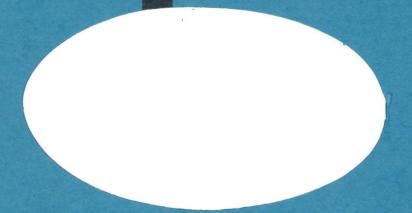
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R-557

GUIDANCE SYSTEM OPERATIONS PLAN FOR MANNED LM EARTH ORBITAL MISSIONS USING PROGRAM SUNDANCE (REV. 306)

SECTION 4 PGNCS OPERATIONAL MODES (Rev. 3)

JANUARY 1969

INSTRUMENTATION CAMBRIDGE 39, MASSACHUSETTS LABORATORY

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R-557

GUIDANCE SYSTEM OPERATIONS PLAN FOR MANNED LM EARTH ORBITAL MISSIONS USING

PROGRAM SUNDANCE

Rev. 306

* SECTION 4 PGNCS OPERATIONAL MODES

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REVISION INDEX COVER SHEET

GUIDANCE SYSTEM OPERATION PLAN

GSOP # R-557 Title: For Manned Earth Orbital Mission Using Program
SUNDANCE

Title: PGNCS Operational Modes (Rev. 2)

Section # 4

Date Rev.

2/20/68 1 Remove Pages Add Pages PCR Ref.

All of R-53 (ppgs. 399-416 New R-53 (16 pages num-inclusive) PCR #7

Title Page

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Index Sheet

7/1/68 2 Revision 2 incorporates the following NASA/MSC approved changes and is published as a complete new document.

e)	MIT No.	NASA PCR		
	15.1	146.1	*	Emergency termination of integration function
	27.2 30 39.1		*R	State Vector synchronization GSOP Change R63 Attitude hold during X axis over ride
	40.1	86.1	*	Deadband selection changes
	$44.1 \\ 47.1$			Attitude maneuver during search routine GSOP update (sect. 4) R30
	49	177	*	GSOP update (section 4) P 40
	50.2	148.2	*	IMU ON check in P51
	52.1	406.1	*	Correction to R04 in GSOP section 4.
	56	178	*	P30 displays and section 4 of update flag changes
	57.1	449	*	Noun 78 scaling in V/Noun list of sect. 4
	58.1	450	*	Noun 78 scaling in R04
	60.1	251	*	GSOP update section 4
	65		*	GSOP update section 4
	71	179	*	New alarm code (1711) for P40, P41, P42
	74	180	*	R77 restriction
	85.1	184.1	*	Standardize termination of extended verbs 47 and 48

^{*} Indicates an MIT Program Change Notice (PCN)

Date: July 1, 1968

REVISION INDEX COVER SHEET (cont.)

GUIDANCE SYSTEM OPERATION PLAN

GSOP $\#R-577$	Title:	For M	anne	ed Earth Oribital Mission Using Program
				SUNDANCE
Section #4	Title:	PGNC	S Or	perational Modes (Rev. 2)
<i>n</i>				
	\mathbf{MIT}	NASA		
	No.	PCR		
	-			
	86	142	*	Rescale attitude error display
	88.1	185.1	*	Sign change to Noun 73
	90.1	186.1	*	Elimination of ullage following an enter or terminate
	92.1	144.1	*	Reduction of ullage duration of delta threshold
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	95.1	451.1	*	P20 display terminates in GSOP
	96.1	452.1	*	Routine 03 mass limits
	102.1	408.1	*	R47 changes to section 4
	103.2	173.2	*	RMS position and velocity display
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	106.2	453.1	*	Alarm 1520 and IMUSE flag
	109.1	410.1	*	Prevent problems arising from RR control
	110.1	415.1	*	mode changes Prevent display conflicts when RR goes out
	110.1	410.1	4.	of auto mode
	118	426	*	V43 Reconcilation
	119	454	*	Noun list corrections
	120	455	*	Verb list corrections
	121	456	*	Correction to V36
	122	427	*	V74 reconciliation
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	130	430	*	V61 Reconciliation
	131	458	*	V41N72 addition of assumption
	132	459	*	RDR check
	133	443	* *	Checklist code reconciliation
*	134 135	$\begin{array}{c} 411 \\ 460 \end{array}$	*	Option code reconciliation IMU check
	136	412	*	Delete N89 in P52
	137	461	*	Update of alarm code list
	138.1	431.1	*	R24/1261 Interface
	139.1	444.2	*	P06 IMUSE flag
	143.1	432.1	*	GSOP section 4 R21 repositioning check
	144.1	413.1	*	GSOP section 4 R02 IMUSE flag
	145.1	433.1	*	GSOP section 4 R60 clarification

^{*} Indicates an MIT Program Change Notice (PCN)

Date: July 1, 1968

REVISION INDEX COVER SHEET (cont.)

GUIDANCE SYSTEM OPERATION PLAN

GSOP # R-557	Title:	For Manned Ea	arth Orbital Mission Usi	ng Program
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	MIT	NASA	,	
	No.	PCR		
2		31 L/79 F: 95 Si 96 C: 97 R: 103 D: 114 D:	PS trimming time GC Req. during AGC sw lagbit update verb gn change to N72 hange to RR coarse alig R monitor routine change elete programs P72, P7 elete minimum deadband in impulse burn	n extended verb ge 73, P74, & P75
Date	Rev.	Revision 3 inco approved chang	orporates the following ges:	NASA/MSC
Jan. 1969	3	PCR/PCN	Remove	Add
		658 401. 3*, 540. 2* 401. 3*, 540. 2* 401. 3* 401. 3* 401. 3* 603. 1* 612* 692 Edit 600* Edit 618. 1* 613. 2* 646. 1* Edit Edit 601* 64, 483* 449* 693. 1	Title Page (Rev. 2) Revision Index Cover Sheet, Page vii P20, Rev. 13 P30, Rev. 10 P32, Rev. 10 P33, Rev. 14 P40, Rev. 20 P41, Rev. 16 P42, Rev. 19 P52, Rev. 18 R00, Rev. 04 R04, Rev. 11 R23, Rev. 16 R24, Rev. 12 R25, Rev. 13 R30, Rev. 10 R33, Rev. 07 R55, Rev. 07 R60, Rev. 09 V41N20, Rev. 05 V41N72, Rev. 04 V61, Rev. 03 Verb List, Rev. 06 Alarm Codes List, Rev. 03	Title Page (Rev. 3) Revision Index Cover Sheet, Page vii P20, Rev. 14 P30, Rev. 11 P32, Rev. 11 P33, Rev. 15 P40, Rev. 21 P41, Rev. 17 P42, Rev. 20 P52, Rev. 19 R00, Rev. 05 R04, Rev. 12 R23, Rev. 17 R24, Rev. 13 R25, Rev. 14 R30, Rev. 11 R33, Rev. 08 R55, Rev. 08 R60, Rev. 10 V41N20, Rev. 06 V41N72, Rev. 05 V61, Rev. 04 Verb List, Rev. 06 Noun List, Rev. 07 Alarm Codes List, Rev. 04

^{*} Indicates an MIT Program Change Notice (PCN)

Preface

The Guidance System Operations Plan is published as seven separate volumes (sections) as follows:

Section 1	Pre-Launch
Section 2	Data Links
Section 3	Digital Autopilots
Section 4	Operational Modes
Section 5	Guidance Equations
Section 6	Control Data
Section 7	Error Analyses

This volume, Section 4 of the Guidance System Operations Plan for Manned LM Earth Orbital Missions using Program SUNDANCE describes the operational modes of the mission.

It constitutes a Control Document to govern the structure of these missions, including PGNCS interfaces with the flight crew and MCC.

Revisions to this plan require NASA approval.

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4. PGNCS OPERATIONAL MODES

4.0 Introduction

Preparation of the PGNCS for any mission involves the generation of computer programs, flight and ground crew procedures, and the provision of hardware to meet interface, accuracy, and instrumentation requirements. All of these mission-related items are specified in the Guidance System Operations Plan.

The guidance operational concept is designed to comprise a set of manually-initiated programs and functions which may be arranged by the flight crew to implement a large class of flight plans. This concept of operation will permit both a late flight-plan definition and a capability for real-time flight-plan changes.

The PGNCS system is designed to perform the LM guidance and navigation functions required on lunar landing missions in a self-contained mode within specified accuracy and maneuver propellant constraints. The System is also designed to accept navigation data from earth-based facilities whenever required to improve accuracy, to reduce maneuver propellant requirements, or to gain some other operational advantage. It is essential on Earth Orbital Missions to demonstrate to the maximum possible extent both the self-contained and earth-cooperative modes of operation, since either mode may be required on lunar missions.

4.1 AGC Program Control

To efficiently coordinate the design of the AGC*Programs, as well as define the astronaut and ground control procedures with respect to the PGNCS system, it is necessary to define the operating inter-relationships between the PGNCS system, other S/C systems, the astronauts and the ground.

In primary PGNCS control modes the AGC can automatically compute required mission parameters and automatically command both PGNCS and LM subsystems. Complete automation of this control throughout a mission is neither feasible nor desirable. For primary as well as secondary control modes of the PGNCS the astronauts and/or the ground must be capable of initiation or termination of AGC Programs. These procedures must be thoroughly defined to design the AGC Program logic for astronaut/ground participation.

4.1.1 AGC Program Initiation

4.1.1.1 AGC Programs

Due to the random time sequencing of many of the AGC tasks the design of Programs which can be utilized at varied times and in varied circumstances offers the best method of accomplishing these tasks. These Programs must incorporate sufficient logic to clearly define the particular time and/or application for which they are used. They must also standardize astronaut/AGC communication procedures, ground/AGC communication procedures and PGNCS and SCS Mode determination.

A logical establishment of these Programs has been made, supplemented by simpler routines not requiring identification as a Program. The Programs, their associated routines and the crew interface are outlined in detail in Section 4.4.

Programs in process in the AGC are identified by the Program light on the keyboard and display panels with two exceptions, P20 and P25. These Programs may be in process at the same time as another Program whose number is displayed.

The AGC is programmed to initiate a Program only in response to the initiation of a specific mission task and will continue the programmed sequence of computations and displays for the specific task until Program completion or termination.

Programs are generally initiated by manual keyboard entry (astronaut) or by AGC UPLINK command (ground). In certain cases Program initiation is automatically done by the previous Program. The diagrams of Section 4.4 show Program selection as it should occur normally.

