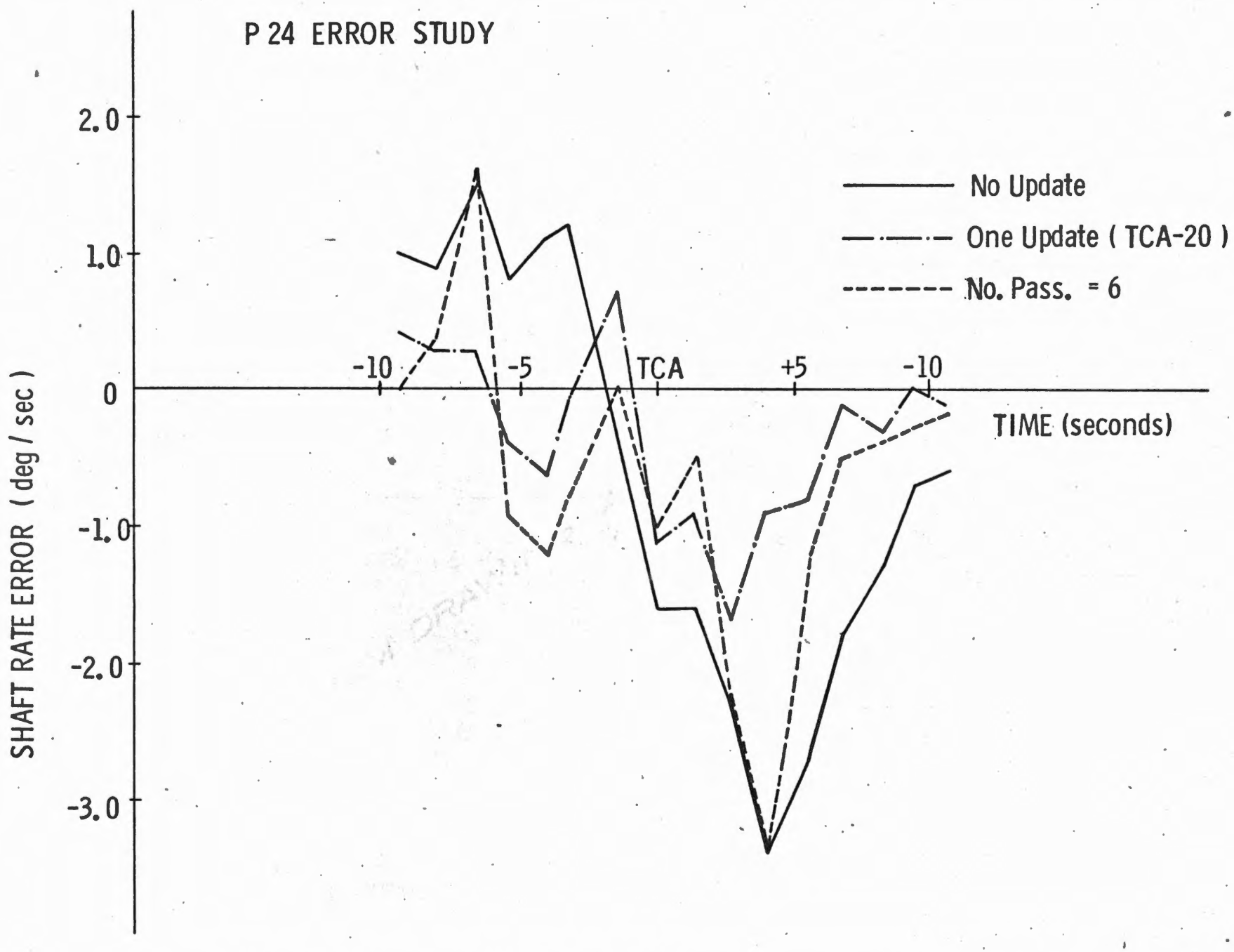
2. Time of first mark should be as soon as possible after recognition of landmark.

