MIT/IL PRESENTATION FOR THE
MISSION "H" APOLLO 12

FLIGHT SOFTWARE READINESS REVIEW
HELD AT NASA/MSC ON 15 OCT 1969

PRELIMINARY DRAFT

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SECTION 1
CSM PROGRAM

Summary of Colossus 2C Development

Establishment of a Colossus 2C assembly	5/26/69
Release of Colossus 2C (Commanche 67) for rope manufacture	7/17/69
Completion of Mission "H" level 6 testing	10/8/69
Total number of PCR/PCN's accomplished in the Colossus 2C release	23
Total number of Anomalies Fixed in the Colossus 2C release	8

COLOSSUS 2C PCR/PCN'S IMPLEMENTED

✓ 778 A fixed DUMPCNT

✓ 781.1 PIPA Bias Compensation Scale change

✓ 785 Reverse V50N18 Logic in P20

✓ 787 Make N63 count during P61

✓ 791.1 Do not allow a proceed response to a V21, V22 or V23.

798.1 Reset GLOKFAIL in R00

✓ 799 V82 Time option

✓ 801.1 Make BAILOUT Alarms start with 3XXXX and POODOO alarms with 2XXXX

✓ 802.1 Save alarmdata after "Error Reset"

803 Change Entry Final Phase Table

✓ 807.1 Add present time option to P21

809 Error variance computation for VHF range and alternate Line-of-Sight measurements.

810 YAW DAP CDU sampling

811 TVC DAP gain change

812.1 Resetting and setting the EXTERNAL ΔV FLAG

815 Digital Autopilot Barbecue mode Routine

825.1 Display option 3 in P52/P54

826.1 Reverse P76 display

831.1 Lambert overflow protection

832.1 Reduce restriction of running R05 only in P00

833 SWTOVER check

835 Change Recycle Point on N63 in P61

837 Change constant Dreg Controller Gains

PCR/PCN'S INCORPORATED IN COLOSSUS 2B

773.1 FIX CONSTANTS FOR PLANETARY INERTIAL ORIENTATION SUBROUTINE

776.1 IMPROVE TIMING FOR R2 LUNAR POTENTIAL MODEL INTEGRATION

ANOMALIES FIXED IN COLOSSUS 2C FOR COMMANCHE 67

COM 12 Rev 1 IMPROPER REPFRAC VALUES

✓ COM 13 V78 DOES NOT TERMINATE

✓ COM 14 P17 DOES NOT TERMINATE

✓ COM 15 CODING ERROR IN RESTART TABLES

COM 16 $\Delta V \neq 0$ AT FIRST MARK

✓ COM 17 ERROR AT RANGES GREATER THAN 163.83 NM

✓ COM 18 SOFTWARE RESTART (BAILOUT OR POODOO)

✓ COM 20 ANOMALY COL 69 NOT COMPLETELY FIXED

PERFORMANCE TESTING

Boost Takeover during Polynomials

CSM Active from Insertion (Nominal Tracking Schedule) (LM in 10 x 45 orbit)

CSM Passive from Insertion (Nominal Tracking Schedule)

Same as 6.2.1 Optics Only

Same as 6.2.1 VHF Only (Use "H" Pad Load Data)

Rescue #1 - Aborts from PDI_2 +2 min.

Rescue #2 - Aborts from PDI_2 +20 sec.

Rescue #3 - Aborts from PDI_2 + 700 sec.

Rescue #4 - Aborts from PDI_2 +21 min., 24 sec.

Landing Site (Zero W-matrix) Auto-optics and Downlink Verification

RTE (EI - 30 Hours) (to Splash)

TEI - No Communication Followed by P23 out Past Sphere and then P37/P40 (to Splash)

Entry

MISSION PROCEDURAL TESTING

LOI-1
Docked DPS TEI Monitor
LM Initiation, Undocking and SEP
CSM Lunar Orbit Plane Change
Post Insertion to TPF-CSM Passive
Post Insertion to TPF-CSM Active
CSI to TPF - CSM Active
CDH to TPF - CSM Active
TPI to TPF - CSM Active
P22 LM Tracking (Landing Site)
P37 RTE - Inbound - Longitude Control
Earth Orbit Abort (P37) and Entry
High Velocity Entry
High Velocity Entry (-P65-)
High Velocity Entry (-P65-P66-)

SYSTEM TEST LAB TESTING

TEST OF P20

TEST OF P52

TEST OF P22

TEST OF IMU COMPENSATION

ALARM TEST

ANOMALIES EXISTING IN COLOSSUS 2C (COMMANCHE 67)

