MSC INTERNAL NOTE 66-FM-50

APOLLO

COMMAND MODULE

GUIDANCE COMPUTER

SOFTWARE REQUIREMENTS

MISSION AS-204

Prepared by

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SECTION 1
INTRODUCTION

1.1 GENERAL

The actual AGC requirements for AS-204 were complete prior to the creation of this requirements document, and exist in such diverse forms and places that it is impractical to try to reconstruct them in the intended requirements format. Instead, reference will be made to a document which evolved from the original requirements, and which includes MSC revisions to a preliminary edition.

SECTION 2

GENERAL AGC REQUIREMENTS FOR AS-204

2.1 GENERAL

With certain changes, MIT document R-507, "System Operations Plan for AS-204," January 1966, is an adequate functional description of AGC programs satisfying MSC's AS-204 requirements.

2.2 CHANGES TO R-507

Because of impact on schedule, deletion of certain programs is required. These are:

- Program P21, Local Vertical.
- Programs P46 and P47, "Burn Monitor" programs.
- Programs P72 through P75, Launch Aborts.

2.3 CORRECTIONS AND CLARIFICATIONS

Table 2-1, following, is a listing of page-referenced review comments on R-507. Where appropriate, these comments will be used in revising R-507.

TABLE 2-1

REVIEW COMMENTS,

"SYSTEM OPERATIONS PLAN FOR AS-507," (MIT,R-207)

NO.	PAGE AND SECTION	COMMENT
1	2-1; 2.2	Manual G&N entry
2	2-4	Misprint. 3.2.6 for 2.3.6
3	2-5; 2.3.7 (par. 2)	Delete last sentence of par. 2. Update will be primary state vector.
4	2-6; 2.3.9	ΔV_{TO} will be changed to $\Delta T_{TO} = \frac{\text{Tail-off impulse}}{\text{SPS thrust at engine off}}$ in seconds to nearest .01 sec.
5	2-8; 2.3.12	The separation attitude is given here with the negative y S/C axis parallel to $\overline{R} \times \overline{V}$; Section 6.3.8 has the positive y S/C along $\overline{R} \times \overline{V}$.
6	3-6, 3-7; 3.3.1, 3.3.2	a. Specify AGC program is required for acceptance of liftoff time or clock align updates. b. Back-up liftoff signal not to come from ground. UPLINK switch to be in "BLOCK." *
7	3-8	DTEPOCH is to be triple precision
8	3-10; 3.3.3 3-11; 3.3.3	"State vector update" must precede "prethrust" *
9	3-13	ΔT_{TO} in place of ΔV_{TO} (see comment on page 2.6) *
10	3-14; 3.3.4	Angles should be in hundredths/18000, not hundreds/18000 *
11	3-15	See 2.6 *
12	3-17	See 2.6

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* MIT comments. See ref. (2)

TABLE 2-1 (CONT'D)

NO.	PAGE AND SECTION	COMMENT
13	3-19; 3.4	It would be desirable to have a comprehensive discussion and description of the AGC digital downlink in R-507, now that the AS-204 downlink is defined
14	3-24; 3.5.4	PIPA SG will not be on S/C for AS-204 *
15	4-2	Change program numbers and assignments * 01-07 to: Prelaunch and Service 01 - Prelaunch initialization 02 - Gyro compassing 03 - Optical verification of azimuth 04 - Inertial reference 05 - G&N startup 06 - G&N power-down (in-flight) 07 - System test (not used in-flight)
16	4-3	Add P54 IMU realign *
17	4-6	Change routine numbers to: * R4 - "fine alignment" now R30 - "gyro torquing" now no basic logic change
18	4-14 thru 4-18	VERB/NOUN CHANGES: * Add V77, Time Update N12 is spare N32 is spare N33 is spare N37 sighting identification N47 Gamma of entry interface N74 R1-ΔV allowable R2-ΔV tailoff

* MIT comments. See ref. (2)

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TABLE 2-1 (CONT'D)

NO.	PAGE AND SECTION	COMMENT
		(See comments 4-105 and 2.6) N70 - See 2.6 comment N75 Delete third component
19	4-16	Noun 43 sequence should be: Apogee alt. Perigee alt. T_{ff}
20	4-17	Noun 45 sequence should be: * Apogee alt. Perigee alt. Delta Velocity required Noun 54: Change to: * (R1) Commanded roll angle, Beta (No Change) (R2) G (No Change) (R3) Range to go to nearest .1 n.m. (changed from altitude) Noun 71: Define as: * (R1) Beta (R2) G (R3) [Range to go] - [Predicted Range] to nearest .1 n.m.
21	4-19 thru 4-20	CODE CHANGES a. Checklist. Add: 00016 Terminate mark sequence 00051 Final IMU/Final vehicle 00052 Final IMU/Interim vehicle 00053 Interim IMU/Final vehicle 00054 Interim IMU/Interim vehicle 00061 IMU power down 00062 AGC power down

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* MIT comments. See ref. (2)

TABLE 2-1 (CONT'D)

NO.	PAGE AND SECTION	COMMENT	
		b. Error codes. Delete: 00103 00106 00410 Add: 00411 Desired IMU/Desired Vehicle not known	
22	4-27 (Fig 4-2)	AGC power fail not wired to S/C caution warning panel. Change (3) to .32 milliradians for 5 ± 2 sec.	*
23	4-29 (4.3.4)	Change 27 mr to 0.32 mr for 5 ± 2 sec.	
24	4-30 (4.3.7)	a. Change PGNS to PGNCS b. (4th paragraph) Change 2.9 mr to 4.6 mr and 2 sec to 2½ ± 1 sec.	*
25	4-33 (4.3.11.1)	Delete "------- and an AGC PWR FAIL indicator--	*
26	4-36	Refer to program number changes given for page 4-2.	*
27	4-39 thru 4-49	Program Flow Chart has minor changes for updated Rev. 1.	*
28	4.4 All programs	A chart indicating the ability to select any given program, while in another program, will be supplied.	
29	4-55 (POS)	Assumption 3. V75E will be used for backup liftoff.	*

* MIT comments. See ref. (2)

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TABLE 2-1 (CONT'D)

NO.	PAGE AND SECTION	COMMENT
30	4-59 (P11)	a. Assumption 4: liftoff discrete from S-IVB, not S/C. b. The following would be useful in "checklist": . To to T_o +25 — Error 5^o — P&Y rate 3^o/sec — Roll rate 20^o/sec . T + 25 to OECO — Error 10^o — P&Y rate 5^o/sec — Roll rate 20^o/sec . GECO to SIVB ECO — Error 15^o — P&Y rate 15^o/sec — Roll rate 20^o/sec Also, GAMMA I increases to 31^o at T_o + 80 sec. and decreases to 19^o at T_o + 171 sec (LET jettison). V-inertial increases from 1342 fps at T_o.
31	4-60	"Gamma" will be used for instantaneous inertial flight path angle. Flight path angle at entry interface will be "Gamma (E1)" *
32	4-63 4-64 (p12)	a. If perigee altitude is greater than 300,000 ft, R3 display will read 59-59, not 99999 * b. G max should be nearest .01 G. *
33	4-66	Same as 4-60
34	4-67 (p21)**	a. Purpose #2 has been enlarged to include use of P21 to provide a preferred IMU orientation for use by the inflight alignment routines to satisfy the requirement of P22 * b. Assumption #1 has been enlarged to describe more clearly the different possible conditions of IMU alignment. *
35	4-70 (p21)**	If there is no gimbal lock problem, TGIMLOC will be displayed as 59-59. *
36	4-71 (p21)**	The crew logic associated with determining the IMU alignment requirements will be clarified. *

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* MIT comments. See ref. (2)
** p21 has now been deleted.