4.1.1.2 Special AGC Routines

In addition to the AGC Programs there are many routines and subroutines not specifically identified with a Program. The majority of these are automatically performed in a particular computation or control sequence and involve no notification to the "outside world" that they are in process. While they may occasionally

* AGC is an acronym for Apollo Guidance Computer. In the LM, this computer is officially designated as the LGC (LM Guidance Computer).

be referred to in this document their large number alone requires that detailed descriptions be restricted to special AGC program documents.

Several special routines are described in detail herein because of one or more of the following characteristics:

- (a) The routine involves AGC communication with the astronaut.
- (b) The routine is of importance in understanding the Programs.
- (c) The routine involves significant sequences of AGC/astronaut action but could be performed while certain programs are in process.

These routines include those automatically called by the AGC as well as those manually called. If the routine requires AGC/astronaut communication, it will start with a particular display which acts as a key to the astronaut that the AGC has automatically entered the routine.

4.1.2 AGC Program Termination

Normally there are two ways by which an AGC Program in process is terminated:

- 1. At completion, the program in process will transfer control to the Final Automatic Request Terminate routine (R 00).
- 2. Via a terminate response by the astronaut to an AGC generated flashing display on the DSKY (usually results in transferring control to R00).

In addition to the above the astronaut may terminate a particular AGC program as follows:

- 1. Select a new Program to operate via the DSKY.
- 2. Select a routine via the DSKY which has been specifically designed to terminate a particular program or activity (e.g. state vector integration).
- 3. Select the FRESH START routine which essentially initializes the AGC.

4.2 AGC/Astronaut/Ground Communications

4.2.1 AGC/Ground Communications

The AGC/Ground Communications are via the AGC UPLINK and AGC DOWN-LINK and are described in detail in Section 2 of this GSOP.

4.2.2 AGC/Astronaut Communications

The display and keyboard logic in the AGC processes information exchanged between the AGC and the computer operator. This information is exchanged via the Display and Keyboard (DSKY).

The modes of operation are basically:

- (a) Display of internal data This includes simple displays and periodically updated displays of data; and displays of requests for operator action required by the AGC.
- (b) Loading of external data the process of inserting data into the AGC via the DSKY.
- (c) Program or Routine calling Initiated by operator action via the DSKY.

The following paragraphs and Table 4-1 (page 4-17) provide a limited description of the DSKY, and the crew/DSKY operating procedures. They are included herein to facilitate understanding of the Program logic in Section 4.4 and do not comprise a complete instruction manual for the use of the DSKY. For detailed DSKY operating instructions refer to other MIT documents.

4.2.2.1 The DSKY (refer to Fig. 4-1, page 4-18).

- (a) UPLINK ACTY Light is energized by the first character of a digital UPLINK message received by the AGC. If the light is not extinguished by the UPLINK transmission it should be extinguished by crew use of the RSET or KEY REL buttons when the UPLINK transmission is complete.
- (b) NO ATT Light is energized when the AGC is in operate mode and there is no inertial reference; i.e. the ISS is off, caged, or in the coarse align mode.
- (c) STBY Light is energized when the AGC is in standby mode and deener-gized when the AGC is in operate mode.

(d) KEY REL LIGHT

- (1) Energized when:
 - a) An internal display comes up while astronaut has the DSKY.
 - b) An astronaut keystroke is made when an internal flashing display is currently on the DSKY. (Note three exceptions: PRO (proceed), RSET (reset) and ENTR (enter) if ENTR is a single button response.

- c) The astronaut makes a keystroke on top of (his own)Monitor Verb display. This is the so-called "suspended monitor" case. (Monitor Verbs display data updated every one second.)
- (2) De-energized when:
 - a) Astronaut relinquishes DSKY by hitting KEY REL button.
 - b) Astronaut terminates his current sequence normally, eg.
 - i) with final ENTR of a load sequence.
 - ii) the ENTR of a response to a flashing display.
 - iii) the ENTR of an extended verb request,
- (3) Some special DSKY cases that may not be universally appreciated are:
 - a) The astronaut may select a non-Monitor Verb display on top of his own previously selected Monitor Verb. This will cause KEY REL light to flash (See 1c above). Hitting the KEY REL button will bring back (unsuspend) the monitor and extinguish the light. However, if these sequences are selected on top of an internal display, the KEY REL light will not go out as the monitor is unsuspended. It requires one more KEY REL button operation to extinguish the light and bring back the internal display.
 - b) Suppose the astronaut selects another verb-noun combination (e.g. a V16 monitor) on top of an internal flashing display. That internal display can still be answered with an ENTR, PRO or VERB 34 ENTR (terminate), which wipes everything from the DSKY till the next internal display. Therefore, an astronaut selected monitor should, as a rule, never be terminated with VERB 34 ENTR, because that may not be the desired response to the flashing display. The KEY REL button should be used instead.
- (e) TEMP Light the AGC receives a signal from the IMU when the stable member temperature is in the range 126.3° F to 134.3° F. In the absence of this signal, the TEMP lamp on the DSKY is actuated.
- (f) GIMBAL LOCK Light is energized when the middle gimbal angle exceeds $\pm 70^{\,0}$ from its zero position. When the middle gimbal exceeds $\pm 85^{\,0}$ from its zero position the AGC automatically commands the coarse align mode in the ISS to prevent gimbal oscillation. The NO ATT light will then be energized (see (b)).

- (g) PROG Light The program alarm actuates the PROG light on the DSKY. A program alarm is generated under a variety of situations. Under program control the AGC inhibits this alarm for 10 sec after system turn-on. For further information see section 4.3.3.
- (h) TRACKER Light when the rendezvous or landing radars are on, the light is energized when:
 - (1) An RR CDU fine error greater than 1.0 vrms occurs.
 - (2) An RR CDU coarse error greater than 2.5 vrms occurs.
 - (3) The RR read counter limit cycles at a rate greater than 160 cps.
 - (4) An RR CDU analog to digital conversion fails (cos θ ϕ) is less than 2 volts.
 - (5) The RR CDU + 14 VDC supply decreases to 50% of nominal.
 - (6) When the RR Data Good Bar discrete occurs during an AGC data read sequence.
 - (7) When an LR Altitude Data Good Bar discrete or LR Velocity Data Good Bar discrete occurs during an AGC data read sequence.
- (i) OPR ERR Light is energized when the DSKY operator performs an improper sequence of key depressions. The light is de-energized by pressing the RSET button.
- (j) COMP ACTY Light is energized when the AGC is occupied with an internal sequence. It is not an indicator of whether the operator may use the DSKY or whether the AGC is not capable of handling further computation.
- (k) RESTART Light in the event of Restart during operate a latch is set in the AGC which maintains the RESTART lamp on the DSKY until the latch is manually reset by pressing the RSET button. For further detail see section 4.3.3.
- (1) Display Panel consists of 24 electroluminescent sections arranged as in Fig. 4-1, page 4-18. Each section is capable of displaying any decimal character or remaining blank, except the 3 sign sections (R1S, R2S, R3S). These display a plus sign, a minus sign, or a blank. The numerical sections are grouped to form 3 data display registers, each of 5 numerical characters; and 3 control display registers, each of 2 numerical characters. The data display registers are referred to as R1, R2, R3. The control display registers are known as VERB, NOUN, and PROGRAM.

At maximum activity, the complete display panel may be updated in 1/4 second.

(m) Keyboard - contains the following buttons:

VERB - pushing the button indicates that the next two numerical characters keyed in are to be interpreted as the Verb Code.

NOUN - pushing the button indicates that the next two numerical characters keyed are to be interpreted as the Noun Code.

+ and - - sign keys used for sign convention and to identify decimal data.

0-9 -numerical keys.

CLR - used during a data loading sequence to clear or blank the data display register (R1, R2, R3) being used. It allows the operator to reload the data word.

PRO - this pushbutton performs two functions:

- 1. When the AGC is in a standby mode, pressing this button will put the AGC in the operate mode, turn off the STBY light (see(c)), and automatically select Program 00 in the AGC.
- 2. When the AGC is in the operate mode but Program 06 is not selected, pressing the button will provide the proceed function. Proceed directs the AGC to continue to the next programmed event. In response to an AGC request it further indicates crew compliance with the request.
- 2a. When the AGC is in the operate mode and Program 06 is selected, pressing the button will put the AGC in the standby mode and turn on the STBY light (see (c)).

ENTR - is used in three ways:

- 1. To direct the AGC to accept a data word just Paded.
- 2. In response to a "please perform" request (see section 4.2.2.7).

RSET - turns off alarm conditions on the DSKY providing the alarm condition has been corrected.

4.2.2.2 Verbs and Nouns

The basic language of communication between the astronaut and the DSKY consists of Verb and Noun codes. The Verb Code indicates what action is to be taken. The Noun Code indicates to what this action is applied.

Verb Noun codes may be originated either by manual operation or by the AGC Program in process.

The standard procedure for a manual keyboard operation consists of a sequence of 7 key depressions:

VERB V_1 V_2 NOUN N_1 N_2 ENTR

The VERB key depression blanks the Verb lights on the display panel and clears the Verb Code register within the computer. The next two numerical characters punched in are interpreted as the Verb Code. Each of these characters is displayed in the Verb lights on the display panel as it is punched in. The NOUN key operates similarly for the Noun lights and Noun Code register.

The depression of the ENTR key causes the performance of the Verb-Noun combination appearing in the lights at the time of depression. Thus it is not necessary to follow any order in punching in the Verb or Noun Code. They may be done in reverse order, or an old Verb or old Noun may be used without repunching it.

No action is ever taken in performing the Verb-Noun combination until ENTR is pressed. If an error is noticed in either the Verb Code or the Noun Code before the ENTR is pressed, correction is simple. Merely press the VERB or NOUN key and repunch the originally intended code, without necessarily changing the other. Only when the astronaut has verified that the desired Verb and Noun Codes are in the lights, should he press the ENTR key to execute the Verb-Noun combination.

A Noun Code can refer to a group of computer erasable registers, a group of counter registers, or may serve merely as a label. A label Noun refers to no particular computer register, but conveys information by its Noun Code number only. The group of registers to which a Noun Code refers may be a group of 1,2 or 3 members. These are generally referred to as 1, 2, or 3 component Nouns. The component is understood as a component member of the register group to which the Noun refers. The machine addresses for the registers to which a Noun refers are stored within the computer in Noun tables.

A single Noun Code refers to a group of 1, 2, or 3 component members. It is the Verb Code that determines which component member of the Noun group is operated on. Thus, for instance, there are 5 different Load Verbs. Verb 21 is

required for loading the first component of whatever Noun is used therewith; Verb 22 loads the second component of the Noun; Verb 23, the third component; Verb 24, the first and second components of the Noun; and Verb 25 loads all three components of the Noun. A similar component format is used in the Display and Monitor Verbs.