3. PROCEDURE FOR LOADING PASSCNT = 0:

AFTER PROCEEDING ON FLASHING V06N89 IN P24

KEY THE FOLLOWING:

V21N01E
1131E
E


P 24 ERROR STUDY
2.0
1.0
0
-1.0
-2.0
-3.0
SHAFT RATE ERROR (deg / sec)
-10
-5
TCA
+5
-10
TIME (seconds)
No Update
One Update (TCA-20)
No. Pass. = 6

CSM RENDEZVOUS

- CFP
  - Results similar to those obtained for Apollo 13.
  - Safisfactory rendezvous is achieved with navigation errors following expected trends and targeting performance within predicted statistical limits.

- M = 1
  - Navigation Results and maneuver uncertainties are as expected for all three sensor variations.
  - The sextant and VHF burn uncertainty in altitude at TPI was larger than expected resulting in a larger than expected first midcourse. This deviation was assumed due to the random dispersions in the single error run and not to program error since all other navigation and targeting results behaved as expected and the rendezvous was not compromised.

M = 1 Rendezvous
Colossus Burn Performance

Sensor Variations	Event	Burn Uncertainty (fps) Range	Alt.	Track	ΔV fps	Miss m
Sextant and VHF	TPI	0.7* (0.2)**	4.7 (1.5)	0 (0.3)	85.0 (88.0)	4798 (1400)
	MCC1	-0.4 (0.2)	0.7 (0.3)	0 (0.1)	11.8 (3.6)	158 (125)
	MCC2	-0.8 (0.1)	0.2 (0.4)	0 (0.1)	1.2 (1.2)	72 (125)
Sextant only	TPI	-0.3 (0.7)	1.0 (0.7)	-0.4 (0.3)	86.9 (88.0)	1450 (710)
	MCC1	-0.9 (0.5)	2.3 (1.1)	0 0.1	2.4 (2.4)	773 (290)
	MCC2	0.2 (0.2	-2.4 (1.4)	0.1 (0.1)	10.0 (4.3)	- (160)
VHF only	TPI	0.1+ (0.3)++	2.9 (2.6)	2.4 (15.4)	85.5 (90.0)	2866 (4900)
	MCC1	2.6 (0.7)	-2.3 (4.3)	2.3 (12.2)	4.2 (5.4)	4184 (4400)
	MCC2	19.6 (6.4)	17.0 (19.7	4.4 (5.1)	6.1 (19)	4193 (4260)

* bit by bit results
** 1σ results in ( )

\+ 17 VHF marks
++ 20 VHF marks

APOLLO 14 NO COMM P23 NAVIGATION TESTING

COMM LOSS AT TEI

	1 Run Simulations			MONTE CARLO 25 Run Sets	
	DIGITAL SIM	ANALYSIS		PROGRAM	
		A	B	C	D
MCC5 FPS	121.2	232.6	18.6	345.5	25.2
MCC6 FPS	151.6	638.9	3.1	771.6	8.7
MCC7 FPS	10.8	19.2	3.8	39.0	2.0
$\delta\gamma$ DEG	-0.31	0.42	0.29	0.47	0.24
$\delta\dot{R}$ FPS	483	272	255.1	1,091.7	197.1

(A) and (C) Meas. schedule from Flight Plan Sept. 23 '70
(B) and (D) Include extra batch of measurements at TEI +1 hour

The 1Run simulations have a 3σ initial navigation error at TEI.

The Monte Carlo sets have an Apollo 13 covariance matrix of errors at TEI.

COMM LOSS AT EI- 30 HOURS

DIGITAL SIMULATOR

MCC 6 FPS	1.3
MCC 7 FPS	3.5
$\delta\gamma$ DEG	-0.03
$\delta\dot{R}$ FPS	155

SUMMARY

The trajectory and measurement schedule gave a satisfactory reentry angle in all cases. All stars were within the 50 degree trunnion angle constraint.

RECOMMENDATION

It is highly recommended that the communication loss at TEI measurement schedule should include 2 or more batches of measurements prior to MCC5.

There are 2 reasons for this:

(1) The reentry conditions will be improved.

(2) The midcourse velocity corrections will be reduced by as much as a factor of 10.