TABLE 2-1 (CONT'D)

NO.	PAGE AND SECTION	COMMENT
37	p4-74 (p22) and 4-79 (p22)	See "page 67" above. If p22 requires IMU realignment, this alignment is obtained via p21.** The crew logic associated with determining the alignment requirements have been clarified. *
38	4-80, 4-81	Logic has been added associated with the AGC processing of marks and their incorporation into the update of the orbital parameters; however nothing of significance to the crew has been changed. *
39	4-82 (p23)	Assumption #1 - The vehicle does not have to be over a tracking station. The crew may record displayed data. In addition, the digital downlink may be recorded onboard for broadcast over the next ground station. *
40	4-85 4-86	Local vertical control will not be maintained during p23 nor resumed after its completion. *
41	4-88 (p27)	a. Assumes AGC is on. b. P27 is selectable only from p00 and will return to p00. * c. Assumption 3 as well as the logic should incorporate an additional update - V77E (AGC Time) d. The uplink light reset should be in this program logic and procedure.
42	4090 (p27)	Register 2 will not be blanked, but will remain unchanged. *

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* MIT comments. See ref. (2)

** p21 has now been deleted.

TABLE 2-1 (CONT'D)

NO.	PAGE AND SECTION	COMMENT
43	4-94 (p31)	a. The assumptions have been enlarged to describe more clearly the different possible conditions of IMU alignment. * b. Assumption #1 is incorrect. See page 4-88, (2nd comment) above. Update must be accomplished before selection of P31. * c. The thrusting attitude flag should be deleted (has been done). * d. Downlink should include Vg (x,y,z) and desired attitudes.
44	4-95 (p31)	a. Local vertical control will not be maintained in P31 * b. Refer to p4-17 comment on noun 45. *
45	4-98 (p31)	Substitute +X S/C for $\overline{a}_T$ in preferred alignment; also, Y_{sm} = unit $(\overline{X}_{sc} \times \overline{R})$.
46	4-105 (p32)	a. Update must be accomplished before selection of P32 (assumption #1) * b. "Purpose, 1-b" ΔV in this program is ΔV to be <u>used</u> not ΔV allowable. c. Local vertical will not be maintained during p32. *
47	4-106 (p32)	Misprint on line #95 in AGC column. Should be ΔV not ΔR.
48	4-107 (p32)	a. Line 150 - Definition of ΔR is in accordance with Flight Crew Support Division requirements (i.e., ΔR = miss distance along ground track); however, is this in accord with present computations? MIT indicates that ΔR = cross-range miss for P32.

* MIT comments. See ref. (2)

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TABLE 2-1 (CONT'D)

NO.	PAGE AND SECTION	COMMENT
		b. GAMMA I should be specified as GAMMA (EI). See comment for page 4-60 *
49	4-109 (p32)	In preferred IMU orientation, change: * a. $\bar{a}_T$ to -X S/C for X_{SM} b. Unit $(\bar{V} \times \bar{R})$ to Y_{SM} = unit $(\bar{R} \times \bar{X}_{SC})$
50	4-116 (p33)	a. See related changes associated with p31 above. * b. It is not made clear what significance the target load has, since it is constrained by the minimum impulse burn. c. Line 120 It is not clear what "Δ V required" is good for in this program. How should it compare to the expected min-impulse Δ V?
51	4-119 (p33)	Line 257 - A line of print seems to have been deleted.
52	4-132 (p41, p42)	Checklist: minimum deadband settings have been deleted from R4 (pg. 4-214) and now must occur sometime immediately before ignition. Max. deadbands are selected soon after the burn. *
53	4-133 (p41, p42)	a. Will Tg be a linear countdown to the initially computed cutoff time, or the Tg computed in the guidance equations every two seconds? b. Line 531; delete "call average G," etc.

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* MIT comments. See ref. (2)

TABLE 2-1 (CONT'D)

NO.	PAGE AND SECTION	COMMENT
54	4-134, 135 (p41, p42)	a. Note: See page 11---12 and update comments. b. Line 630, astro checklist: Why should FDAI error indication increase during the burn? c. Specify time from "SPS off" to termination of average G. Is tailoff integrated? d. See comment 4-133 on Tg. Also, how is displayed Vg computed and counted down? e. Note: Average G integration is terminated after cutoff in p41 only. In p42, average G is maintained after cutoff. * f. Use of V71E (MTVC) needs to be included, stating that AGC continues its Δ V integration and monitoring.
55	4-142 (p43)	a. See page 4-132 comment above * b. See page 4-133 comment above c. ΔT burn is of little use in this program unless displayed in seconds x 10^{-1} or 10^{-2} d. See comment (c) under page 4-134 concerning AVEG termination.
56	4-143	Line 525; delete "call average G," etc. *
57	4-146 (p46)	The prethrusting mode done prior to this program will notify the AGC whether the burn was for deorbit, in which case, average G can be continued. *
58	4-148 (p47)	Note: P32 must be accomplished prior to RCS deorbit, in accordance with comment 4-146 above. *
59	4-154	(Line 465) No attitude control mode or mode routine is required *

* MIT comments. See ref. (2)

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TABLE 2-1 (CONT'D)

NO.	PAGE AND SECTION	COMMENT
60	4-157 (p52)	Purpose: P52 is also satisfactory for realigning the IMU to correct drift errors alone, but if the errors are large, coarse alignment will be done without any accounting mode of the size of the errors (drift data will be lost). P54 has been originated to provide a program in which IMU realignments can be made to correct for drift errors using fine alignment alone -- and in the process, display all corrected errors. All attitude maneuvers and star acquisitions and sightings must be done manually. *
61	4-160	Preferred IMU orientation is available in REFSMAT, and need not be recalculated.
62	4-161	The logic of P52, P53, R4 and R25 has been reorganized for clarity, but remains essentially the same. *
63	4-162 (p53)	New Assumption: In order to use p53 to realign the IMU to correct for drift errors alone, it is necessary to recycle to the program specifying the preferred IMU and vehicle orientations. *
64	4-166 (p53)	Line #420: "Is the interim platform flag set?" is redundant, and has been deleted. *
65	4-167 (p53)	a. See 4-161 above. * b. The AGC will display which of the following conclusions have been arrived at: final IMU/final vehicle; final IMU/interim vehicle; interim IMU/final vehicle; interim IMU/interim vehicle.