When the decimal Display Verb is employed, all the component members of the Noun being used are scaled as appropriate, converted to decimal, and displayed in the data display registers.

Decimal data is identified by a + or - sign preceding the 5 numerical characters. If decimal is used for loading data of any component members of a multi-component Load Verb, it must be used for all components of the Verb. Thus no mixture of decimal and octal data is permitted for different components of the same Load Verb. (If this is violated, the OPR ERR light is turned on.)

There is a class of verbs called Monitor Verbs which display data every one second. Once a Monitor Verb is executed, the data on the display panel continues to be updated until the Monitor is turned off.

The Monitor may be turned off by keying in: PRO, VERB 34 ENTR (terminate), by internal program initiation of the Keyboard and Display System Program, (if the DSKY is not busy) or by a Fresh Start of the AGC.

Monitor action is suspended (but not ended) by the depression of any key, except RSET. This turns on the KEY REL light immediately. Monitor action continues after the Keyboard and Display System is released. Thus it is possible to suspend a monitor while the astronaut loads some data (or requests another display) and to return to the original monitor when his intervention is concluded.

After any use of the DSKY, the numerical characters (verb, noun and data words) remain visible until the next use of the DSKY. If a particular use of the DSKY involves fewer than 3 data words, the data display registers (R1, R2, R3) not used remain unchanged, unless blanked by deliberate program action.

The DSKY procedures above were described for manual operation; however, the principles described remain the same for DSKY operation by the AGC Programs and routines.

As outlined in the Mission Programs (section 4.4) the majority of DSKY operations are of the following categories:

- a) Display to display data to the operator. Display Verbs present data computed by the mission program.
- b) Load to request a data load as described in detail below.

- c) Please Perform to request an action from the astronaut. (see section 4.2.2.7)
- d) Please Mark to request the astronaut to push the "MARK" button for an optics sighting.

AGC initiated Verb/ Noun combinations are either statically displayed or flashed. If static they identify data displayed only for astronaut information requiring no response from him. If the Verb/Noun is flashing, appropriate astronaut response is required as dictated by the Verb/Noun combination. In this case the AGC Program or Routine is interrupted until the astronaut responds appropriately, then the Verb/Noun flash is terminated and the Program or Routine is resumed.

An appropriate astronaut response to a flashing Verb/Noun should be a data load and ENTR, VERB 32 ENTR (recycle), PRO, or VERB 34 ENTR (terminate). The internal program response to any one of these astronaut responses varies according to the Verb/Noun flashing and the Program in process as described below and in Section 4.4.

4.2.2.3 Acceptance of Keys

The numerical keys, the CLR key, and the sign keys are rejected if struck after completion (final ENTR) of a data display or data load Verb. At such time, only the VERB, NOUN, ENTR, RSET, or KEY REL are accepted. Thus the data keys are accepted only after the control keys have instructed the program to accept them.

Similarly the plus (+) and minus (-) keys are accepted just before the first numerical character of R1, R2, R3 is punched in, and at no other time.

The 8 or 9 key is accepted only while defining a verb or noun, or when loading a data word into R1, R2, or R3 which was preceded by a plus or minus sign. (If this is violated, the OPR ERR light is turned on.)

If more than two numerical characters are punched in while loading the Verb, Noun, or Program code, or more than five numerical characters while loading a data word, the excess characters are not accepted.

4.2.2.4 Release of Keyboard and Display System

The Keyboard and Display System Program can be used by internal computer programs. However, any operator keyboard action (except RSET) makes the Keyboard and Display System Program busy to internal routines. The operator has control of the Keyboard and Display System until he wishes to release it. Thus he is assured that data he wishes to observe will not be replaced by internally initiated data displays. In general, it is recommended that the operator release the Keyboard and Display System for internal use when he has temporarily finished with it. This is done by pressing the KEY REL button.

If an internal program attempts to use the Keyboard and Display System, but finds that the astronaut has used it and not yet released it, the KEY REL light is turned on. When the astronaut finds it convenient, he should strike the KEY REL button to allow the internal program to use the keyboard and display panel.

4.2.2.5 Display - Verb/Noun Flashing

This is an internally initiated action. The appropriate astronaut response to a flashing display Verb/Noun combination is:

- (a) Correct the data (see Section 4.2.2.6 below). Perform the appropriate Load Verb sequence. Upon the final ENTR, the program proceeds normally.
- (b) VERB 32 ENTR (recycle). This causes the program to return to a previous location.
- (c) PRO. This indicates acceptance of the displayed data, and a desire for the internal sequence to continue normally.
- (d) VERB 34 ENTR (terminate). The astronaut wishes to terminate the operation.

NOTE: Uncommon responses are defined in the program logic of Section 4.4 4.2.2.6 Load - Verb/Noun Flashing

Whenever any data is to be loaded the Verb/Noun flashes. The flash occurs whether the data load is initiated by the AGC or by the astronaut. The appropriate data display register (R1, R2, or R3) is blanked in anticipation of the data load. Data is loaded in 5-character words and is displayed character-by-character in one of the 5-position data display registers as it is keyed in.

Numerical data is considered decimal if the 5-character data word is preceded by a plus or minus sign; if no sign is supplied it is considered octal. The plus and minus keys are accepted only when they precede the first numerical character of the data word; they are ignored at any other time. Decimal data must be loaded in full 5-numerical-character words (no zeros may be suppressed); octal data may be loaded with high order zeros suppressed. If decimal is used for any component of a multi-component Load Verb, it must be used for all components of that Verb. No mixing of octal and decimal data is permitted for different components of the same Load Verb. (If this principle is violated, the OPR ERR light is turned on.)

The ENTR key must be pressed after each data word. This tells the program that the numerical word punched in is complete. The flash is turned off after the last ENTR of a loading sequence.

As data is loaded, it is temporarily stored in buffers. It is not placed into its final destination, as specified by the Noun Code, until the final ENTR of the load sequence.

If an attempt is made to key in more than 5 numerical characters in sequence, the sixth and subsequent characters are simply rejected. If the 8 or 9 key is punched during octal load (as identified by lack of a sign entry), it is rejected and the OPR ERR light is turned on.

Verbs are flashed one at a time. The computer always instructs the astronaut through a loading sequence. For example: the astronaut (or the internal program) initiates the sequence by selecting VERB 25, "load 3 components of: "(any 3-component noun will do). The Verb Code is changed to 21,"load first component of: "and the flash is turned on. VERB 21 continues to be flashed as the astronaut punches in the first word of data. When the ENTR is pressed, the Verb Code is changed to 22. Flashing continues while the astronaut punches the second data word. When ENTR is pressed, the Verb Code is changed to 23, "load third component," and again the flash continues while the third data word is punched in. When ENTR is pressed, the flash is turned off, and all three data words are placed in the locations specified by the Noun. Throughout the changing of the Verb Codes, the Noun Code is left unchanged.

The CLR button is used during data loading to remove errors in R1, R2, or R3. It allows the astronaut to begin loading the data word again. It does not clear the Program, Noun, or Verb lights. (The Noun lights are blanked by the NOUN key; the Verb lights, by the VERB key.) In the following discussions, the term Clearing Function will be used to mean blanking the data display register.

For single component Load Verbs, the CLR button depression performs the Clearing Function on whichever register is being loaded, provided that CLR is punched before data ENTR. Once ENTR is depressed, CLR does nothing. The only way to correct an error after the data ENTR for a single component Load Verb is to begin the Load Verb again.

For the 2- or 3- component Load Verbs, there is a backing-up feature of CLR. The first depression of the CLR buttons performs the Clearing Function on whichever register is being loaded. (CLR may be pressed after any character, but before its ENTR.) Consecutive depressions of CLR perform the Clearing Function of the data display register above the current, one, and also changes the VERB light to indicate the register being acted upon until R1 is cleared. Any attempt to back up beyond R1 are simply ignored.

The backing-up of CLR operates only on whatever data is pertinent to the Load Verb which initiated the loading sequence. For example, if the initiating Load Verb was a load second component only, no backing-up action is possible.

4.2.2.7 Please Perform - Verb/Noun Flashing

This is always an internally initiated action, as astronaut response is always required to the "please perform" request; the Verb-Noun is always flashed, and the Program is interrupted. The "please perform" verb (50) is usually used with the "Checklist" noun (25) with an appropriate "checklist code" number in R1. The appropriate response is:

- (a) PRO to indicate an affirmative response to the request.
- (b) ENTR to indicate a negative response to the request.

4.2.2.8 Please Mark

The "please mark" verbs (52, 53 or 54) are flashed when the AGC is prepared to accept optical sighting data upon the pushing of the "MARK" button. The logic associated with the "please mark" function is completely described in Section 4.4.

4.2.2.9 Machine Address to be Specified

There is a class of Noun available to allow any machine address to be used. These are called "Machine Address to be Specified" Nouns. When the ENTR which causes the Verb-Noun combination to be executed senses a noun of this type, R3 is blanked and the flash is immediately turned on. The Verb Code is left unchanged. The astronaut should load the 5-octal-character complete machine address of interest. It is displayed in R3 as it is punched in. If an error is made in loading the address, the CLR may be used to remove it. Pressing ENTR causes the verb to be executed.

4.2.2.10 Program Selection

VERB 37 ENTR is used to select a Program. This causes the Noun display register to be blanked and the Verb Code to be flashed. The 2-character Program Code would then be loaded. For verification purposes, it is displayed as it is loaded in the Noun display register. The ENTR causes 1) the flash to be turned off, 2) a request for the new Program to be entered, and 3) the new Program Code to be displayed in the Program display register.

4.2.2.11 Alarm Philosophy

The OPR ERR light is turned on when the astronaut performs some improper sequence of key depressions.

4.2.2.12 Illegal Verbs, Nouns and Combinations

The simplest alarm situation is an attempt to use an undefined (or spare) Verb Code or Noun Code. The OPR ERR light is turned on when the ENTR that attempts to execute the Verb/Noun combination is pressed. No further action is taken.

It is possible to choose a Verb that is defined and a Noun that is defined, but have the combination of Verb and Noun be illegal (for example, the "decimal display" Verb used with a Noun which is restricted to be "octal only"). The OPR ERR light is turned on at the ENTR that attempts to execute the Verb/Noun combination. No further action is taken.

Violation of the following principles causes the OPR ERR light to be turned on. No further action is taken.