Com 21	BACKWARDS INTEGRATION CAN OCCUR IN P27 UPLINK	PROGRAM NOTE (FIX FOR 2D) 1.3.1
Com 22	V79, V91, V55 & V42 DO NOT PERFORM CCS NEW JOB	PROGRAM NOTE (FIX FOR 2D) 1.2.9
Com 23	OPTICS IN CMC MODE DORING TVC USE OF DAC'S	PROGRAM NOTE 1.6.3
Com 24	CODING ERROR IN ITERATOR	(FIX FOR 2D)
Com 26	V92 FLAGWD 6 IS CHANGED WHILE THE JOB IS NOT IN INHINT	(FIX FOR 2D)
Com 27	V32E RESPONSE TO FLVICN45 IN P37 WILL RESULT IN INDETERMINATE PROGRAM TRANSFER	PROGRAM NOTE (FIX FOR 2D)

CONCLUSION

BASED ON THE PRECEDING DATA, MIT/IL CAN FIND NO REASON TO DISQUALIFY COLOSSUS 2C (COMMANCHE 67) FOR MISSION "H" AND RECOMMENDS ITS USE.

SECTION 2
LM PROGRAM

Summary of Luminary 1B Development

Establishment of a Luminary 1B Assembly ——— 6/12/69

Release of Luminary 1B (Revision 116) for Rope Manufacture ——— 8/12/69

Completion of Mission "H" Level 6 Testing ——— 10/8/69

Total Number of PCR/PCN's Accomplished in the Luminary 1B (Revision 116) Release ——— 40

Total Number of Anomalies Fixed in the Luminary 1B (Revision 116) Release ——— 25

LUMINARY 1B PCR/PCN'S IMPLEMENTED

✓ 277 Affixed DUMPCNT

279 Variable Insertion Computation
284 VGTIG's on C/A downlist.

773.2 Fix Constants for Planetary Inertial Subroutine.

776.2 Improved R2 model timing

✓ 779 Leave Track Enable set when R29 is terminated

✓ 780 Provide pure RR Range, Range Rate and time tag during P20, P22 and P25

✓ 781.2 PIPA Bias Compensation scale

✓ 791.2 Do not allow a PROCEED response to V21, V22 ~~or~~ V23

798.2 Reset GLOKFAIL in R00

✓ 801.2 Make BAILOUT alarms start with 3XXXX and POODOO alarms with 2XXXX.

✓ 802.2 Save alarm data after "Error Reset".

✓ 805 Don't allow V66 on the surface

✓ 807.2 Add present time to P21

✓ 812.2 Resetting and Setting of the External ΔV flag.

✓ 814 (Rev.) Reduce keystrokes required to check and approve LR data.