* MIT comments. See ref. (2)

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TABLE 2-1 (CONT'D)

NO.	PAGE AND SECTION	COMMENT
		This information is to keep the crew informed of future maneuvers.
66	4-168 (p53)	P53 will not return to any program, but will request the crew to select the next required program manually. *
67	4-169 (p61)	Assumption: Average G program is in progress *
68	4-172	See comment for page 4-63 *
69	4-173 (p61)	a. Line 350: Mention is made of CSM orientation w.r.t. earth. According to memory data on page 6-6, separation attitude is w.r.t. the velocity vector. b. P61-P63: These programs should display bank angle, Gmax, and Δ R.
70	4-174 (p62)	a. See p4-169 * b. Line 40: Should note iss-entry mode present
71	4-175	a. An "arrow" should indicate AGC receipt of CM/SM separation discrete (line 80) b. Line 120-130: substitute "angle of attack (alpha) "for "flight path angle (gamma)" *
72	4-176 (p63)	See 4-169 *
73	4-177	a. P63 and P64: Change V16N54 in accordance with noun 54 change in "page 4-17" above. * b. See page 4-63 comment. * c. Delete "ind. alt." from R3. R3 should be "R to Go", range to desired splash point at calculated impact time, in n.m. to nearest .1 *

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* MIT comments. See ref. (2)

TABLE 2-1 (CONT'D)

NO.	PAGE AND SECTION	COMMENT	
74	4-178 (p64)	See page 4-177 (b) above	*
75	4-179 (p67)	a. Define final phase program b. Include display V16 N71 (see page 4-17)	*
76	4-180, 181 (p71)	The G&N ΔV mode will be selected prior to the 1st abort burn per NAA request, but ISS will remain in fine align mode.	*
77	4-182	a. Average G integration is not terminated	* *
78	4-183 (p72)**	a. Include values for TPAD, TDISP b. DELTA V AVAIL INS should be padded for possible tumble arrest. c. Line 25: Noun 62 is in different order than as defined on page 4-18. d. What state vector is used to compute display quantities? e. Astro "proceed" is missing	
79	4-189**	See 4-132	*
80	4-190**	Line 158: Delete "call average G," etc.	
81	4-191**	See 4-182 (re-average G)	*
82	4-193**	See 4-132	
83	4-194 (p74)**	a. Line 150: Change N51 to N52 b. Line 140: delete "Call Average G," etc.	*
84	4-197 (p75)**	Would like to see further explanation of prethrust computations. P74 and P72 do not fully explain.	

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* MIT comments. See ref. (2)
** p72 through p75 have been deleted.

TABLE 2-1 (CONT'D)

NO.	PAGE AND SECTION	COMMENT
85	4-199	See 4-132
86	4-200	Line 290: delete "call Average G," etc. *
87	4-204	How is desired SCS bit set?
88	4-207	See 4-204
89	4-213, 214, 215 (R4)	See 4-161 *
90	4-223, 224	a. Sequence of some displays doesn't agree with Verb-noun codes. * b. P224 (line 200) Display is LAT, LONG, ALT. instead of LAT., LONG, 00000.
91	4-226	(Line 25) Should state that Δ V steps are accumulated.
92	4-228, 229	a. See 4-161 * b. (line 70) Are gimbal angles or gimbal angle changes tested?
93	4-230	Sighting mark routine logic is considerably changed.
94	4-231 (R27)	a. The mark index for stars is 1 and for landmarks, 5. The minimum required number of unrejected marks is 1 for stars, 1 for known landmarks, and 2 for unknown landmarks. If unrejected marks equal the mark index; (1), "please mark" is terminated and (2)the DSKY displays a request to terminate the mark sequencer. * If unrejected marks exceed the mark index; (1) program alarm (00120) occurs and (2) excess mark data is not stored.

* MIT comments. See ref. (2)

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TABLE 2-1 (CONT'D)

NO.	PAGE AND SECTION	COMMENT
		Mark reject will not be effective unless a mark has been made and then will only remove the last set of mark data. b. Want 3 attitude angles, two optics angles, and star I.D.'s on downlink c. Line #20: Why isn't 20 sec. wait mentioned after fine align is commanded?
95	4-235 (R28)	a. In the case of the optics angles' exceeding * the stops, the AGC will continue to read the vehicle attitude and check the optics angles. The crew may thus maneuver the vehicle to facilitate acquisition. If the crew does not wish to maneuver the vehicle, they may put the optics switch to manual and do further star acquisition manually. b. (Line 235) Shaft angle should be to * nearest .01 degree. c. (Line 255) Specify how "terminate" is accomplished by calling program or routine d. (Line 165) What is done with optics * discrete monitor?
96	4-236 (R29)	Display V06N05 will be held 10 seconds if * the angle difference does not exceed tolerance criteria.
97	4-238 (R30)	See comment #4-161. This routine is now * called "gyro torquing routine" but is logically unchanged.

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* MIT comments. See ref. (2)

TABLE 2-1 (CONT'D)

NO.	PAGE AND SECTION	COMMENT
98	4-238	(Line 50) V06 N67 is "display delta gyro angles", not "gyro angles."
99	4-240 **	Assumption should refer to "pre-thrusting" instead of "thrusting." Change P41 and P42 to P31 and P32.
100	4-241	If a keyboard correction is made, what scaling and units are to be used? (Applies to R33, R35, R36.)
101	4-242	a. (Line 105) N45 is wrong. What noun code is used for orbital period? b. $\Delta V_{TO} \longrightarrow T_{TO}$ in .01 secs. * c. ΔT_{TO} should be all zeros on display, as it is necessary for min inp. computations. *
102	4-244	Refer to page 4-16 comment
103	4-245 (R34)	LAT. and LONG. SPLASH displayed are the prethrust computed values of predicted closest point of approach (on the ground track) to the desired target. *
104	4-247	See page 4-242 comment on noun 45
105	4-250	a. (Line 70) Change "DELTA V ALLOW" to "DELTA V MANEUVER" or equivalent. b. (Line #90) Change V24 to V21 c. (Line 148) Change V24 to V25 d. Change ΔV_{TO} ΔT_{TO} (See note above) * e. Line 145. Under "Checklist," add option of navigator's rejecting data.
106	4-252	a. Line 22 of "checklist" should read +X instead of +Z *

* MIT comments. See ref. (2)
** DELTA-V(SCS) will not be adjusted by tailoff or tolerance

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TABLE 2-1 (CONT'D)