- (a) An undefined (or spare) verb must not be used.
- (b) An undefined (or spare) noun must not be used.
- (c) In octal Display and Monitor Verbs and all Load verbs, the components number of the verb must not exceed the number of components in the noun. (Note, all "machine address to be specified" nouns are considered 3component.)
- (d) The octal display and Monitor Verbs must not be used with a "decimal only" noun.
- (e) The decimal Display and Monitor Verbs must not be used with an "octal only" noun.
- (f) The double precision decimal Display and Monitor Verbs (07, 17) must not be used with mixed nouns (codes 40-99).
- (g) No Load Verb may be used with a noun restricted to be "no load". All nouns having split MIN/SEC scale or 2 integers for any component are "no load" for the entire noun.
- (h) An input code other than those which are defined is received from the keyboard.
- (i) The contents of the register used to determine which display panel character is to be lighted has exceeded its limit.

4.2.2.13 Illegal Data and Recycle

Many legal Verb/Noun combinations require the loading of additional data (either numerical or machine address). It is possible that the data supplied may itself be improper for the Noun selected. Examples are: (1) the numerical data exceeds the maximum value allowed by the scale factor associated with the Noun, and (2) decimal data is loaded into an "octal only" noun.

In general the offense is detected at the final ENTR of the loading sequence. The alarm is turned on and a recycle is performed back to the beginning of the loading sequence. The flash is left on, and the data display register associated with the first data word in the sequence is blanked again. It is necessary for the astronaut

only to supply the data again; he need not attempt to re-execute the Verb/Noun combination. (Note, if decimal data is supplied for the address of a "machine address to be specified" noun, the alarm and recycle are performed at the ENTR immediately following the address keyed in.)

Violation of the following principles causes the OPR ERR light to be turned on, and a recycle to be performed.

- (a) The address keyed in for a "machine address to be specified" noun must be octal.
- (b) In multicomponent load verbs, no mixing of octal and decimal data is permitted. All the data words loaded for a given noun must either be all octal or all decimal.
- (c) Octal data must not be loaded into a "decimal only" noun.
- (d) Decimal data must not be loaded into an "octal only" noun.
- (e) Decimal data loaded must not numerically exceed the maximum permitted by the scale factor associated with the appropriate component of the noun.
- (f) Negative decimal data must not be loaded using the Y optics scale.
- (g) All 3 words must be loaded for the Hours, Minutes, Seconds scale.
- (h) When loading with the Hours, Minutes, Seconds scale, the minutes must not exceed 59; the seconds must not exceed 59.99; and the total number must not exceed 745 hours, 39 minutes, 14.55 seconds.
- (i) Two numerical characters must be supplied for the Program Code under V37. 4.2.2.14 Operator Error and Key Rejection

There are four situations which cause the OPR ERR light to be turned on and the offending key depression to be simply rejected. These are:

- (a) An attempt to ENTR a decimal data word having fewer than 5 numerical characters. The ENTR is simply rejected. The flash is left on and the Verb Code is not advanced. Thus it is possible to supply the remaining characters and to press the ENTR again for the same data word. Or the CLR key may be used if the operator wishes to begin loading the offending data word again.
- (b) An 8 or 9 is punched while loading a word which was not preceded by a plus or minus sign. The 8 or 9 is simply rejected. The remaining characters may then be supplied or the offending word removed and its loading begun again.

- (c) Certain program controlled cases (see Section 4.4).
- (d) An attempt to call one extended verb on top of another without allowing proper termination of the first.

	DISPLAY OF INF	ORMATION	REQUEST FOR ASTRO ACTION	REQUEST FOR DATA LOAD	REQUEST FOR OPTICS MARK
	Type of informat by V_N_follower three available re information, R1,	ed by up to egisters of	Request identified by V99 (please enable engine on), V37 (please select program) or V50 (please perform checklist) identifying a function to be performed or a checklist, one register R1 identifying function on that checklist.		Request identified by V52, V53 or V54. At completion of "MARKs" identify target (final entry is "ENTR")
	AGC Awaiting ASTRO Response	AGC Not Awaiting ASTRO	AGC alway Awaiting ASTRO Response	AGC Always Awaiting ASTRO Response	AGC Always Awaiting ASTRO Response
ASTRONAUT RESPONSE	V N Flashing	V_N_ Static	V50N Flashing	V_N_ Flashing	V52, V53, or V54 Flashing
Key in "ENTR"	No AGC Action	No AGC Action	AGC assumes ASTRO did not comply, terminates flashing Verb-Noun, and continues.	AGC takes loaded data, terminates flashing Verb- Noun and continues.	No AGC Action
Key in "PRO"	AGC assumes displayed data is correct, ter- minates flashing Verb-Noun, and continues.	No AGC Action	AGC assumes ASTRO complied, terminates flashing Verb-Noun, and continues.	AGC assumes no data available, terminates flashing Verb-Noun, and continues if possible.	No AGC Action
Key in VERB 34 ENTR (ter- minate)	Varies with program in progress.	Varies with program in progress.	Varies with program in process.	Varies with program in process.	Program in progress is terminated.
Key in VERB 32 ENTR (re- cycle)	AGC returns to earlier point in sequence.	No AGC Action	Incorrect Response.	Incorrect	No AGC Action
Press "MARK X" button or "MARK Y" button			*	,	AGC reads time, ter- minates flashing Verb- Noun if a suitable number of marks have been made and continues.

4-17

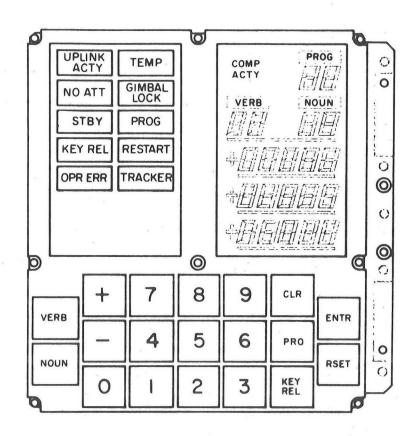


Fig. 4-1 Display and Control Panel

4.3 PGNCS Failure Monitor

The PGNCS performance and operational readiness are self-monitored and caution and warning information are displayed to the crew. Two warning (red) lamps are actuated by the PGNCS on the Caution/Warning Panel: AGC Warning indicates computer failure; ISS warning indicates failure of the inertial subsystem. Also a PGNCS Caution (amber) light is actuated to indicate non-critical problems in the system. Further detail regarding the caution items is displayed by means of the DSKY event lamps and the DSKY data registers (in the event of a program alarm).

4.3.1 AGC Warning

An AGC warning alarm is generated in the event of AGC power failure, scaler failure of either of two types, restart or counter fail during AGC operate, or in response to an alarm test program. A scaler fail or prime power fail result in an immediate alarm indication whereas the other inputs are buffered by a filter so as to prevent transient disturbances from causing a warning alarm. In this subsection the various inputs and conditions associated with AGC warning are defined.

- (a) SCAFAL Occurs if scaler stage 17 (1.28-sec period) fails to produce pulses. This provides a check on the timing for all logic alarms.
- (b) COUNTER FAIL Occurs if counter increments happen too frequently or else fail to happen following an increment request. "Too frequently" means continuous counter requests and/or incrementing for from 0.625 to 1.875 ms.
- (c) SCADBL Occurs if the 100 pps scaler stage operates at a pulse rate of 200 pps or more.
- (d) PARITY FAIL Occurs if any accessed word in fixed or erasable memory whose address is octal 10 or greater contains an even number of "ones".
- (e) RUPT LOCK Occurs if interrupt is either too long or too infrequent. The criterion for "too long" is phase dependent, varying in duration from 140 ms to 300 ms. Likewise the criterion for "too infrequent" varies from 140 ms to 300 ms.
- (f) TC TRAP Occurs if too many consecutive TC or TCF instructions are run or TCF instructions are too infrequent. The criterion for "too many" varies in duration from 5 ms to 15 ms. The criterion for "too infrequent" varies in absence from 5ms to 15ms.
- (g) NIGHT WATCHMAN Occurs if the computer should fail to access address 67 within a period whose duration varies from 0.64 sec to 1.92 sec.

(h) V FAIL - Occurs if the AGC voltages (28, 14, 4) are out of limits. This signal produces STRT1 if it stays on for a period of between 157 and 470 μsec. If the computer is in the STANDBY mode, an input to the AGC WARNING FILTER is generated simultaneously with STRT1. The following criteria apply for V FAIL:

4 V Supply > 4.4 V 4 V Supply < 3.65 V 14 V Supply < 12.5 V 28 V Supply < ~22.6V

- (i) STANDBY This is a signal which turns on RESTART and turns off the switchable +4 and +14 voltage, thus putting the AGC into a low power mode where only the scaler, timing signal, and a few auxiliary signals are operative. STANDBY is initiated by first setting the ENABLE STANDBY outbit (CH13 B11), and then pressing the PRO button on the DSKY for a time which varies from 0.64 sec to 1.92 sec. at the end of which time the STANDBY light is turned on. (All AGC alarms are inhibited during the Standby mode with the exception of AGC WARNING, which can be caused by VOLTAGE FAIL or SCALER FAIL; and TEMPERATURE CAUTION, which can be caused by TEMP ALARM.) Normal operation is resumed by pressing the PRO Button on the DSKY again. Time of depression same as above.
- (j) RESTART RESTART occurs at next time 12 following occurrence of any one or more of the following parameters: RUPT LOCK, TC TRAP, NIGHT WATCHMAN parity fail, and standby as described above.

RESTART occurs immediately and forces time counter to 12 upon occurrence of OSCILLATOR FAIL. (See paragraph (1) below.)

RESTART causes the computer to transfer control to address 4000 as soon as it disappears. It sets a flip-flop which lights the RESTART CAUTION lamp in the DSKY.

The Flip-flop is reset either by the ALARM RESET hardwired signal or by the CAUTION RESET outbit CH11 B10. ALARM TEST operates the lamp but not the flip-flop.

(k) WARNING FILTER - This circuit is used to operate the AGC WARNING output following repeated or prolonged occurrences of any of certain parameters. All occurrences of these signals are stretched so that no more than one input to the filter is generated in each 160-millisecond period. Approximately six consecutive stretched pulses cause AGC WARNING to turn on for

about 5 seconds. Non-consecutive stretched pulses may also cause AGC WARNING after an interval dependent on the frequency of the pulses. The output will not occur if input pulses occur at a frequency of less than 0.9 pps; and the output will remain on if pulses occur at a frequency of 0.6 pps or more. The threshold of the filter resumes its normal level with a time constant of many seconds after the filter has received inputs. An immediate reset of the AGC FAIL due to a WARNING FILTER output is therefore not possible.