COLOSSUS 2E MISSION "H-3" RTCC TESTING

Lunar Orbit Insertion
Uplink (15 Command Loads)
Nominal High Speed Lunar Re-Entry
Low Speed De-orbit Re-entry

LOI

Due to roundoff errors in the calculation of $\frac{\theta}{2}$ the VG vector after rotation and before the burn will be in error as follows:

$$VGX_{LV} = -.42 \text{FPS}$$

$$VGY_{LV} = 0$$

$$VGZ_{LV} = +1.58 \text{ FPS}$$

COLOSSUS 2E

MISSION PROCEDURAL TESTING

LOI

LM Initiation, Undocking and Separation (Not to be completed)

P22/P24 Landing Site Tracking

CSM Lunar Orbit Plane Change

Post Insertion to TPF (D. T)

Post Insertion to TPF

TEI

RTE P37

Entry Nominal Range

Entry, 1800 Miles

Entry, 2500 Miles

MIT/CSDL HYBRID SIMULATOR TESTING OF COLOSSUS 2E

(Cockpit hours =150)

WIRE TRACING - covered all programs, routines, extended verbs except P02, P03, P07, P11. Three GSOP errors were discovered and PCN documentation initiated.

PCR TESTING - all COL 2E PCR's were tested individually and worked as advertised.

MISSION VERFICATION - representative mission sequences were run on both preliminary and final trajectory information including extensive testing of M = 1 RDZ. One anomaly was discovered and documented - see COM 41, Rev 1. Other anomalies were verified on the hybrid.

COLOSSUS 2E
SYSTEM TEST LAB TESTING

Extended Verbs
IMU Operational Programs
IMU Performance Test
IRIG Scale Factor
Prelaunch Alignment
Rate Aided Optics
IRIG Pulse Torque
Channel 77 Restart Monitor
Sum Uplink
P52 Test
IMU Compensation Programs
Special P11/Gimbal Lock

COLOSSUS 2E

DOCUMENT REVIEW CHRONOLOGY

I. CSM Flight Data File

G & C Checklist, dated 7/1/70, received 7/15/70.
Update, dated 10/22/70, received 11/17/70.

Launch Checklist, dated 7/15/70, received 8/3/70
Update, dated 10/15/70, received 10/27/70.
Update, dated 11/9/70, received 11/23/70.

System Data, dated 6/24/70, received 7/14/70.

Rescue Book, dated 7/8/70, received 7/14/70.
Update, dated 10/23/70, received 11/9/70.

System Checklist, dated 9/24/70, received 10/8/70.

Solo Book, dated 9/30/70, received 10/14/70.

Malfunction Procedures, dated 6/18/70, received 6/30/70.

CSM Cue Cards, dated 8/8/70, received 8/19/70.

CSM Updates, dated 6/24/70, received 7/9/70.

Entry, dated 7/1/70, received 7/15/70.

Contingency Checklist, dated 10/5/70, received 10/20/70.

II Crew Procedures Documents

Apollo Operations Handbook Vol. 2, dated 6/11/70, received 7/8/70.
Update, dated 10/9/70, received 11/17/70.

Comments to the above listed documents were transmitted to NASA/MSC (CF22, CF34) in DG Memo# 1627, 1637, 1641, 1646, 1654, 1657, 1664, 1669 and 1675.

ANOMALIES EXISTING IN COLOSSUS 2E
(COMANCHE Rev 108)

Anomaly	Description	Disposition
COM 38	In R23, R22 mark processing will continue before COAS mark is stored.	Fix for Colossus 3. Program Note for 2E.
COM 39	HOLDFLAG is not on the downlists; it has been replaced by CDUCHKWD.	Fix for Colossus 3. Program Note for 2E.
COM 40	Erroneous calculation of Splash error.	Fix for Colossus 3. Program Note for 2E.
COM 41 Rev. 1	Response to V06N51FL in R05 will not be recognized by R05.	Fix for Colossus 3. Program Note for 2E.
COM 42 Rev. 1	A mark reject to F50 25 in R56 returns to the F53 display with ext. verbs not locked out.	Fix for Colossus 3. Program Note for 2E.
COM 43	Entry Overshoot	
COM 44 Rev. 1	Optics Error Counter not disabled (zeroed) in routine S40. 6.	Fix for Colossus 3. Program Note for 2E.
COM 45	Celestial body code 77777 (-0) does not turn on operator error light.	Fix for Colossus 3. Program Note for 2E.