NO.	PAGE AND SECTION	COMMENT
		b. It is not specified whether Average G is called during +X. In P41, etc, R37 is called before Average G. Is ullage not integrated?
107	4-256	Add under assumption #21 "If engine restarts are involved, the accounting of this total time delay is up to the crew. The AGC automatically accounts only for a 15 second delay at engine ignition.
108	5-1	Change 17/16 to 16/15 *
109	5-2	a. (Eq. 5-14) Change 17/16 to 16/15 b. Eq. 5-6 thru 5-12 include some incorrect formulation. Correct formulation may be found in section 5.5 ("correct" in the sense that the equations in 5.5 will be the ones actually used for 204A) *
110	5-4	It is stated that the period is set to zero to indicate desire for circular orbit. All previous indications (as in R35) are that altitude, $\underline{h}$, be set to zero.
111	5-6	a. Change ref. to eqs. 5-6 thru 5-12 (see 5-2 above) * b. The argument of the arccos in eq. 5-36 should be normalized. c. (eq. 5-39) The symbol Vv is not defined
112	5-8	(eq 5-50) Last sign should be changed from minus to plus. *
113	5-9	(eq 5-54) Last term in denominator should be vector $\underline{V}_r$ *

* MIT comments. See ref. (2)

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TABLE 2-1 (CONT'D)

NO.	PACE AND SECTION	COMMENT
114	5-19	Why is $\lvert \underline{a}n \rvert$ limited to a max. of 7ft/sec^2
115	5-21	a. (Section 5.3.4.3) Delete (1) b. Eq. (5-117). What is $\underline{i}_H$, ?
116	5-22	Footnote: Change 99999 to 59-59 *
117	6-5	a. Change angle Rate Limits to 0.4 deg/sec or 5.0 deg/sec depending on program and astronaut selection. * b. Incorrect launch pad is given c. Item #1 in 6.3.4 is subject to change and should be erasable. The present value is 0.53 seconds.
118	6-6; 6.3.8	Sep. attitude. See comment on section 2.3.8.
119	8-5	Define "pitch" and "yaw" angles.
120		General: It would be helpful to include a comprehensive definition of the AGC navigational reference coordinate system, and a discussion of how it is related to the star catalogue, to the prelaunch alignment, etc.

* MIT comments. See ref. (2)

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2.4 INCLUSION OF DOWNLINK TELEMETRY

Downlink telemetry information should be included in the next revision of R-507. This material is provided, in general, in Section 3, following.

SECTION 3

AS-204A DOWNLINK

3.1 DOWNLINK WORD

3.1.1 Format

The general format of the 40-bit AGC downlink word is exactly the same as used for AS-202.

3.1.2 DSKY Displays

DSPTAB + 0 through DSPTAB + 10D indicates the status of the DSKY displays as defined for the AS-202 AGC downlink.

3.1.3 Content and Decoding

The content and decoding of DSPTAB + 0 through DSPTAB + 10D is as follows:

a. DSPTAB + 0 through DSPTAB + 10D give the status of the DSKY displays, if bits 15 thru 12 are 0001, the next 11 bits will indicate actual status of DSKY displays; if bits 15 thru 12 are 1110 the next 11 bits indicate the complement of the status to which the AGC will command the DSKY display.

R3D1 stands for digit one of the third register and VD1 stands for the first digit of the verb display, etc. For the right character of a pair, bit 5 is the MSB with bit 1 the LSB. For the left character of a pair the MSB is bit 10 with bit 6 as the LSB.

As shown in Table 3-1, bit 11 of some of the DSPTABS contains discrete information. A one in bit 11 indicates that the discrete is on. For example, a one in bit 11 of DSPTAB + 1 indicates that R3 has a plus sign while a one in bit 11 of DSPTAB + 9D indicates that the displays

TABLE 3-1

DSPTAB CONTENT

DSPTAB	DOWN LINK WORD NUMBER	BIT DESCRIPTION		
		Bit 11	Bits 10 thru 6	Bits 5 thru 1
DSPTAB + 0	2/52	-R3S	R3D4	R3D5
DSPTAB + 1	3/53	+R3S	R3D2	R3D3
DSPTAB + 2	4/54		R2D5	R3D1
DSPTAB + 3	5/55	-R2S	R2D3	R2D4
DSPTAB + 4	6/56	+R2S	R2D1	R2D2
DSPTAB + 5	7/57	-R1S	R1D4	R1D5
DSPTAB + 6	8/58	+R1S	R1D2	R1D3
DSPTAB + 7	9/59	UPACT		R1D1
DSPTAB + 8D	10/60		ND1	ND2
DSPTAB + 9D	11/61	FLASH	VD1	VD2
DSPTAB + 10D	12/62		MD1	MD2

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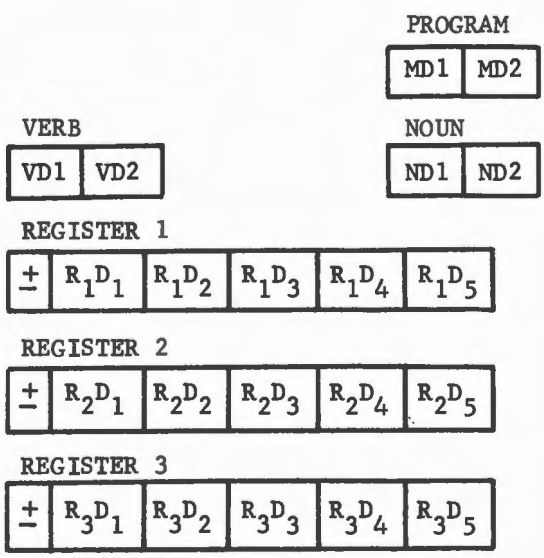
are flashing. If the sign bits associated with a register are both zeroes, then the content of that particular register is octal; if either of the bits are set the register content is decimal data.

The five bit codes associated with the digits are:

	MSB LSB
0	1 0 1 0 1
1	0 0 0 1 1
2	1 1 0 0 1
3	1 1 0 1 1
4	0 1 1 1 1
5	1 1 1 1 0
6	1 1 1 0 0
7	1 0 0 1 1
8	1 1 1 0 1
9	1 1 1 1 1
Blank	0 0 0 0 0

The following is a diagram of the DSKY face showing the positions of the different digits.



DSPTAB + 11D contains the same discrete information as AS-202:

DSPTAB + 11D

BIT	
1	Zero encode
2	Coarse align
3	Lock CDU
4	Fine align
5	Encoder zero lamps
6	CDU fail lamp
7	PIPA fail lamp
8	IMU fail lamp
9	Spare
10	Attitude control
11	Roll entry

If bits 15 through 12 of DSPTAB + 11D are 1000, the last 11 bits indicate the state to which the AGC will command the relays; if bits 15 through 12 are 0000, the last eleven bits indicate the actual state of the relays. A one indicates that the discrete is on.

b. The use of the bits of the two Flagwords have not been defined. Bit 14 of Flagword 1 will be used for update verification. This bit will be set for 8 seconds upon the successful uplinking of Verb 33 Enter.

c. The INO, IN 2 and OUT 1 register contents are the same as defined for the AS-202 AGC downlink. The contents of IN 3 will also be the same with one exception; bit 13 will be used to indicate sextant on. The contents of the registers are listed in Table 3-2 (next page).