(1) OSCILLATOR FAIL - Occurs if the oscillator stops. Has nominal 250-millisecond delay to keep signal present after the oscillator starts. Also occurs when AGC is in STANDBY because of loss of power to front end of circuit. This results in a 250-millisecond delay in starting when AGC comes out of STANDBY into OPERATE, and causes an immediate restart without waiting for time pulse 12.

4.3.2 ISS Warning

The ISS Warning signal is the logical "OR" of the following parameters, any one of which will cause an ISS Warning under the following conditions:

- (a) IMU Fail
 - (1) IG Servo Error greater than 2.9 mr for 2 sec
 - (2) MG Servo Error greater than 2.9 mr for 2 sec
 - (3) OG Servo Error greater than 2,9 mr for 2 sec
 - (4) 3200 cps supply-decrease to 50% of normal voltage level
 - (5) 800 cps wheel supply decrease to 50% of normal voltage level

These parameters are generated in the Inertial Subsystem. However, the "FAIL" signal itself is under AGC program control. It is ignored by the AGC program when the G&N System is in the Coarse Align Mode and during the 5-second interval following Coarse Align. During this mode the servo errors normally exceed the above criteria.

(b) PIPA FAIL

Pipa fail occurs if no pulses arrive from a PIPA during a 312.5-sec period, or else if both plus and minus pulses occur, or if a "long time" elapses without at least one plus pulse and at least one minus pulse arriving. By "long time" is meant a period of between 1.28 sec and 3.84 sec.

This FAIL signal is generated totally within the AGC and thus is completely under AGC program control. Its generation is enabled by the AGC only during AGC controlled translation or thrusting maneuvers.

- (c) ISS CDU FAIL (Monitored for each of 3 CDU's)
 - (1) CDU fine error in excess of 1.0 V rms
 - (2) CDU coarse error in excess of 2.5 V rms
 - (3) READ COUNTER limit cycle in excess of 160 cps
 - (4) Cos $(\Theta \phi)$ below 2.0 V
 - (5) +14 VDC Supply decrease to 50% of normal level

These parameters are generated in the Inertial Subsystem. However, the "FAIL" signal itself is under AGC program control. It is ignored by the AGC program when the G & N System is in the CDU Zero Mode. During this Mode the CDU errors normally exceed the above criteria.

4.3.3 PGNCS Caution

The PGNCS Caution lamp is actuated by the following undesirable but non-critical events:

- (a) AGC Restart during Operation. In the event of Restart during operate a latch is set in the AGC which maintains the PGNCS Caution alarm and the RESTART lamp on the DSKY until the latch is reset by program or until the latch is manually reset by ALARM RESET. For further detail see section 4.3.4.
- (b) Temperature out of Limits. The AGC receives a signal from the IMU when the stable member temperature is in the range 126. 3°F to 134. 3°F. In the absence of this signal, the Caution alarm and the TEMP lamp on the DSKY are actuated.
- (c) Gimbal Lock. When the AGC determines that the middle gimbal angle (MGA) of the IMU is greater than 70°, the Caution alarm and the Gimbal Lock lamp on the DSKY are actuated. When MGA exceeds 85° the ISS is downmoded to Coarse Align and the No Attitude lamp on the DSKY is actuated.
- (d) Program Alarm. Under a variety of situations a program alarm is generated. One example is that of a PIPA fail when the vehicle is not in a thrusting mode. Under program control the LMC inhibits this alarm for 10 sec after system turn-on. The program alarm actuates

the Caution alarm and the Program lamp on the DSKY. For further information see section 4.3.4.

(e) Tracker Alarm indicates one of five possible Rendezvous Radar CDU failures. (see paragraph 4.2.2. (h))

4.3.4 Restart and Program Alarms

When the Restart or Program Alarm lamps are illuminated on the DSKY, either V05N09 will automatically appear on the DSKY with the alarm code displayed in R1, R2, R3, or this information can be displayed by astronaut call up from the DSKY. This allows the astronaut to identify and normally correct the alarm condition. The listing of program alarms is included in Section 4.4.

4.4 AGC Logic/Ground/Crew Interface Diagrams

These diagrams outlined the detailed logic of the inter-relationship the AGC/Crew/Ground. For ease of correction and reproduction the diagrams have been incorporated on IBM cards and are presented as a computer printout.

The diagrams contain the following:

- 1) Program Control Indication of sequence interruptions and the following display notation:
 - a) PRIO (Priority) denotes a priority display
 - b) HOLD denotes that the flashing verb-noun and data will continue to be displayed until the astronaut takes DSKY action.
 - c) TEMP HOLD (Temporary HOLD) denotes that the duration of the display on the DSKY (non-flashing) is controlled by the AGC.
 - d) POSS HOLD (Possible HOLD) denotes that the display is a possible path taken by the AGC.
 - e) MON (Monitor) denotes that the displayed data is automatically updated and displayed by the AGC.
 - f) SNAP denotes that the displayed data is not automatically updated (monitored) by the AGC.
- 2) AGC The sequence logic and interface relationships of the
- 3) Ground AGC logic, ground operations and crew activities.
- 4) Crew

5) A line count is provided on the far right hand side of the page.

The reproductions of IBM printrouts in Section 4.4 is deliberately not paginated. Reference to the material on these pages is accomplished by using title and line numbers.

APOLLO COMPUTER LOSTS SHECKLIST INTERFACE

"CHE OCOLUS NON VIDET, COS NIN DOLFT."

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THIS LIST PERRESPATS THE PROGRAMS AND POUTIVES DIABRAMMED IN SECTION 4.4.2 FOR PROGRAM SUNDANCE. 4.4.1

04/32/68

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CDAST	20	RENDEZVOUS NAVIGATION
	21	SPOUND TRACK DETERMINATION
	22	*
	23	*
	24	*
	25	PREFERRED TRACKING ATTITUDE
	26	*
	27	LGC UPDATE
	28	*

INDEX/SDN

26

29

PRE- THRUSTIN	30	EXTERNAL DELTA V
INKUSTIN	31	*
	32	CO-ELLIPTIC SEQUENCE INITIATION (CSI)
	33	CONSTANT DELTA ALTITUDE (CDH)
	34	TRANSFER PHASE INITIATION (TPI)
	35	TPANSFER PHASE MIDCOURSE (T24)
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REQUEST
AJTOMATIC
LINAL

IMJ STATJS CHECK

DAP DATA LOAD

RR/LP SELF TEST

RP MANUAL ACQUISITION

RP DESTGNATE 22 DATA 2FAD

1 1 1

RR MONITOR RR SEARCH

27	
28	*
2.9	*
30	TRRIT PAPAMETER DISPLAY
31	REPORTED STEMPARA SUCVESSORS
32	TAPGET DELTA V
33	LGC/CMC CLOCK SYNCHRONIZATION
34	
35	*
36	RENDEZVOUS OUT-OF-PLANE DISPLAY
37	*
38	*
39	*
40	*
41	
42	*
43	*
44	*
45	*
46	*
47	AGS INITIALIZATION
48	*
49	*
50	CCARSE ALIGN
51	INFLIGHT FINE ALISY
52	AUTO OPTICS POSITIONING
53	INFLIGHT SIGHTING MARK

INDEX/SDN

CHANGE COMTRAL NOTES: LOGIC REV 23 POP NASA 103

NOS
ASSEMBLY
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177
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ENITICE
3 <u>.</u>
PFNSRAM
THIS

SIGHTING DATA DISPLAY	SYRO TOPQUING	* !	** 1	***************************************	#\	ATTITUDE MANEUVER	PREFERRED TRACKING ATTITJDE	CPFW-DEFINED MANEJVER	BENDEZVOUS FINAL ATTITUDE	# 	*	#	**	***	**	**	**	## 	**	#2 	#P	## 	13 Supplied FEST
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CHILD	
MUJ UT	100
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4.4.2

LGC LUBIC/GROUND/CRFW INTERFACE DIABRAMS FOR PRICRAM SUNDANCE.

APOLLO COMPUTER LOGIC CHECKLIST INTERFACE

LGC IDLING PROGRAM (POO)

LOGIC **REV 05** 04/16/58

PURPOSE:

- (1) TO PROVIDE A PROGRAM TO FULFILL THE FOLLOWING REQUIREMENTS:
 - (A) PROVIDE AN INDICATION TO THE CREW THAT THE LGG IS ENGAGED IN NO CONTROL OR COMPUTATIONAL OPERATIONS WHICH MIGHT REQUIRE CONSIDERATION FOR COORDINATION WITH OTHER CREW TASKS IN PROGRESS.
 - (B) MAINTAIN THE LGC IN A CONDITION OF READINESS FOR ENTRY INTO ANY OTHER PROGRAM.

- ASSUMPTIONS: (1) THE LGC IS ON.
 - (2) THE IMJ MAY OR MAY NOT BE ON. IF ON THE IMJ IS INEPTIALLY STABILIZED BUT NOT NECESSARILY ALIGNED TO AN ORIENTATION WHICH IS KNOWN TO THE LGG.
 - (3) THE DAP IS AVAILABLE FOR MANUALLY CONTROL FO ATTITUDE MANEUVERS IF THE IMU IS DN. IF ATTITUDE MANEUVERS ARE MADE BY THE CREW CARE MUST BE TAKEN TO AVOID IMJ GIMBAL LOCK BY OBSERVING THE IDDUS (V16 N20) OR BY MONITORING THE FDAI BALL (THE BALL REPEATS IMU GIMBAL ANGLES ONLY WHEN PENCS IS SELECTED).
 - (4) DURING THIS PROGRAM THE LGC ERASABLE STORAGE MAY BE INITIALIZED BY KEYING IN V36F (FRESH START). THIS WOULD BE DONE DALY WHEN THE CONTENT OF THE LGC ERASABLE STORAGE IS IN QUESTION. IF THIS ENTRY IS PERFORMED THE LGC KNOWLEDGE DE THE PRESENT IMU DRIENTATION (REFSMMAT) IS INVALIDATED.
 - (5) DURING THIS PROGRAM THE COASTING INTEGRATION ROUTINE WILL JPDATE THE LM AND CSM STATE VECTORS TO APPROXIMATELY THE CURRENT TIME AS DESCRIBED IN SECTION 5.6.11 OF 3557.