816 Modify R03 to permit astronaut setting of 1° Deadband

817 Eliminate undesirable LR position alarms from R12

818 Permit rejection of Individual Measurement incorporations in P20

820 Eliminate lighting of ALT light when low scale discrete is absent

823 Delete P31 from Luminary 1B

825.2 Display option 3 in P52/P54

826.2 Reserve P76 display

827 Add ZDOTD to ascent descent downlist

830 Supplementary ASTEER modification

831.2 Lambert Overflow protection

832.2 Define actual restrictions on running R05

838 Prevent RCS Jet on Lunar surface

839 R12 and LR Repositioning Routines improvements

840 Reduce oscillation in P64/P65

841 PGNCS derived Vehicle Attitude Rate on FDAI Error Needle

842 Modification of criteria used to determine DAP phase plan parabola intercept

844 Deletion of P38/P78 and P39/P79

845 Do not turn on R29 during P70/P71

847 Eliminate possible lockout of pitchover from P12, P70 and P71

848 Prevent RR ECDU's from stealing LGC Memory Cycles

✓ 853 Restrict V35 to P00

✓ 854 Provide a flexible method for crew to modify RLS

✓ 855 Begin reading LR velocity as soon as velocity data good appears

✓ 856 Change 1502/1206 from P00D00's to BAILOUTS

ANOMALIES FIXED IN LUMINARY 1B FOR REV 116

55 ERRORS IN FIXED CONSTANTS

58 RDRUSECK BUG R76

61 RESTART PROTECTION P20 & P22

62 P70 & P71 SELECT 1° DEADBAND

63 P40 RECYCLE

64 RESTART IN P63

66 R04 ERASABLE CONFLICT WITH R65

67 MAKE ATTSTALL 1210 INTO BAILOUT INSTEAD OF POODOO

68 P57 IMU COMPENSATION CONFLICT

69 CODING ERROR, DOWNWARD JET FIRING

71 P22 LUNAR SURFACE NAVIGATION

72 511 ALARM AFTER V32E

73 CORRECT LOCATION OF V06N61

74 ERASABLE CONFLICT

76 WRONG ERASABLE IN PINBALL

77 Software restart will not now cause up to .163 sec activity delay

78 NON-ZERO ATTITUDE ERRORS NEAR ORBIT INSERTION

79 CROSSPLANE VERTICAL OSCILLATIONS DURING P64/P65

80 V63E WITH LR POWER OFF CAUSES IMPROPER RADMODES BIT 6

81 ERASABLES SHARED BETWEEN RADAR TASKS AND JOBS

82 MAX DB ONLY WHEN P68 RUNNING

87 CODING ERROR IN P22

88 LANDING RADAR REPOSITIONING ROUTINE IS NOT RESTART PROTECTED

89 BACKWARDS INTEGRATION CAN OCCUR IN P27

90 V97N63 DISPLAY OVERWRITTEN BY V06N63 DISPLAY

91 CDU FAIL PROGRAM ALARM IN P20 WHEN NOT AN ALARM CONDITION

PERFORMANCE TESTING

Rendezvous

LM Active-Nominal

P00, P52, P20, P32, P41, P30, P41, P33, P41, P34, P41, P35, P41, P35, P41, P47

Abort Insertion Profile to Rendezvous

P00, P52, P20, P32, P41, P32, P41, P33, P41, P34, P41, P35, P41, P35, P41

Lunar Surface and Ascent

P68, P00, P12, P57 (2 stars), P06, P57 (gravity/star), P57 (gravity/refsmmat), P22, P12, P20, P32 (initialized with 5° pitch, 15° yaw)

Aborts from Descent

Early - P00, P63, P70 (at 30 kft), P20 (11 mks), P32 ~~(one soln)~~ (1st solution)

Mid - P00, P63, P70 (at 10 kft), P71 (at FV97), P20 (11 mks), P32 ~~(one soln)~~ (1st solution)

Late - P00, P63/P64, P71 (at 500 ft), P20 (11 mks), P32 ~~(one soln)~~ (1st solution)

Landing

Enter P66 at 700 ft altitude; null all velocity components

Redesignations and Noun 69 Deltas

Nominal Error-free Run-automatic

LR Position Check

MISSION PROCEDURAL TESTING

Docked DPS, SPS Backup
Pre-DOI to Touchdown
Auto Landing
Manual Attitude Control Landing
Full Manual Landing
Redesignate Landing
DPS Abort from Descent
DPS-APS Abort from Descent
Pre-Liftoff to Rendezvous
Pre-CSI to Rendezvous
Pre-CDH to Rendezvous
Pre-TPI to Rendezvous
Lunar Surface Operations

SYSTEM TEST LAB TESTING

Polarity & Scaling Test for Accelerometers

Alarm Code Test

Anti Max Limit & Remode

LR ÷ RR data R04

P20 Options

Operations of Lunar Surface Prog. P22

R29 Test

R77 Test

LGC/CMC Clock Synch. (R33) Including V55

AGS Initialization Prog.

Nominal Turn On

Turn On with Failures Test

Gimbal Lock Protection Test

Cage Test

IMU Error Monitor Test

P51-IMU Orientation Determination

P-51 Options Case

report in summary

SYSTEM TEST LAB TESTING

P52-IMU Realign Prog

P52-Options Case

AOT Bias Calibration Test

P57-Lunar Surface Align

Verb 40 Zero IMU-CDU

Verb 41 Coarse Align IMU

Verb 42 IMU to Inertial Mode

Verb 43 Load IMU Error Needles

Free Fall Bias Comp. Test

Thrusting & Comp. Test

Gyro Drift & Acceler. Comp. Test

report in

ANOMALIES EXISTING IN LUMINARY 1B (REVISION 116)

12	V06 FLASH DURING V97NXX	PROGRAM NOTE
31	USE OF V30 AND V31	PROGRAM NOTE
75	RADAR SELF TEST ROUTINE	WORK AROUND IN 1B FIX IN SUBSEQUENT
83	INCONSISTENCY BETWEEN N63 AND N43 (IN P68)	INSUFFICIENT DATA
84	H_d AND H_p DISCREPANCY IN P30 VS D01	INSUFFICIENT DATA
85	RESTART AND ALARMS AT TIG (PDI) -4:30	INSUFFICIENT DATA
92	V41 AND V42 DO NOT PERFORM CCS NRW JOB BEFORE FINAL DISPLAY	FIX FOR 1C
L-1B-01	SELECTION OF P22 BEFORE CSM IS WITHIN RR COVERAGE	WORK AROUND IN 1B FIX FOR 1C
L-1B-02	R29 WILL NOT ACHIEVE RR LOCKON	WORK AROUND IN 1B FIX FOR 1C
L-1B-03	QUANTITY COEFFR DISCREPANCY WHEN 1/ACCQ AND 1/ACCR ARE EQUAL	FIX FOR SUBSEQUENT PROGRAMS
L-1B-04	SWITCHING RR MODE CONTROL INTO LGC DISABLES X-POINTER	FIX FOR 1C

CONCLUSION

BASED ON THE PRECEDING DATA, MIT/IL CAN FIND NO REASON TO DISQUALIFY LUMINARY 1B (REVISION 116) FOR MISSION "H" AND RECOMMENDS IT'S USE.