TABLE 3-2

REGISTER CONTENT (INO, IN 2, OUT 1)

BIT	INO	IN2	OUT1	IN3
1	Key code 1	1600 PPS	Program alarm	K1
2	Key code 2	800 PPS	Comp. activity	K2
3	Key code 3	400 PPS	Key rlse.	K3
4	Key code 4	200 PPS	Tel. alarm	K4
5	Key code 5	Liftoff	Prgm. check fail	K12
6	Accept uplink	Guid. release	Spare	Trn. sw.
7	Inhibit upsink	Saturn ullage	Rupt trap reset	K5
8	Spare	S-IVB separate	Spare	Spare
9	Spare	SM/CM separate	ID word	Spare
10	Spare	CDU fail	Block endpulse	Opt. mode SW3
11	Spare	PIPA fail	Spare	Star pres.
12	Spare	IMU fail	Spare	Zero opt.
13	Spare	Spare	Engine on	Sextant on
14	Spare	Spare	Spare	Opt. mode SW2
15	Mark	Parity	Spare	Or of C1-C33.

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d. Data words TIME 2 TIME 1, CDU X, CDU Y, CDU Z, and REDO COUNTER are as defined for AS-202.

e. The bit configurations for SPARES and TM MARKER words are:

SPARE	52525_8	
DUMMY MARKER	74000_8	
MARKER 1	74001_8	Associated with PIPA's and PIPTIME
MARKER 2	74002_8	Associated with position and velocity
MARKER 3	74004_8	Associated with CDU angles

f. The following data words should not be considered to be in complement form if bit 15 is a one.

(1) DSPTAB + 11D
(2) IN0
(3) IN2
(4) IN3
(5) OUT 1
(6) STATE word
(7) Flagwords
(8) Desired and actual CDU's

g. All of the downlinked state vectors will be in stable member coordinates.

h. Word 27 of the Coast and Align downlist is a STAR I.D. Word 27 in the other three downlists will not be used for anything, but it will not contain the bit configuration for a legitimate SPARE (52525_8). In any downlist other than the Coast and Align, the contents of word 27 should be considered to be garbage. If the STAR ID in the Coast and Align downlist is equal to a minus zero (77777_8), this indicates that the sighting vector is from a landmark sighting.

i. The contents of the STATE register will probably be the same. Bit two of the STATE word will indicate a $\overline{KKK}$ fail.

j. Actual marker words may be interspersed in data words 28 through 48 and 64 through 97, therefore, the data words may be shifted down on the list from the position shown. No marker words may appear between words 1 through 27 and words 52 through 63. The TM marker words are used exactly as in AS-202.

TABLE 3-3

UPDATE DOWNLIST

WORD NO.	DATA WORD	WORD ORDER CODE
1	Downlist Identification Word (62001_8)	1
2	DSPTAB + 0	0
3	DSPTAB + 1	0
4	DSPTAB + 2	0
5	DSPTAB + 3	0
6	DSPTAB + 4	0
7	DSPTAB + 5	0
8	DSPTAB + 6	0
9	DSPTAB + 7	0
10	DSPTAB + 8D	0
11	DSPTAB + 9D	0
12	DSPTAB + 10D	0
13	DSPTAB + 11D	0
14	TIME 2 (MSB)	0
15	TIME 1 (LSB)	0
16	IN 0	0
17	IN 2	0
18	IN 3	0
19	OUT 1	0
20	STATE	0
21	FLAGWORD 1	0
22	FLAGWORD 2	0
23	CDU X	0
24	CDU Y	0
25	CDU Z	0
26	REDO COUNTER	0
27	GARBAGE[1]	0
28	STATE COUNTER	0
29	STATE BUFFER + 0	0
30	STATE BUFFER + 1	0
31	STATE BUFFER + 2	0

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1. See subparagraph h., p. 3-6.

TABLE 3-3 (CONT'D)

WORD NO.	DATA WORD	WORD ORDER CODE
32	STATE BUFFER + 3	0
33	STATE BUFFER + 4	0
34	STATE BUFFER + 5	0
35	STATE BUFFER + 6	0
36	STATE BUFFER + 7	0
37	STATE BUFFER + 8D	0
38	STATE BUFFER + 9D	0
39	STATE BUFFER + 10D	0
40	STATE BUFFER + 11D	0
41	STATE BUFFER + 12D	0
42	STATE BUFFER + 13D	0
43	UPDATE I.D.	0
44	SPARE	0
45	SPARE	0
46	SPARE	0
47	SPARE	0
48	SPARE	0
49	DUMMY MARKER	1
50	DUMMY MARKER	1
51	DUMMY MARKER	1
52	DSPTAB + 0	0
53	DSPTAB + 1	0
54	DSPTAB + 2	0
55	DSPTAB + 3	0
56	DSPTAB + 4	0
57	DSPTAB + 5	0
58	DSPTAB + 6	0
59	DSPTAB + 7	0
60	DSPTAB + 8D	0
61	DSPTAB + 9D	0
62	DSPTAB + 10D	0

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TABLE 3-3 (CONT'D)

WORD NO.	DATA WORD	WORD ORDER CODE
63	DSPTAB + 11D	0
64	X position component of the latest calculated state vector MSB	0
65	X position component of the latest calculated state vector LSB	0
66	Y position component of the latest calculated state vector MSB	0
67	Y position component of the latest calculated state vector LSB	0
68	Z position component of the latest calculated state vector MSB	0
69	Z position component of the latest calculated state vector LSB	0
70	X velocity component of the latest calculated state vector MSB	0
71	X velocity component of the latest calculated state vector LSB	0
72	Y velocity component of the latest calculated state vector MSB	0
73	Y velocity component of the latest calculated state vector LSB	0
74	Z velocity component of the latest calculated state vector MSB	0
75	Z velocity component of the latest calculated state vector LSB	0
76	Time of latest calculated state vector MSB	0
77	Time of latest calculated state vector LSB	0
78	STATE COUNTER	0
79	STATE BUFFER + 0	0
80	STATE BUFFER + 1	0
81	STATE BUFFER + 2	0
82	STATE BUFFER + 3	0
83	STATE BUFFER + 4	0
84	STATE BUFFER + 5	0
85	STATE BUFFER + 6	0

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TABLE 3-3 (CONT'D)

WORD NO.	DATA WORD	WORD ORDER CODE
86	STATE BUFFER + 7	0
87	STATE BUFFER + 8D	0
88	STATE BUFFER + 9D	0
89	STATE BUFFER + 10D	0
90	STATE BUFFER + 11D	0
91	STATE BUFFER + 12D	0
92	STATE BUFFER + 13D	0
93	SPARE	0
94	SPARE	0
95	SPARE	0
96	TIGN MSB	0
97	TIGN LSB	0
98	DUMMY MARKER	1
99	DUMMY MARKER	1
100	DUMMY MARKER	1

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3.2 UPDATE LIST

3.2.1 General

a. The update list applies only to the updates associated with verbs 72, 73, 74, 76, and 77.

b. Only dummy marker words will be sent during the use of the update list.

c. The update downlist will be transmitted during the operation of program 27.