++ +06

- (6) STATE VECTOR INTEGRATION IS INHIBITED FOR 10 MINUTES FOLLOWING V96E. JSEAGE OF V96 CAN CAUSE INCORRECT W MATRIX EXTRAPOLATION SINCE STATE VECTOR SYNCHRONIZATION IS NOT MAINTAINED.
- (7) THE PROGRAM IS MANUALLY SELECTED BY THE ASTRONAUT BY DSKY ENTRY.

LGC GROUND CHECKLIST TOTAL PROG CREN TIME TIME CUNT

> CREW PRIG SELECTION

START LGC IDLING PROGRAM (POD) DISPLAY PROGRAM 00

KEY IN LGC IDLING PROGRAM (200) V37E DDE

#10

#20

NJNIFA DSKY: DBSERY JISPLAY 3F. #30

440

#20

IS QUIT FLAS SET?	>	•	•	RESET OUTT FLAG.		•	ANT OF TIAM		•	•	START COASTING IN- TEGATION ROUTINE AS
15 2017	7			. RESET		•	OL TIVM		٠		START CO TEGATION

LUGIC REV 06 PCN - MIT - 15

POO/SUNDANCE

#10

APOLLO COMPUTER LOGIO CHECKLIST INTERFACE

LGC POWER DOWN PROGRAM (PO6)

LOGIC REV 09 05/13/68

PURPOSE:

(1) TO TRANSFER THE LGC FROM THE OPERATE TO THE STANDBY CONDITION.

- ASSUMPTIONS: (1) THE VORMAL CONDITION OF READINESS OF THE PONCS WHEN NOT IN USE IS STANDBY. IN THIS CONDITION THE IMU STANDBY CIRCUIT BREAKER IS ON, THE IMU OPERATE CIRCUIT BREAKER IS DEF, THE LGC/DSKY CIRCUIT BREAKER IS ON AND THE STANDBY LIGHT ON THE DSKY IS ON. IN THIS CONFIGURATION BOTH THE IMJ AND LGC ARE DEF WITH POWER DNLY APPLIED TO THE IMU HEAT. CONTROL SIRCUITRY AND THE LGC TIMING SIRCUITRY.
 - (2) A POSSIBLE CONDITION OF READINESS OF THE PONCS WHEN NOT COMPLETELY DN IS THE SAME AS STANDBY (1) ABOVE, EXCEPT THAT THE STANDBY LIGHT ON THE DSKY IS OFF. IN THIS CONFIGURATION THE LGC IS RUNNING FOR COMPUTATIONAL PURPOSES THAT DO NOT REQUIRE THE IMU.
 - (3) IF THE COMPUTER POWER IS SWITCHED OFF IT WILL BE NECESSARY TO PERFORM A COMPUTER FRESH START (V36E) TO INITIALIZE THE EPASABLE STORAGE. THE LGC JPDATE PROGRAM (P27) WAS TO BE DONE TO UPDATE THE LM AND CSM STATE VECTORS AND COMPUTER CLOCK TIME.
 - (4) THE LGC IS CAPABLE OF MAINTAINING AN ACCURATE VALUE OF GROUND ELAPSED TIME (GET) FOR ONLY 23 HRS WHEN IN THE STANDBY MODE. IF THE LGC IS NOT BROUGHT OUT OF THE STANDBY CONDITION TO THE RUNNING CONDITION (SEE (2) ABOVE) AT LEAST ONCE WITHIN 23 HOURS THE LGC VALUE OF GET MUST BE UPDATED.
 - (5) ONCE THE PROGRAM HAS BEEN SELECTED THE LGC MUST BE SHUTDOWN. AFTER POS SELECTION THE LGC WILL NOT HONOR A NEW PROGRAM REQUEST (V37E--E), A TERMINATE (V34E) OR AN ENTER IN RESPONSE TO THE LGC REQUEST FOR LGC STANDBY.
 - (6) THE PROGRAM IS SELECTED BY THE ASTRONAUT BY DSKY ENTRY.

CHECKLIST TIME TOTAL PROG L GC GROUND CREA CONT TIME

> . CREW PROG SELECTION

START LGC POWER DOWN PRIGRAM (PO6) DISPLAY PROGRAM 06 KEY IN LGC POWER DOWN PROGRAM (POS)

V37F 05E

#10

	*		MONITOR OSKY: OBSERVE DISPLAY OF PROGRAM OF					*	
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+09	RESET IMUSE FLAG		•					v.	
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HOLD .	FLASH VERB-NOUN TO REQUEST PLEASE PUT LGC IN STANDAY: V50 N25 R1-00062		MONITOR DSKY: DBSERVE VER3-NDJN FLASHING TO REQUEST- PLEASE PJT LSC IN STANDBY:						#50
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	R3-BLANS	•	•						
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	•	•	•						191
	WAIT FOR KEYBOARD ENTRY		KEY IN PROCEED (STANDBY) BUTTON		*				#60
	A CONTRACTOR	· ·							
		•	•						
		•	•	393					
190		•							
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	× ×	· a a	EXIT PO6						
		•					*	PO6/SUNDANCE	=
		•						PUB/SUNDANCE	
26		•							

PO6/SUNDANCE

#70

#80

#90

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TERMINATE FLASH UPON
RECEIPT OF STANDBY
ENTRY

STANDBY ENTER
ENTRY OR
(PROCFED) TERM-
INATE

PUT LGC IN STANDBY

EXIT P06
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CHANGE CONTROL NOTES
LOGIC REV 08 PCN MIT - 65
LOGIC REV 09 PCN-MIT - 139

APOLLO COMPUTER LOGIC CHECKLIST INTERFACE

RENCEZVOUS NAVIGATION PROGRAM (P20)

LOGIC REV 14 01/17/69

PURPOSE:

- (1) TO CONTROL THE LM ATTITUDE AND THE RENDEZVOUS RADAR(RR) TO ACQUIRE AND TRACK THE CSM WITH THE RR WHILE THE LM IS IN FLIGHT.
- (2) TO UPDATE FITHER THE LM OR CSM STATE VECTOR (AS SPECIFIED BY THE ASTRONAUT BY DSKY ENTRY) ON THE BASIS OF RR TRACKING DATA.
- (3) TO POINT THE LM OPTICAL BEACON AT THE CSM.
- (4) TO TRACK THE CSM WITHOUT UPCATING EITHER VEHICLE STATE VECTOR.

- ASSUMPTIONS: (1) THE ISS MAY BE IN STANDBY OR OPERATE. THE IMU WOULD NORMALLY BE ON AND THE IMU DRIENTATION DETERMINATION PROGRAM (P51) COMPLETED BEFORE THE SELECTION OF THIS PROGRAM. NO PREFERRED DRIENTATION IS SPECIFIED OR REQUIRED FOR THIS PROGRAM AS THE ATTITUDE MANEUVER ROUTINE (R60) CAN ALWAYS CALCULATE A VEHICLE ORIENTATION ABOUT A SPECIFIED +Z LM VECTOR (RR LOS) THAT CAN AVOID GIMBAL LOCK FOR ANY INEPTIAL IMU CRIENTATION. THE ISS THUS MAY BE:
 - (A) CFF (STANDBY).
 - (B) CN, AND NCT ALIGNED SINCE TURN ON.
 - (C) ON AND AT AN INERTIAL ORIENTATION KNOWN ONLY INACCURATELY BY THE LGC, I.E. HAVING BEEN ALIGNED AT LEAST CNCE SINCE TURN ON BUT HAVING DRIFTED FROM THE STORED ALIGNMENT.
 - (D) ON AND AT AN INERTIAL ORIENTATION KNOWN ACCURATELY BY THE LGC.
 - IF (A) IS TRUE A PRCGRAM ALARM WILL BE MADE BY THIS PROGRAM.
 - IF (B) IS TPUE A PROGRAM ALARM WILL BE MADE BY THIS PROGRAM.
 - IF (C) IS TRUE THE LGC MAY OR MAY NOT HAVE A SATISFACTORY INERTIAL REFERENCE TO ACCURATELY COMPLETE THE PROGRAM.
 - IF (D) IS TRUE THE LGC HAS A SATISFACTORY INERTIAL REFERENCE TO ACCURATELY COMPLETE THE PROGRAM.
 - (2) THE CSM IS MAINTAINING A PREFERRED TRACKING ATTITUDE FCR RR TRACKING BY THE LM, THIS PREFERRED ATTITUDE CORRECTLY ORIENTS THE CSM RADAR TRANSPONDER.
 - (3) AT THE BEGINNING OF THE PROGRAM THE STATE VECTOR UPDATE OPTION IS AUTOMATICALLY SET TO THE LM. THIS OPTION MAY BE CHANGED AT ANY TIME LATER BY CNE OF THE FOLLOWING MANUAL ENTRIES:

V80E LPDATE LM STATE VECTOR V81F UPDATE CSM STATE VECTOR V95E NO STATE VECTOR UPDATE

- (4) THE PENDEZVUS RACAR IS ON, PRELIMINARY CHECKOUT HAS BEEN COMPLETED AND THE RADAR IS UNDER PONCS CONTROL.
- (5) THE OPERATION OF THE PROGRAM INCLUDES THE FOLLOWING FLAGS:

RENDEZVOUS FLAG- CONTROLS THE PERMANENT TERMINATION OF THE TOTAL RENDEZVOUS NAVIGATION PROCESS. THIS PROGRAM WILL ONLY RUN OR RESUME RUNNING WHEN THIS FLAG IS SET. SET BY P20 SELECTION. RESET BY SELECTION OF LGC IDLING PROGRAM (POO) OR BY V56F.

TRACK FLAG- CONTROLS THE TEMPORARY TERMINATION OF THE TOTAL PENDEZVOUS NAVIGATION PROCESS. RESET OF THIS FLAG INTERRIPTS THE AUTOMATIC ATTITUDE MANEUVER/RADAR DESIGNATE/TRACK PROCESS, AS WELL AS THE STATE VECTOR UPDATE PROCESS. THE SET OF THIS FLAG ENABLES ALL THESE PROCESSES.

UPDATE FLAG- CONTROLS THE TEMPORARY TERMINATION OF THE STATE VECTOR UPDATE PROCESS ONLY.

STATE VECTOR FLAGS (LM AND CSM) - DEFINES THE STATE VECTOR TO BE UPDATED BY THIS PROGRAM. SEE ASSUMPTION(3).

MANUAL ACQUIRE FLAG - BYPASSES RR DESIGNATE ROUTINE (R21) IF CSM HAD BEEN ACQUIRED BY MANUAL ACQUISITION ROUTINE (R23).