Anomaly	Description	Disposition
COM 46	P24 MARK REJECT during a short time interval can result in 21302 P00D00 or spurious optics drive rates.	Fix for Colossus 3. Program Note for 2E. 11/6/70
COM 47	P00D00 Aborts while P20 is running in the background will kill P20.	Fix for Colossus 3. Program Note for 2E. 11/6/70
COM 48	ELEV (elevation angle) is stored and may contain a non-zero value when P34/74 is selected even though the DSKY displays zero.	Fix for Colossus 3. Program Note for 2E. 11/6/70
COM 49	FDAI NEEDLES in Mode II may have momentary glitch prior to call of R60 from R61.	Fix for Colossus 3. Program Note for 2E.
COM 50	V79 Does not lockout V79.	Not in Colossus 3. Program Note for 2E.

CONCLUSION

BASED ON THE PRECEDING DATA, MIT/CSD LABORATORY RECOMMENDS THE USE OF COLOSSUS 2E(COMANCHE Rev 108) FOR MISSION "H-3".

SECTION 2

LM PROGRAM

SUMMARY OF LUMINARY 1D DEVELOPMENT

Establishment of a LUMINARY 1D Assembly . . . . . 6 Nov. 1969

Release of LUMINARY 1D for Rope Manufacture
- Rev 163 . . . . . 6 May 1970
- Rev 173 . . . . . 16 June 1970
- Rev 178 . . . . . 17 Sept. 1970
- FACI Meeting . . . . . 10 Sept. 1970

Completion of Mission "H-3" Level 6 Testing . . . . . 7 December 1970

Completion of Mission "H-3" RTCC Testing . . . . . 24 November 1970

Completion of Mission "H-3" STG Testing . . . . . 29 October 1970

Total Number of PCR/PCNs Accomplished in the LUMINARY 1D Release 55

Total Number of Anomalies Fixed in the LUMINARY 1D (Rev 178). 7

LUMINARY 1D PCR/PCNs IMPLEMENTED

286	Format Change to Landing Site Update
287	Removal of 526 Alarm in P22 (See PCR 1038)
294	Update Fixed Memory Mass Properties
296	Set "G" Vector Parallel to Landing Site for Radius Vector
298	Decrease Time to Call Alarm Code 523
302.2	Channel 77
306	Add ΔV_M to Descent/Ascent Downlist
307	Lunar Surface Align Downlist Change
310	Time to Call 511 Alarms
312	Disapproval of PCR 303 "DAP Change"
313	Disapproval of PCR 1012 "Multiple Servicer Avoidance"
314	Downlist Changes for Powered Descent
315.2	Channel 77 Modification
322	Change Fixed Constant "THROTLAG" from 0.2 to 0.08
331.2	Section 2 GSOP Additions
821.2	Move AZ0 to Fixed Ephemeris Constant
872.2	Initiate TFI in P40s (See PCN 1040)
874.2	Change Decimal Load Technique
892	Delete R29
896	LR Velocity Read Centered at PIPTIME (cause for re-release)

LUMINARY 1D PCR/PCNs IMPLEMENTED

897	Delete PCR 775 "Modify R12 to Permit LGC Compensation for Doppler in LR Range Reading"
898	LR Velocity Read
899	N38 in C/A, LS and R/P Lists
944	Read X-Pointer Input from CDUs
945	Descent Downlist Change
970.2	Modify Gyro Torquing Routine
976	Erasable Program for LM De-orbit
979	Delete 521 Alarm
982	Extend Capability of Lunar Surface Star Acquistion Routine
983	Unit Vector Capability for N88.
986.2	Update Fixed Constants for 1970-1971 Ephemeris Year
*990	V44 RR Remode Check
991.2	Sum Uplink Data
996	Liftoff Check in P07
1015	Check for AVEGON at Start of R36
1021	Fixed Memory Landing Radar Transformation Matrices
1022	Landing Radar Position Alarms
1025	Remove Gravity Computation after Landing Radar Altitude Update
1027	A-Priori Terrain Models
1028	Two-Segment Altitude Weighting Functions for Landing Maneuver