3.2.2 Word Content

a. Word 28/78, STATE COUNTER, is different from AS-202. This counter will start at 1_8 and go up to a maximum of 16_8 (in increments of 1). If uplinking a DEORBIT update, the maximum value will be 11_8. It will tell what component is being processed or loaded.

Example: Suppose you are loading the LSB's of Z position for a Navigation update. The STATE COUNTER would contain an octal 6, while the STATE BUFFER would have 5 good components, STATE BUFFER + 0 to STATE BUFFER + 4. When all 14 components have been loaded, the STATE COUNTER will be 16_8. If a line-by-line correction is made, STATE COUNTER will remain a 16_8.

The STATE COUNTER applies only to the updates associated with verbs 72, 73, 74, 76 and 77.

b. Words 29/79 through 42/92, STATE BUFFER + 0 to STATE BUFFER + 13, will contain the uplinked parameters in the same order as uplinked. In the event the update has less than 14_{10} quantities, the quantities will appear sequentially, beginning with STATE BUFFER + 0. Any STATE BUFFER register that is left over should be disregarded for it will contain garbage.

c. Word 43 will indicate the type of update that is being uplinked, as follows: It will contain the octal equivalent of the number of update quantities associated with a particular update.

		WORD NUMBER 48	NUMBER OF COMPONENTS
Navigation	V 76	16_8	14_{10}
Orbit Change	V 74	13_8	11_{10}
Deorbit	V 73	11_8	9_{10}
Minimum Impulse	V 72	14_8	12_{10}
L/O Time Update	V 77	1_8	1_{10}

The appropriate ID number will be put into this data word at the time the downlist is changed and will remain constant throughout the updating process. The scale factor is 2^{14}.

d. Words 64 through 75 is the latest calculated position and velocity in SM coordinates. The position scale factor is $M/2^{24}$; velocity is $M/C.S./2^{7}$.

e. Words 76 and 77 is the associated state vector time. Scale factor of $C.S/2^{28}$.

f. Words 96 and 97 is time of ignition (TIGN). This is not associated with the updating that is going on; it is the time associated with the next burn (orbit change or minimum impulse). Scale factor is $C.S/2^{28}$.

3.3 POWERED AND BOOST LIST

3.3.1 General

The powered and boost list will be transmitted during the operation of the AGC programs listed below.

PROGRAM NUMBER	PROGRAM TITLE
01	Initialization
02	Gyrocompassing
03	Optical Verification of Azimuth
04	Inertial Reference
41	Orbit Change
42	Return to Earth
43	SPS Minimum Impulse
11	Pre LET Jettison
12	Post LET Jettison
17	LET Abort
71	First Abort Run

3.3.2 Word Content

See Table 3-4.

a. Words 2 through 27 are the same as described under the Update List.

b. Words 28 through 33 contain the velocity to be gained (Vg) in the three axes. The scale factors for the parameters are $M/C.S/2^{7}$, and are in SM coordinates.

c. The scale factor for the time of freefall is $C.S/2^{28}$.

TABLE 3-4

POWERED AND BOOST LIST

WORD NO.	DATA WORD	WORD ORDER CODE
1	Downlist Identification Word (62066_8)	1
2	DSPTAB + 0	0
3	DSPTAB + 1	0
4	DSPTAB + 2	0
5	DSPTAB + 3	0
6	DSPTAB + 4	0
7	DSPTAB + 5	0
8	DSPTAB + 6	0
9	DSPTAB + 7	0
10	DSPTAB + 8D	0
11	DSPTAB + 9D	0
12	DSPTAB + 10D	0
13	DSPTAB + 11D	0
14	TIME 2 (MSB)	0
15	TIME 1 (LSB)	0
16	IN 0	0
17	IN 2	0
18	IN 3	0
19	OUT 1	0
20	STATE	0
21	FLAGWORD 1	0
22	FLAGWORD 2	0
23	CDU X	0
24	CDU Y	0
25	CDU Z	0
26	REDO COUNTER	0
27	GARBAGE[1]	0
28	Vgx MSB	0
29	Vgx LSB	0
30	Vgy MSB	0
31	Vgy LSB	0

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[1] See subparagraph h., p. 3-6.

TABLE 3-4 (CONT'D)

WORD NO.	DATA WORD	WORD ORDER CODE
32	Vgz MSB	0
33	Vgz LSB	0
34	Time of freefall MSB	0
35	Time of freefall LSB	0
36	SPARE	0
37	SPARE	0
38	SPARE	0
39	SPARE	0
40	SPARE	0
41	TIME OF EVENT MSB	0
42	TIME OF EVENT LSB	0
43	DELV X	0
44	DELV Y	0
45	DELV Z	0
46	DESIRED CDU X	0
47	DESIRED CDU Y	0
48	DESIRED CDU Z	0
49	DUMMY MARKER	1
50	DUMMY MARKER	1
51	DUMMY MARKER	1
52	DSPTAB + 0	0
53	DSPTAB + 1	0
54	DSPTAB + 2	0
55	DSPTAB + 3	0
56	DSPTAB + 4	0
57	DSPTAB + 5	0
58	DSPTAB + 6	0
59	DSPTAB + 7	0
60	DSPTAB + 8D	0
61	DSPTAB + 9D	0
62	DSPTAB + 10D	0

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TABLE 3-4 (CONT'D)

WORD NO.	DATA WORD	WORD ORDER CODE
63	DSPTAB + 11D	0
64	X position component of the present state vector MSB	0
65	X position component of the present state vector LSB	0
66	Y position component of the present state vector MSB	0
67	Y position component of the present state vector LSB	0
68	Z position component of the present state vector MSB	0
69	Z position component of the present state vector LSB	0
70	X velocity component of the present state vector MSB	0
71	X velocity component of the present state vector LSB	0
72	Y velocity component of the present state vector MSB	0
73	Y velocity component of the present state vector LSB	0
74	Z velocity component of the present state vector MSB	0
75	Z velocity component of the present state vector LSB	0
76	PIP TIME MSB	0
77	PIP TIME LSB	0
78	REFSMMAT ROW 1 COL 1 MSB	0
79	REFSMMAT ROW 1 COL 1 LSB	0
80	REFSMMAT ROW 1 COL 2 MSB	0
81	REFSMMAT ROW 1 COL 2 LSB	0
82	REFSMMAT ROW 1 COL 3 MSB	0
83	REFSMMAT ROW 1 COL 3 LSB	0
84	REFSMMAT ROW 2 COL 1 MSB	0
85	REFSMMAT ROW 2 COL 1 LSB	0