SEARCH FLAG - BYPASSES RR DESIGNATE ROUTINE (R21) IF CSM HAD BEEN ACQUIRED BY RR SEARCH ROUTINE (R24).

NO UPDATE FLAG - WHEN SET TERMINATES STATE VECTOR UPDATING. SET BY V84F SELECTION OF TARGET DELTA V ROUTINE (R32) OR BY KEYING IN V95E. RESET BY KEYING IN V80E (UPDATE LM STATE VECTOR) OR V81E (UPDATE CSM STATE VECTOR).

SURFACE NAVIGATION FLAG - SET BY SELECTION OF P22, RESFT BY SELECTION OF P20.

- (6) THE INITIALIZATION OF THE W MATRIX (SEE SECTION 5.2.4.2 OF R557) IS ENABLED BY:
 - (A) A MANUAL ESKY ENTRY (V93E).
 - (B) COMPUTER FRESH START (V36E).
 - (C) STATE VECTOR UPCATE FROM THE GROUND (P27).
- (7) THE RR TRACKING MARK COUNTER COUNTS THE NUMBER OF RR MARKS PROCESSED BY THE LGC. THIS COUNTER IS ZEROED BY:
 - (A) MANUAL SELECTION CF P20 (V37E20E).
 - (8) COMPLETION OF THE TARGET DELTA V ROUTINE (R32).
 - (C) SELECTION OF A NEW PROGRAM FROM A PROGRAM WHICH HAD TURNED ON AVERAGE G.
 - (D) INITIALIZATION OF THE W MATRIX (SEE (6) ABOVE).
- (8) THE CREW MAY MANUALLY ADJUST THE LGC-STORED VALUES OF RR SHAFT AND TRUNNION BIAS BY A DIRECT LOAD OF FOUR REGISTERS TO BE SPECIFIED. HOWEVER, UNLESS THE RR HAS BEEN JARRED, THE LGC BIAS ESTIMATE SHOULD BE MORE ACCURATE THAN THAT FROM ANOTHER SCURCE.
- (9) THIS PROGRAM IS SELECTED BY THE ASTRONAUT BY DSKY ENTRY. IT MAY BE TERMINATED BY THE SELECTION OF THE LGC IDLING PROGRAM (POO), TERMINATION OF RR SEARCH ROUTINE (R24), V56E OR BY A V34E RESPONSE TO A FLASHING P20 DISPLAY. POO SELECTION WILL TERMINATE P20 AND ANY OTHER PROGRAM IN PROCESS AND ESTABLISH POO. ALL OTHER PROGRAMS SELECTED WILL CHANGE THE PROGRAM NUMBER DISPLAYED ON THE DSKY BUT WILL NOT TERMINATE P20. THIS PROGRAM IS THEREFORE DESIGNED TO OPERATE AUTOMATICALLY AND SIMULTANEOUSLY WITH ANOTHER PROGRAM WITHOUT REQUIRING USE OF THE DSKY UNLESS NON-NOMINAL CIRCUMSTANCES REQUIRE LGC COMMUNICATION WITH THE ASTRONAUT. IF V56 OR V34 IS KEYED INTO THE DSKY AND P20 IS THE ONLY PROGRAM IN PROCESS, THE FINAL AUTOMATIC REQUEST TERMINATE ROUTINE (ROO) WILL BE INITIATED.

3 (43) PROG CONT	LGC	GROUND	CPFW		CHECKLIST	TIME	TOTAL TIME
					4		
			• CREW • PROGRAM • SELECTION				
	START PENDEZVOUS NAVIGATION PROGRAM (P20).	•	KEY IN RENDEZVOUS NAVIGATION PROGRAM (P20) V37E20E				#10
	DISPLAY P20		•				
			MONITOR DSKY: OBSERVE DISPLAY OF P20				#20
	•		•				
	RESET SURFACE NAVIGATION FLAG.						
	:		:				#30
	(NOTE: FRCM THIS PCINT ON THE LGC LOGIC DESCRIBES BOTH THE RENDEZVOUS NAVI-		(NOTE: ALL LOGIC IN THE CREW COLUMN IS ONLY THAT ASSOCIATED WITH THE RENDEZVOUS				
*	GATION PROGRAM (P20) AND THE LUNAR SUP- FACE NAVIGATION PRC- GRAM (P22). CNLY THAT LOGIC ASSOCIA-		NAVIGATION PROGRAM				-#40
	TED WITH P20 IS PER- TINENT HERE HOW- EVER).		•	į.		,	
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P20/SUNDANCE

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DO IMU STATUS CHECK	 DC IMU STATUS	CHECK				
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•	•					
SET RENDEZVOUS FLAG	•					#60
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SET TRACK FLAG	•					
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SET UPDATE FLAG	•				×	
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RESET SEARCH FLAG	•					
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ZERO RR TRACKING	•					
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RESET NO ANGLE	•					#100
MONITOR FLAG.	•					#100
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44)

+14

+14

+EDIT

#110

#120

#130

#140

#150

P20/SUNDANCE

IS SURFACE NAVIGA-TICN FLAG SET? . SET STATE VECTOR . UPDATE OFTION TO SET STATE VECTOR UPDATE CPTICN TO INTEGRATE BCTH PER-MANENT STATE VEC-TCRS TO PRESENT TIME USING PRECISION INTEGRATION. 80 V 88 . ENTER . HERE . FRCM

• SEARCH • ROUT-• INE • (R24)•

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TI d3+	CSM STATE	VECTORS TO	•	•			*				
+		TIME USING	•	•							
++	KEPLER (C		•	•							#160
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		•	•		ENTER H	ERE					
		•	•		FRCM RR						
.7	CALCULATO		•	•	SEARCH						
		E LCS VECTOR	•	•	ROUTINE (R24)						
		EATER THAN	•	•	•						
	400 NM?										#170
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PRIO											
HOLD .		VERB-NCUN		. MONITOR							
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SNAP	. AND DI	SPLAY ALARM		DISPLAY							#180
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P20		

#220

#230

#240

#250

#260

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	• E •		IN PROCESS. IF	•			
• 6	•C •		NO OTHER PRO-	•			
• E	. Y .		GRAM IS IN PRC-	•			
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IS IN PROCE	ESS			•			
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RCUTINE				-			
(R21).				-			
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P20/SUNDANCE

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	ROUTINE	•		(R61).						
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•	(R22).	•	•	•	RFA	n				
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(48)

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(49)		•	•	•		
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POSS	FLASH VERB-NCUN		MONITOR DSKY:			
PRIO	TO REQLEST RES-		DOES VERB-N	CUN		
HOLD .	PENSE AND DIS-		FLASH TO REQU			
			RESPONSE AND			
SNAP .	INDICATING IM-		ALARM CODE OO			
S. (A.)	PROPER REMOVAL		INDICATING TH			#340
	CF RR FROM AUTO		HAS BEEN IMPR			#540
	. MCDE.	•				
			SWITCHED OUT	CF AUTO		
	V05NC9		MODE?			
	R1 00514	•				
	R2 XXXXX		. Y	N.		
	P3 XXXXX	•	•	•		
			•	•		
	• •					
			DO I WISH TO	•		
			RESELECT RR			#350
			AUTO MODE AND			
	WAIT FCR KEY-	1 1	CONTINUE WITH			
	BCARC ENTRY		AUTOMATIC P20			
	• DEPARE ENTRY	•	OPERATION?	•		
	• •	•	UPERATION:	•		
	• •	•				
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	• •		SWITCH TO			#360
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			KEY IN	5 5		
			PPOCFED			
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P20/SUNDANCE

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		200			. KEY IN TER					
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			. TERMINATE FLASH		MINATE .					
		_	. UPCN RECEIPT	_	(V34E) .					#380
				•	(4) 7 ()					#30U
		•	. OF PROCEED OR	•						
		•	. TERMINATE							
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			.EXIT .		<u>.</u>					
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			•P20/P22 •	•	•					
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	HOLD .		FLASH VERB-NCUN	Mr	ONITOR DSKY:					
	HULD .			a a m						
			TO REQUEST PLEASE		IS VERB-NOUN					
	SNAP .	_	PERFORM SELEC-		LASHING TO REQUEST					#410
	JIMI .									4410
			TION OF RR AUTO	• • • SI	ELECTION OF RR AUTO			*		
*		-	MCDE:	_ MI	ODE?					
				•	C/OL:					
			V50N25	•						
		•	R1-00201	. (1	NOTE: (1) THE MAN-					
		•								
			R2-BLANK	•	UAL ACCUISITION					
			R3-BLANK		ROUTINE (R23) MAY					
		-					-			
				•	ONLY BE CALLED FROM					
					THIS DISPLAY (EN-					
		-	•							
			•		TER). THIS DISPLAY					
					IS NOT CALLED IF					#420
		-	-							
			•		THE RR MODE SWITCH					
					IS IN LGC. THERE-					
					FORE IF R23 IS DES-					
			•							
			•		IRED THE RR MODE					
		Contract Con	-		SWITCH MUST BE CUT			*		
			•							
			•		OF THE LGC POSITION					
		200	-		BEFORE THE LGC PRO-					
		•	•							
			•		GRAM CHECKS THE					
			2		AUTO MCDE DISCRETE.					
			•	•	AUTO MEDE DISCRETE					
			•							#430
									P20/SUNDANCE	
		•	•	•					LOT SCHUANCE	
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P20/	SUNE	ANCI
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	(2)	THE	DD
MUST	BE I	N THE	
OTUA	MCDE	(LGC	
POSIT	ION)	FOR	AUTO-
MATIC	P20	OPER	AT-
ION.			

(3) WHENEVER
THE PR AUTO MODE
DISCRETE IS PRESENT
THE LGC WILL CALL
THE RP MONITOR POUTINE (R25) AS DESCRIBED IN SECTION
5-2-4-3 OF R557).

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DO	I	WI	SH	TO	
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MΔ	NU	L			
AC	001	SI	TI	CN?	
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PUT	RR	
MODE	-	
SWIT	ГСН	TO
LGC.		

. KEY IN PROCEED

#440

#450

#460

#470

#480

P20/SUNDANCE

. WAIT FOR KEY-. BOARD ENTRY.