LUMINARY 1D PCR/PCNs IMPLEMENTED

1029	Timing - Indicator
*1035	V63 and P66 Terminate the Terrain Model
*1036	PCR 996 (Liftoff Check in P07) Improvements
*1037	P66 Corections
1038	Keep 526 Alarm in P20 (PCR 287)
*1039	Terrain Model Improvements (PCR 1027)
*1040	Only P40 has Early TFI Countdown (PCR 872. 2)
*1042	Sect. 3 Rev 4 GSOP Fix for L-1C-08
*1043	Remove Zeroing of Bit 4 of Channel 14 on Restart or V37
*1007	GSOP Sect. 2 Rev 9 Editorial Changes
*1008	GSOP Sect. Rev 5 Editorial Changes
*1048	Initialize Elevation Angle in P34
*1052	P66/IMU Offset Compensation
1056 Rev 1	Improvements for Impulse and Ullage Logic
1058	New Landing Analog Display (R10)

* PCN's

ANOMALIES FIXED IN LUMINARY 1D

L-1C-01	Delta V Increment may be subtracted from V_G twice following a restart.
L-1C-03	The routine LRPOS2 is called by a TC, but it returns via SWRETURN
L-1C-04	Insert check for remode in progress in V44 coding.
L-1C-05	Correct for sign agreement when HCALC is calculated in RVBOTH.
L-1C-06	Move engine off call from SEUDOP00 to a point after determing Average G is on. but before resetting V37 flag.
L-1C-08	A hardware or software restart while DAP is in the manual rate command mode may cause erroneous operation.
L-1D-03	Velocity updates to state vector are done before all of the 5 radar reads have been taken.

LUMINARY 1D
PERFORMANCE TESTING

Rendezvous

Short Rendezvous - program sequence P00, P20, P34, P42, P35, P41, P35, P41.

Initial Conditions: (1) 1σ IMU, Radar, state vector errors
(2) normal astronaut interface from Apollo 14 Data File
(3) Apollo 13 O. T., Data Package
(4) 10% TLOSS during Average G

Aborts from Descent

Abort at 33k ft - program sequence: P00, P63, P70, P20, P32

Abort at 7k/ft, Abort Stage at DPS depletion - program sequence: P00, P63, P64, P70, P71, P20, P32

Abort Stage after Touchdown - program sequence: P63, P64, P66, P71, P20, P32.

Initial Conditions: (1) 1σ IMU, LR Radar, state vector, (LM), terrain profile $+1^{o}$ errors.
(2) normal astronaut interface from Apollo 14 Data File.
(3) Apollo 14 O. T., Data Package
(4) Abort at 33K ft. with 10% T-LOSS until orbit insertion
(5) Yaw LM 40^{o} after the pitch maneuver

LUMINARY 1D

PERFORMANCE TESTING

Lunar Surface Operations and Ascent

Lunar Surface Alignments - program sequence: P68, P00, P12, P57 AT-1 (Recycle Gravity Determination), V41N72, P57 AT-2 (Planet/star), P57 AT-2 (2 Stars), P00, V47, V41N20, P06, P57 AT-3 (1Star), V64, V48, P57 AT-3 (1Star), P00, V47, V48, V82, P12, P00.

Initial Conditions: (1) offset RLS to show effect of gravity vector updates to RLS.

(2) see 3 below

(3) see 4 below

Ascent from Lunar Surface - program sequence; P00 P22 P12 P20. P34

Initial Conditions: (1) 1σ state vector, IMU, radar errors

(2) yaw LM 40 after the pitch maneuver occurs; target for 1 N. M. out of plane

(3) Apollo 14 O. T., Data Package

(4) normal astronaut interface from Apollo 14 Data File

LUMINARY 1D

PERFORMANCE TESTING

Landing on Lunar Surface

Complete Automatic Landing - program sequence: P00, P63, P64, P66, P68, P00.

Redesignations and Att-Hold-P66 Landing - program sequence: P00, P63, P64, P66, (at 700 ft), P68, P00

NOUN 69: 10K/ 5K ft; ACA: none

NOUN 69: 20K/20K ft; ACA: 2(+AZ), 2(-EL)

NOUN 69: none; ACA: 2(-AZ), 2(=EL)

Initial Conditions: same as Aborts from Descent Test
NOUN 69: 20K/20K ft:ACA 2 (+AZ), 2(-EL) - 10% T-LOSS

SPECIAL TESTS

LM RCS Deorbit Burn-program sequence: P00, P30, P27, V96, P99, P00

APS TPI Burn - program sequence: P00, P30, P42, P00 model errors in thrust, rise time, tailoff, and mass for worse cases c. g. locations.