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TABLE 3-4 (CONT'D)

WORD NO.	DATA WORD	WORD ORDER CODE
86	REFSMMAT ROW 2 COL 2 MSB	0
87	REFSMMAT ROW 2 COL 2 LSB	0
88	REFSMMAT ROW 2 COL 3 MSB	0
89	REFSMMAT ROW 2 COL 3 LSB	0
90	REFSMMAT ROW 3 COL 1 MSB	0
91	REFSMMAT ROW 3 COL 1 LSB	0
92	REFSMMAT ROW 3 COL 2 MSB	0
93	REFSMMAT ROW 3 COL 2 LSB	0
94	REFSMMAT ROW 3 COL 3 MSB	0
95	REFSMMAT ROW 3 COL 3 LSB	0
96	TIME OF GRR/TIME OF IGNITION MSB	0
97	TIME OF GRR/TIME OF IGNITION LSB	0
98	DUMMY MARKER	1
99	DUMMY MARKER	1
100	DUMMY MARKER	1

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d. Words 41/42 contain the special events time (scaled C.S./2^{28}) which are defined as:

(1) Time of liftoff until the SPS is ignited (since the AGC clock is synchronous with GMT prior to liftoff, the time of liftoff will be downlinked as GMT) and then,

(2) SPS engine on or off time, whichever occurred last. This time will be in total centiseconds from the time the AGC clock is zeroed (GMTLO).

e. The DELV's and DESIRED CDU's are the same as defined for AS-202.

f. Words 78 through 95 are REFSMMAT, downlinked as indicated with a scale factor of 2^{-1} for each element of the matrix. REFSMMAT times Earth Centered Inertial coordinates equal Stable Member coordinates.

g. Words 96/97 are time shared as follows: The contents will be the time of guidance reference release during programs 04, 05, 11, and 12; the time of ignition (TIGN) during the other programs.

3.4 COAST AND ALIGN LIST

3.4.1 General

The Coast and Align List will be transmitted during operation of the AGC programs listed below.

PROGRAM NUMBER	PROGRAM TITLE
00	AGC Idling
05	Power Up
06	Power Down
22	Landmark Tracking
23	Star-Landmark or Horizon Navigation Measurement
24	Ground Track Determination
31	Orbit Change
32	Return to Earth
33	SPS Minimum Impulse
51	IMU Orientation Determination
52	S-IVB/IMU Align
53	CSM/IMU Align
61	Maneuver to CM/SM Separation Attitude
62	CM/SM Separation and Entry Maneuver

3.4.2 Word Content

See Table 3-5.

a. Words 2 through 26 are the same as defined for the Update Downlist.

b. Words 34 through 39 are the sighting vector. It is three double-precision quantities associated with a unit vector. The scale

TABLE 3-5

COAST AND ALIGN LIST

WORD NO.	DATA WORD	WORD ORDER CODE
1	Downlist Identification Word (62153_8)	1
2	DSPTAB + 0	0
3	DSPTAB + 1	0
4	DSPTAB + 2	0
5	DSPTAB + 3	0
6	DSPTAB + 4	0
7	DSPTAB + 5	0
8	DSPTAB + 6	0
9	DSPTAB + 7	0
10	DSPTAB + 8D	0
11	DSPTAB + 9D	0
12	DSPTAB + 10D	0
13	DSPTAB + 11D	0
14	TIME 2 (MSB)	0
15	TIME 1 (LSB	0
16	IN 0	0
17	IN 2	0
18	IN 3	0
19	OUT 1	0
20	STATE	0
21	FLAGWOOD 1	0
22	FLAGWOOD 2	0
23	CDU X	0
24	CDU Y	0
25	CDU Z	0
26	REDO COUNTER	0
27	STAR I.D.	0
28	Vgx MSB	0
29	Vgx LSB	0
30	Vgy MSB	0
31	Vgy LSB	0

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TABLE 3-5 (CONT'D)

WORD NO.	DATA WORD	WORD ORDER CODE
32	Vgz MSB	0
33	Vgz LSB	0
34	Note: Words 34 through 39 are three double precision quantities defining the sighting vector.	0
35		0
36		0
37		0
38		0
39		0
40	Note: Words 40 through 45 are three double precision quantities defining the maneuver vector.	0
41		0
42		0
43		0
44		0
45		0
46	DESIRED CDU X	0
47	DESIRED CDU Y	0
48	DESIRED CDU Z	0
49	DUMMY MARKER	1
50	DUMMY MARKER	1
51	DUMMY MARKER	1
52	DSPTAB + 0	0
53	DSPTAB + 1	0
54	DSPTAB + 2	0
55	DSPTAB + 3	0
56	DSPTAB + 4	0
57	DSPTAB + 5	0
58	DSPTAB + 6	0
59	DSPTAB + 7	0
60	DSPTAB + 8D	0
61	DSPTAB + 9D	0
62	DSPTAB + 10D	0

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TABLE 3-5 (CONT'D)

WORD NO.	DATA WORD	WORD ORDER CODE
63	DSPTAB + 11D	0
64	X position component of the latest calculated state vector MSB	0
65	X position component of the latest calculated state vector LSB	0
66	Y position component of the latest calculated state vector MSB	0
67	Y position component of the latest calculated state vector LSB	0
68	Z position component of the latest calculated state vector MSB	0
69	Z position component of the latest calculated state vector LSB	0
70	X velocity component of the latest calculated state vector MSB	0
71	X velocity component of the latest calculated state vector LSB	0
72	Y velocity component of the latest calculated state vector MSB	0
73	Y velocity component of the latest calculated state vector LSB	0
74	Z velocity component of the latest calculated state vector MSB	0
75	Z velocity component of the latest calculated state vector LSB	0
76	Time of latest calculated state vector MSB	0
77	Time of latest calculated state vector LSB	0
78	REFSMMAT ROW 1 COL 1 MSB	0
79	REFSMMAT ROW 1 COL 1 LSB	0
80	REFSMMAT ROW 1 COL 2 MSB	0
81	REFSMMAT ROW 1 COL 2 LSB	0
82	REFSMMAT ROW 1 COL 3 MSB	0
83	REFSMMAT ROW 1 COL 3 LSB	0
84	REFSMMAT ROW 2 COL 1 MSB	0
85	REFSMMAT ROW 2 COL 1 LSB	0

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TABLE 3-5 (CONT'D)

