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COLOSSUS Memo # 286

To: Distribution
From: N. Brodeur
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Subject: Revisions 52 through 57 of ARTEMIS

Revision 57 was GOOD.

Major Changes Incorporated into Revision 52:

- 1) The following changes were incorporated for MINKEY Rendezvous (PCR 1049).
 - a) R36 (VERB 90) was modified to display the newly created NOUN 96 instead of NOUN 90 to avoid erasable conflict with the targetting program display of NOUN 90. Three new double precision erasables - YCSM, YDOTC and YDOTL - were defined as the new N90 erasables; they share with UNITR. The Assembly and Operations log section comments were changed to reflect these changes.
 - b) Coding was added to V37 logic to clear PCMANFLG when a non-MINKEY program change is requested.
 - c) A bug in the implementation of restart protection of AUTOSET was fixed by storing MMNUMBER before the contents of the accumulator is overwritten.
 - d) Coding was added to MINKEY initialization to check AZIMFLAG - if reset, set it and load AZIMANGL accordingly. AZIMANGL checking and setting was removed from P20 MINKEY.
 - e) Redundant clearing of RNDVZFLG in MINKEY was deleted.
 - f) The order of checking the PTV93FLG was reversed with TPMINFLG; thus if the PTV93FLG is set, the W-MATRIX will be initialized when incorporating the first mark after the maneuver.
 - g) Code in the N90 display subroutine which incorrectly loaded a vector from the push-list was changed to load it from AUTOY.

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- h) An erroneous octal code for phase change was corrected in AUTOCHK.
 - i) The description for RANGFLAG was corrected to 328 N.M. in the Erasable Assignments.
- 2) AUTPOINT, HOLDFLAG and SWSAMPLE were relocated to allow HOLDFLAG to be contiguous with OPTMODES for downlink purposes. (COM 39)
 - 3) More references to flagbits by bit names were changed to use the specific flag bit mnemonics. New flag bit mnemonics were defined for the special display interface flagwords, DSPFLG, +1, +2. (ACB A10)
 - 4) Assembly & Operation information log section was updated to include N80 references which were inadvertently deleted in a previous update. P20 tracking options were added to the option code lists.
 - 5) The clearing of TARG2FLG was removed from R00 and added to P23. (ART-2E-04)
 - 6) The priorities were raised before and lowered after calling the display in R05 to allow detection of a response to said display. (COM 41)
 - 7) The following changes were incorporated for Universal Tracking (PCR 1051).
 - a) UTFLAG is reset in P06 and IMUTURNON.
 - b) RNDVZFLG is reset in non-rendezvous options of P20.
 - c) RNDVZFLG and UPDATFLG are set only for option 0 and 4 of P20.

Major Changes Incorporated into Revision 53:

- 8) The automatic selection of RCS DAP was deleted from MINKEY. (PCN1077)

9) The following changes were incorporated for MINKEY Rendezvous (PCR 1049).

- a) The definition and use of R23FLG were deleted because the new P20 marking philosophy made it obsolete.
- b) A new interpretive tag, SERVXT1, was added to P40 to correct bug created by MINKEY implementation.
- c) Display interface subroutine TIMECHEK was modified to avoid a 2 sec. wait at the end of automatic maneuver in P20 (R61).
- d) The P54 entry of the PREMM1 table was corrected to the proper code.
- e) An erroneous EBANK5 setting was removed from P20.
- f) A restart bug to restore reset point in controller was fixed.

10) Comments in the Erasable Log Section were updated and corrected for R67FLAG and DBPTC.

11) Return to Earth erasables were moved to avoid conflict with Universal Tracking.

12) Downlink comments were updated.

13) A new downlist symbol directory was added to the Downlink Lists Log section to aid in the prevention of moving of items that are not directly referenced in the list but whose order in the list must be maintained.

14) ENTRY LEXICON remarks cards were updated.

15) A test was added to Fresh Start to prevent the selection of Please Perform MINKEY display if REFSMFLG is not set. R02 was changed to go to RLGOTOPU and flash V37 if the IMU is not on and aligned.
(PCR 1064)

- 16) The priority of R23 is raised above that of R22 to insure that the mark taken would have the correct time associated with it. It is restored to its former priority when terminating R23 to allow R22 to complete the processing of the mark before setting R21MARK and thus indicate regular optics marking. (COM 38)
- 17) P20 was modified to load N78 with the preferred axis only if the astronaut chooses rendezvous option (0 or 4). (PCR 1061)
- 18) V56 was changed to call INITSUBB which is a newly defined RTB routine to call INITSUBA. This routine performs a STOPRATE and RESTORDB. If TRACKFLG is set, STOPRATE is bypassed in GOPROG; STOPRATE and RESTORDB are bypassed in V37. If TRACKFLG is reset, FIXDB is called to restore deadband and perform STOPRATE in RELINUS, PICKUP20, R67, R66 and R52END. The net effect is that new program selection or a restart during a tracking sequence does not disturb deadband or rate as it formerly did. (PCR 1062)
- 19) P20 initialization was changed to do a permanent State Vector update for rendezvous only; i. e. if UTFLAG is not set. (PCR 1051)
- 20) V37 logic was modified to bypass the setting of UPDATFLG if P20 (options 1, 2 or 5) is operating in the background and P20 is selected. (PCR 1051)
- 21) The RNDVZFLG check was removed from PICKUP20. (PCR 1051)
- 22) CSMPOS & LMPOS were moved to bank 36 because room was needed in bank 34. Four interpretive constants were moved to bank 32 because room was needed in bank 30. BITS7+4 was moved from Bank 10 to Fix-Fixed.LOADTIME & CDULOGIC was moved from Bank 4 to Bank 22. An interpretive constant in Time of Free Fall was moved from Bank 37 to Bank 34.