Docked-DPS Burns-program sequence: P00, P30, P42, P00
CSM/LM Configuration
CM/LM Configuration

LUMINARY 1D

MISSION "H-3" RTCC TESTING

APS Abort (P30/P42)

DPS Abort (P30/P40)

Uplink Test (all LGC Command Loads)

* NOM CSI (P32)

* CDH (P33)

* TPI (P34)

TPI (P34)

Two Star Alignment (P57)

Star/G-vector Alignment (P57)

*Not completed; Data not received from NASA/MSC.

LUMINARY 1D

MISSION PROCEDURAL TESTING

No PDI + 12 Abort thru Rendezvous

Landings - Auto

Landings - ROD Control

Landings - Redesignate (N69 & ACA)

High Altitude DPS Abort to Insertion

Landings (From High Gate-2 Min.)

DPS & APS Aborts from Descent

APS Aborts from Touchdown

Lunar Surface Activities

Ascent thru Insertion

Ascent thru Rendezvous

LM Jettison

Docked DPS Abort

~~Docked APS Abort~~

LUMINARY 1D
SYSTEM TEST LAB TESTING

Extended Verbs
IMU Operational Programs
IMU Performance Test
IRIG Scale Factor
P57 Changes
Radar Test
IRIG Torque
Sum Uplink
Channel 77 Restart Monitor

LUMINARY 1D

DOCUMENT REVIEW CHRONOLOGY

I LM Flight Data File

LM Timeline Book, dated 9/15/70, received 9/30/70, received 9/30/70.
Update, dated 9/30/70, received 10/14/70.

LM Data Card Book, dated 8/8/70, received 8/11/70.
Update, dated 10/2/70, received 10/20/70.

LM System Activation Checklist, dated 9/15/70, received 9/30/70.
Update, dated 11/2/70, received 11/23/70.

LM G&N Dictionary, dated 6/15/70 received 6/29/70.
Update, dated 10/15/70, received 10/27/70.

LM Contingency Checklist dated 7/8/70, received 8/3/70.

LM Lunar Surface Checklist dated 9/15/70, received 9/30/70.

LM Cue Cards dated 8/8/70, received 8/19/70.
Update dated 8/21/70, received 9/9/70.

LM Systems Data dated 6/24/70, received 7/10/70.

LM Malfunction Procedure dated 6/18/70, received 7/6/70.

II Crew Procedures Documents
Apollo Operations Handbool Vol. 2 dated 6/11/70 received 7/6/70.

Comments to the above listed documents were transmitted to NASA/MSC (CF22, CF34) in DG Memo #1627, 1637, 1641, 1646, 1654, 1657, 1664, 1669 and 1675.

ANOMALIES EXISTING IN LUMINARY 1D

(REVISION 178)

Anomaly		Description	Disposition
L-1D-01	SS	NEEDLER initialization never takes place following DAP Turn-on	Fix in Luminary 1E
L-1D-02	SS	Core set overflow (31202) Alarm from bad return from pulse torquing	Fix in Luminary 1E
L-1D-04	287	P25 will not control spacecraft attitude if range to CSM is greater than 566N. M.	Fix in Luminary 1E
L-1D-05	287	Certain Verb routines should not be requested if P20 or P22 is running and the range is greater than 400 N. M.	Fix in Luminary 1E
L-1D-06	SS	DVTOTAL increments twice in one SERVICER cycle	Fix in Luminary 1E
L-1D-07	SS	Manual rate control mode improperly terminates	Fix in Luminary 1E
L-1D-08	1028	Padload LRWH1 shares erasable location with RM of P20	Fix in Luminary 1E
L-1D-10	SS	There are a number of windows during which a change in major modes would wipe out a waiting 1/ACCS jobs leaving the DAP with improper data	Fix in Luminary 1E
L-1D-11	986.2	W_B is mis-scaled by a factor of 2.	Fix in Luminary 1E