WORD NO.	DATA WORD	WORD ORDER CODE
86	REFSMMAT ROW 2 COL 2 MSB	0
87	REFSMMAT ROW 2 COL 2 LSB	0
88	REFSMMAT ROW 2 COL 3 MSB	0
89	REFSMMAT ROW 2 COL 3 LSB	0
90	REFSMMAT ROW 3 COL 1 MSB	0
91	REFSMMAT ROW 3 COL 1 LSB	0
92	REFSMMAT ROW 3 COL 2 MSB	0
93	REFSMMAT ROW 3 COL 2 LSB	0
94	REFSMMAT ROW 3 COL 3 MSB	0
95	REFSMMAT ROW 3 COL 3 LSB	0
96	MANEUVER THETA MSB	0
97	MANEUVER THETA LSB	0
98	DUMMY MARKER	1
99	DUMMY MARKER	1
100	DUMMY MARKER	1

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factor is 2^{-1}. It is the direction of the landmark or star in SM coordinates.

c. Words 40 through 45 contain three double-precision quantities which define the maneuver vector. It is in a unit vector form with a scale factor of 2^{-1}. It is the vector about which the next maneuver is to take place, in stable member coordinates.

d. Words 96 and 97 are the most and least significant part of a quantity called maneuver theta. It is an angle with a scale factor of degrees/360.

e. Word 27 is the ID of the star associated with the sighting vector (words 34 through 39). The star ID will be the octal equivalent of the AGC catalogue number (refer to page 6-9 of R-507) multiplied by six, with a scale factor of 2^{14}.

Example:

Star	AGC Catalogue Number	Downlink Star ID
Polaris	04	30_8

3.5 ENTRY LIST

3.5.1 General

The Entry Downlist is transmitted during operation of AGC programs listed below.

PROGRAM NUMBER	PROGRAM TITLE
63	Initialization
64	Post 0.05G
65	Upcontrol
66	Ballistic
67	Final Phase

3.5.2 Scale Factors

Scale factors for Words 68 through 89 are listed in Table 3-6 (next page).

3.5.3 Entry Downlist

See Table 3-7, page 3-28.

TABLE 3-6

ENTRY SCALE FACTORS

WORD NUMBER	DATA WORD	SCALE FACTOR
68	F 3(V)	Nautical miles/2700
69	- DREFR	Feet per second/805
70	RTOGO	Nautical miles/2700
71	RDOTREF	Feet per second/(25766.1973 x 2^{-2})
72	- F 2(V)	(25766.1973/(2700 x 4) nautical miles/fps
73	F 1(V)	(2700/805) nautical miles/fps^2
74	PREDANGL	(2^3/21600.) nautical miles
75	JJ	2^{14}
76	THETA	Nautical miles/21600.
77	THETA +1	
78	LATANG	Scaled/2^2
79	LATANG +1	
80	RT	Scaled/2^1
81	RT +1	
82	RT +2	
83	RT +3	
84	RT +4	
85	RT +5	
86	L/D	Scaled/2^0
87	L/D +1	
88	DIFF	Nautical miles/(21600. x 2^4)
89	DIFF +1	

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TABLE 6-7

ENTRY DOWNLIST

WORD NO.	DATA WORD	WORD ORDER CODE
1	Downlist Identification Word (62240_8)	1
2	DSPTAB + 0	0
3	DSPTAB + 1	0
4	DSPTAB + 2	0
5	DSPTAB + 3	0
6	DSPTAB + 4	0
7	DSPTAB + 5	0
8	DSPTAB + 6	0
9	DSPTAB + 7	0
10	DSPTAB + 8D	0
11	DSPTAB + 9D	0
12	DSPTAB + 10D	0
13	DSPTAB + 11D	0
14	TIME 2 (MSB)	0
15	TIME 1 (LSB)	0
16	IN 0	0
17	IN 2	0
18	IN 3	0
19	OUT 1	0
20	STATE	0
21	FLAGWORD 1	0
22	FLAGWORD 2	0
23	CDU X	0
24	CDU Y	0
25	CDU Z	0
26	REDO COUNTER	0
27	GARBAGE[1]	0
28	F 3 (V)	0
29	-DREFR	0
30	RTOGO	0
31	RDOTREF	0

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[1] See subparagraph h., p. 3-6.

TABLE 6-7 (CONT'D)

WORD NO.	DATA WORD	WORD ORDER CODE
32	-F 2(V)	0
33	F 1(V)	0
34	PREDANGL	0
35	JJ	0
36	THETA + 0	0
37	THETA + 1	0
38	LATANG + 0	0
39	LATANG + 1	0
40	SPARE	0
41	TIME OF EVENT MSB	0
42	TIME OF EVENT LSB	0
43	DELV X	0
44	DELV Y	0
45	DELV Z	0
46	DESIRED CDU X	0
47	DESIRED CDU Y	0
48	DESIRED CDU Z	0
49	DUMMY MARKER	1
50	DUMMY MARKER	1
51	DUMMY MARKER	1
52	DSPTAB + 0	0
53	DSPTAB + 1	0
54	DSPTAB + 2	0
55	DSPTAB + 3	0
56	DSPTAB + 4	0
57	DSPTAB + 5	0
58	DSPTAB + 6	0
59	DSPTAB + 7	0
60	DSPTAB + 8D	0
61	DSPTAB + 9D	0
62	DSPTAB + 10D	0

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TABLE 6-7 (CONT'D)

WORD NO.	DATA WORD	WORD ORDER CODE
63	DSPTAB + 11D	0
64	X position component of the latest calculated state vector MSB	0
65	X position component of the latest calculated state vector LSB	0
66	Y position component of the latest calculated state vector MSB	0
67	Y position component of the latest calculated state vector LSB	0
68	Z position component of the latest calculated state vector MSB	0
69	Z position component of the latest calculated state vector LSB	0
70	X velocity component of the latest calculated state vector MSB	0
71	X velocity component of the latest calculated state vector LSB	0
72	Y velocity component of the latest calculated state vector MSB	0
73	Y velocity component of the latest calculated state vector LSB	0
74	Z velocity component of the latest calculated state vector MSB	0
75	Z velocity component of the latest calculated state vector LSB	0
76	Time of the latest calculated state vector MSB	
77	Time of the latest calculated state vector LSB	0
78	RT + 0	0
79	RT + 1	0
80	RT + 2	0
81	RT + 3	0
82	RT + 4	0
83	RT + 5	0
84	L/D + 0	0

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TABLE 6-7 (CONT'D)

WORD NO.	DATA WORD	WORD ORDER CODE
85	L/D + 1	0
86	DIFF + 0	0
87	DIFF + 1	0
88	SPARE	0
89	SPARE	0
90	SPARE	0
91	SPARE	0
92	SPARE	0
93	SPARE	0
94	SPARE	0
95	SPARE	0
96	SPARE	0
97	SPARE	0
98	DUMMY MARKER	1
99	DUMMY MARKER	1
100	DUMMY MARKER	1

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