RDCDUS was corrected to put CDUX and CDUY into 1 and 2 of the Pushlist. (ART-2E-09)

A superfluous RELINT was removed from CM Body Attitude log section. (ACB A13)

A new log section "CHECK EQUALS LIST" was added in anticipation of the implementation of ACB A-15.

A new tag VIN70DSP was created for P20.

CTLIST was defined directly in the Erasable Assignment log section instead of being equated to LDATAALST in the Down-Telemetry Program log section. LDATAALST, OPTY and OPTX were deleted as being unreferenced. (ACB A14)

A new tag NWNGL17D was added to Kalcmanu Steering for edit purposes.

Coding was added to R61CSM to set the deadband to the N79 value on each cycle of R61. Coding was added to P20 to initialize N79 with R03 deadband for MINKEY rendezvous and to display N79 for non-MINKEY P20 initialization. (PCR 1060)

The clearing of STARIND was moved from STARTSB2 to V37 logic. (ART-2E-07)

Inconsistencies in the earlier implementation of Pinball Code Saving changes were corrected by:

a) saving the contents of "L" in NVQTEM rather than MONSAVE2 before the astronaut busy check thus avoiding the overwriting of MONSAVE2; and

b) adding a "greater than 5" check to 89TEST to avoid sending alarm if 8 or 9 is keyed-in after accepting 5 octal digits. (ART-2E-08)

Major Changes Incorporated into Revision 54:

- 32) The bad return from IMUSTALL in 1/GYRO was changed to continue rather than end the 1/GYRO job. (ACB A-16)
- 33) Failure protection for bits 13, 14 and 15 of Channel 31 was incorporated. Erasable cell 377_g was defined as C31FLWRD. If bit 1 of this word is set to 1 (by astronaut or ground) the 3 high order bits of Channel 31 are ignored and the corresponding bits of C31FLWRD are used instead. The setting of bits 13, 14 and 15 of C31FLWRD are treated as the inverse of Channel 31 settings - e.g., if bit 15 of C31FLWRD is 1, the logic assumes G&N is selected. Code in Automatic Maneuvers, RCS Autopilot, P20, and R60 which read the channel bits was changed to call the newly created subroutine C31BTCHK. The subroutine reads either the channel or the erasable cell depending on bit 1 of C31FLWRD. (PCR 318)
- 34) The following changes were made for MINKEY Rendezvous (PCR 1049):→
- a) A check for extended verb activity in DISPN90 was deleted. The use of N96 in R36 and the redefinition of N90 erasables negates the need of this test in DISPN90. ✓
 - b) Coding was added to DISPN90 to include the display of N81. ✓
 - c) DEG130 and DEG208 were deleted as they are equivalent to 130DEGLO and 208DEGLO respectively. ✓
 - d) 15NM and 25THOUS were redefined to be 27780 B-29 meters and $-.4114470842 \text{ E-5 B+17}$ respectively. ✓
 - e) The setting of RNDVZFLG in P20 and AUTOSEQ in FRESH START were relocated to avoid a possible erroneous return to the controller.
 - f) Coding was added to Pinball to load 34DEC into VERBREG in subroutine JAMTERM so that the terminate action will be recognized by the Display Interface routines.
 - g) RUTMXTAB was modified to include the N96 entry which was inadvertently left out in earlier revisions.

- h) 328NM was redefined to be 605604 B-29 meters instead of 607456 B-27 meters.
- i) R67TIME, UTSTARNO and AUTTEMP were redefined to not share with targetting and measurement incorporation erasables. (They do share with each other.)
- j) Coding was added to P32 alarm sequence to test HAFLAG to determine if alarm condition was generated by P31 or P32 and proceed accordingly.
- k) A bug in the decoding of the downlink type in V37 logic was fixed. ✓

35) A new subroutine INPUTDSP was added to P32 and used by P31 to initialize CENTANG to 130° and ELEV to 208° and display N11, N55 and N37. (PCR 1065)

36) An initial list of erasable items making use of the new "CHECK=" assembler operator was inserted into the assembly to aid in the detection of improper erasable assignments. (ACB A-15)

37) Some comments were updated or deleted in the Downlink Lists and Erasable Assignments Log sections.

38) Inasmuch as non-rendezvous P20 allows P27 to operate, coding was added to the Update Program to restore the downlink code to 2 if non-rendezvous P20 is active when P27 is terminated. (PCR 1051)

39) A modification was made to SXTMARK to complement the rejected mark's time registers on the downlist when a "MARK REJECT" occurs during P22. (PCR 1063)

40) Coding was added to the S40.6 subroutine to disable the optics error counters (clear bit 2 of channel 12). (COM 44)

41) The recycle (mark reject) response to V50N25 (00016 checklist) in R56 was changed to return to the point that locks out extended verbs while the flashing V53 is displayed. (COM 42)

- 42) All changes made under PCR 1050 were removed. This involved deletion of the SATURN DAP log section, replacement of the new P11 coding, and changes in NEEDLER, IMU zero, noun tables, V46, restart tables, restart code, T4RUPT, Erasable definitions and Assembly and Operation information.
- 43) Code was added in GLOCKMON (gimbal lock detection) to check DAPDATR1 configuration bits and AVEGFLAG if gimbal lock is found. If SATURN Stick DAP is selected and Average G is on, course align is bypassed. (PCR 984, 1041)

Major Changes Incorporated into Revision 55:

- 44) Scaling of R1 in N49 was changed from XXXX.X N.M. to XXX.XX N.M. (PCR 317.1)

Major Changes Incorporated into Revision 56:

- 45) A new program P77 was added. This program makes use of existing P76 code and updates the permanent CSM state vector in the same manner that P76 updates the permanent LM state vector. P77 displays delta V via N81.OPTFLAG, a newly defined erasable, is used as a switch for branching to P76 or P77. (PCR 325)
- 46) Coding was added to R61 and KALCMAN3 to recalculate any large R61 initiated automatic maneuver based on the anticipated maneuver completion time plus a bias of 20.48 secs. A new flag CYC61FLG (BIT 4 FLAG 0) was defined to communicate to KALCMAN3 whether to return to R61 after calculation of maneuver time (if set) or to proceed with the maneuver (if clear). The flag is set in R61 at the first call to KALCMAN3, cleared in R61 after return from KALCMAN3, and cleared in STARTSB2. (PCR 326)
- 47) The effect of the V32 and PRO responses to the final P22 N89 display was reversed so that a V32E is required to update RLS. (PCR 327)

- 48) P34 was modified to initialize R2 of N55 to +000.00. Constant 208DEG was deleted since it is no longer used for initialization. (PCR 328)
- 49) The following changes were made for MINKEY RENDEZVOUS (PCR 1049).
- a) The resetting of AUTOSEQ and R21MARK was relocated before the resetting of RNDVZFLG in V56 to avoid a possible restart problem.
 - b) A bug in the automatic W-MATRIX initialization was corrected by reversing the test of FULTKFLG.
 - c) The check of RNDVZFLG was restored in PIKUP20 to suspend tracking via FIXDB if flag is not set. This check was added to avoid a possible restart problem. (It had been deleted in Revision 53).
 - d) An error of improper vector switching in the controller subroutine HARTBURN was corrected by reversing BURNTMP1 and BURNTMP2.
- 50) A new tag V37XEQ+3 was appended to replace a transfer to a relative address.
- 51) Bank switching was done in RTB OP CODES and Integration Initialization to make room for new coding.

Major Changes Incorporated into Revision 57:

- 52) DELTAR was removed from the Downlink Lists as it is meaningless because of the deletion of P38 & P39. (PCR 985)
- 53) Coding was deleted from P27 which restored the downlink code of P01. It is not one of the programs that allows updates. This oversight evolved in the implementation of PCR 1051.

The following changes were made for MINKEY RENDEZVOUS (PCR 1049).

- a) An erroneous branch to SERVXT -1 was replaced with the proper SERVXT1. This reference was overlooked when corrections in Revision 53 were made.
 - b) Coding in the controller was modified not to set TCSI equal to TCSI2 until after it is determined that there are to be multiple CSI's (NN > 1).
 - c) Coding was added to the final pass of subroutine VN1645 to load NOMTIG with TIG. This will prevent an erroneous TIG in P76 if P76 is selected without P40 having been executed. P76 expects the targetted TIG to be contained in NOMTIG.
- 55) SXTMARK was modified such that a MARK REJECT will not do a KLEENEX before re-establishing the V51FL, thus preserving any astronaut activity that might be on the DSKY. (ART-2E-10)
- 56) Saturn interrupt code was moved out of Bank 33 where it had been improperly placed during the deletion of PCR 1050.

GSOP Impacts:

- 1) MINKEY Rendezvous (PCR 1049) is detailed in the User's Guide.
- 2) The following items should be examined for possible impact on the various GSOP sections:
 - Section 2: Items 1(b), 1(d), 5, 7, 9(a), 20, 39, 46
 - Section 3: Items 8, 18, 29, 33, 40, 43, 46
 - Section 4: Items 8, 14, 15, 17, 18, 19, 20, 29, 35, 40, 41, 44, 45, 46, 47, 48, 49(a), 49(c)
 - Section 5: Item 14