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	TERMINATE FLASH		•	<u>.</u>
		• •		•
	UPON RECEIPT OF		KEY IN FATER	
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	PRCCEED OR ENTER	• •		•
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	IS THE SURFACE	•	•	•
	NAVIGATION FLAG	•		
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	SET?	•	•	•
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	SITICN RCUTINE			
	10331	•	•	•
	(R23)	•		•
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	•	•	•	· #520
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	CET THE MANUAL	-	•	•
	SET THE MANUAL	•	•	•
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	•	•	•	P20/SUNDANCE
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	201			
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12 (52)

P20/SUNDANCE

#540

#550

#560

#570

#580

P20/SUNCANCE

	•	•	•					P20/SUNDANCE	
•	•	XIT	•						#590
•		0/22	•	•					4590
•	•	• • • •	•	•					
•	IS TRACK FL SET?	AG .	ENTER . HERE . FROM RR . DATA . RFAD .	•					#600
•	. WAIT		ROUTINE . (R22)	•			,		
•			• •	:			*		#610
•	•	*	•	• • •					
•	•			• • •	•				
•	DC RR DESI NATE ROUTI (R21)		MONITOR THE VEH ATTITUDE AND TH DSKY. THE ATTITUDE MANEUVER/RR DES	HE E	•	* *			#620
•	•		MARK/STATE VECTUPDATE PROCESS NOW AUTOMATIC. THE LGC WILL OF	TOR IS	•				
WAIT	2.5 SEC.		CCMMUNICATE WIT ASTRONAUT DURIN THIS PROGRAM:	TH THE					#630
	R CATA READ		 (1) WHEN A I ENTRY OF VI- IS MADE TO I QUEST A DISI CF THE NUMBI	6N45F RE- PLAY			*		
	•		MARKS (M). DISPLAY WILL TAIN M IN R THIS DISPLA ALSO BE USE	THIS L CON- 1. Y MAY	•				#640
	•		OBTAIN THE	TIME				P20/SUNDANCE	
	•				•				

14 (54)

THE NEXT BURN (R2-TFI) AND THE MIDDLE GIMBAL ANGLE WHEN THE IMU IS CN AND THE +X LM AXIS IS ALIGNED WITH THE INITIAL THRUST VECTOR (R3-MGA). IF NO BURN HAS BEEN DEFINED R2 AND R3 WILL BE MEANINGLESS. CONTROL OF THE DSKY DISPLAY IS RETURNED TO THE LGC BY PUSHING KEY PELFASE.

#660

#650

(2) WHEN THE DATA
GOOD DISCRETE
LAPSES DURING THE
DATA READ ROUTINE
(R22), A TRACKER
FAIL ALARM AND A
PROGRAM ALARM RESULT. NO DISPLAY
INTERRUPTION OCCUPS. AN ALARM
CODE (00521) IS
STORED WHICH MAY
BE IDENTIFIED BY
V05 N09.

#670

(3) WHEN THE RR
AUTO MODE DISCRETE IS NOT PRESENT IMMEDIATELY
PRIOR TO RR DESIGNATION THE LGC
GRABS THE DISPLAY
AND REQUESTS THIS
DISCRETE-

#680

(4) WHEN THE RR AUTO MODE DIS—
CRETE IS NOT PRE—
SENT IMMEDIATELY
PRIOR TO A DATA
READ SECUENCE
DURING THE DATA
PEAD ROUTINE
(P22) THE LGC
GRABS THE CISPLAY
AND REQUESTS THIS

#690

DISCRETE.

(5) WHEN THE LGC
DETERMINES THAT
THE ACTUAL RR LOS
DIFFERS FPCM THE
LGC CALCULATED
LOS BY MORE THAN
3 DEGREES AFTER
A DATA READ SEQUENCE THE LGC
GRABS THE DISPLAY
AND DISPLAYS AN
ALARM CODE
(00525).

(6) WHENEVER AN ATTITUDE MANEUVER TO THE PREFERRED ATTITUDE IS REQUIRED THE LGC GRABS THE DISPLAY AND DISPLAYS THE FINAL BALL ANGLES (N18) (SEE ATTITUCE MANEUVER ROUTINE R60).

(7) WHEN THE LGC
FAILS TO RECEIVE
THE DATA GOOD
DISCRETE FROM THE
THE RR WITHIN
APPROXIMATELY 45
SECONDS OF THE
INITIATION OF A
DESIGNATE SEQUENCE THE LGC
GRABS THE CISPLAY
AND DISPLAYS AN
ALARM CODE
(00503).

(8) WHEN THE
MAGNITUDE OF A
STATE VECTOR CORRECTION IS GREATER THAN THE ALLOWABLE LIMITS (AS
DEFINED IN SECTION 5.2.4.2.2 OF
R557) THE LGC
GRABS THE DISPLAY
AND DISPLAYS THE
EXCESSIVE UPDATE

#700

#710

#720

#730

#740

#750

P20/SUNDANCE

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•	•	P20/SUNDANCE
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•	0404457500	
•	PARAMETERS	
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•		#760
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•	DC I DESIRE TC .	
•	TERMINATE P20? .	
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•	.Y .N .	
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•	•	#770
•		
•	DO I DESIRE TO	
•	SFLECT LGC IDLING	
•	PROGRAM (POO)?	
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•	• Y	
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•	• •	
WAIT FOR KEYBOARD .	SELECT LGC .	#780
ENTRY.	• ICLING PRC-	
•	GRAM (POO)	
	KEY IN .	
	V37E00E .	
	•	
RESPOND TO V56E CR .	• •	
V37E0CE	KEY IN	
IMMEDIATELY	. V56E	#790
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i i		
	•	#800
RESET THE .	•	
RENDEZVOUS, .		
SURFACE .	•	
NAVIGATION, . TPACK, AND .	•	
UPDATE FLAGS	:	
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		P20/SUNDANCF

P20/SUNDANCE

#810

IS P20 THE ONLY PROGRAM RUNNING?

. N

EXIT P20

#820

DO FINAL AUTOMATIC REQUEST TERMINATE RCUTINE (ROC). (NCTE: ENTRY INTC ROO DIFFERS FOR CREW PROGRAM SELECTION AND LGC ROUTINE SELECTION).

EXIT . P20/P22 .

IS P20/P22 THE

ONLY PROGRAM

RUNNING?

(NOTE: ENTRY INTO ROO DIFFERS FOR CREW PROGRAM SELECTION AND LGC ROUTINE SELECTION).

DO FINAL AUTOMATIC

REQUEST TERMINATE

RCUTINE (ROO).

#830

EXIT P20/P22

EXIT P20

#840

CHANGE CENTREL NOTES

LOGIC REV 12 PCN MIT - 65 LOGIC REV 13 PCN - MIT - 95 + PCN MIT - 110, PCR 97.1 LOGIC REV 14 PCN 658, EDITCRIAL CORRECTIONS

APOLLO COMPUTER LOGIC CHECKLIST INTERFACE

	C2 O1	IND TO ACK DET	TENNINATION DESCRIPTION	10211	1.0015	. 251/ 02	11/27//7		
	(38)	JIGH IKASA JET	FERMINATION PROGRAM	(12/1)	LOGIC	3EV 09	11/27/67		
					<i>3</i> 1				
PURPUSE:	(1)	TO PROVIDE	THE ASTRONAUT DETAI	LS OF HIS GROUN	D TRACK WITHOU	JT THE NEED	FOR GROUND COMMUNICA	.NCITA	
MCITAMUSSA	S: (1)	THIS PROGRA	AM MAY BE SELECTED WITHE CSM.	HILE THE LM IS	EITHER IN EART	TH OR LUNAR	ORBIT TO DEFINE THE	GROUND TRACK O	F EITHER
	(2)		AM ASSUMES THE VEHIC ME UNTIL T LAT LONG.	LE WHOSE GRIJNO	TRACK PARAMET	TERS ARE CAL	I NIAMAN CT CATALUS	FREE FALL FRO	M THE
	(3)	THE PROGRAM	1 IS SELECTED BY THE	ASTRONAUT BY D	SKY FNTRY.				,
PPOG CONT		LGC	GNUCSS	CREW			CHECKLIST	TIME	TDT AI
								*	
					A GRAM ECTION				
	DETERMIN PR-)GRAM		·	KEY IN GROUN DETERMINATIO PROGRAM (P21 V37E21F	И				#10
				DBSERVE DISP PROGRAM 21					
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			•					P21/SUNDANCE	
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		(B) (B)		-	-				

#30

05#

MONITY DSKY: 18 SERVE VENE-NOUN FLASH, TO PEOMEST RESDINS AND FISOLAY OF OPTION CODE FOR ASSUMED VEHICLE (14) OR CSM)	IS THE VEHICLE (LM) OR CSM) ASSJMPTION	2356F7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	DESIA DESIA VEHISLE
MONITAL DBSERVE FLASHLTA CT CT C	IS THE V OR CSM V OR SECT?		
FLASH VERS-40.04 TO PEOULE T PESPINASE AND DISPLAY (PTI)N GOOF FOR ASSUMED VEHICLE (LITE CS4): YC4 NC6 21-00.00 2 R2-00.00 X R3-9LANK FI IS THE OPTION COOF OR ASSUMED VEHICLE (LM 3% CS4).	P 2 IS THE LG2 ASSUM- P 3 DOTTON: P 3 DOTTON: P 4 DOTTON: P 6 CSM) P 7 CSM) P 6 CSM) P 7 CSM) P 7 CSM) P 7 CSM) P 7 CSM)	FOR KEY3GARD	A A A A A A A A A A A A A A A A A A A
HOLS FLASH PFDUF PFDUF PFDUF AS	+ 60 000 + 6000 000 000 000 000 000 000	INT TTE	۰،۲۰

#50

#50

02#

221/SUNDANCE

#130

921/SUNDANCE		P21/SUNDANCE
	MONITOR DSKY: 985ERVE VERB-VJUV FLASH TO REJEST RESPONSE AND DISPLY OF T LAT LONG 1S THIS THE T LAT LONG I DESIRE? V N	
** • • •		
	STOPT CODE DATA STOPT CODE DATA STOPT CODE DATA ASH VERS-NOW TO OUEST RESPONSE AND SPLAY T LAT LONG: VOE N34 A1-T LAT LONG-HRS A1-T LAT LONG-HRS A2-T LAT LONG-HRS A3-T LAT LONG-HRS A2-T LAT LONG-HRS A2-T LAT LONG-HRS A3-T LAT LONG-HRS A3-T LAT LONG-HRS A3-T LAT LONG-HRS A1-T LONG-HRS A1-T LONG-HRS A1-T LONG-HRS A1-T LONG-HRS A2-T LAT LONG-HRS A3-T LAT LONG-HRS A3-T LAT LONG-HRS A3-T LAT LONG-HRS A3-T LAT LONG-HRS A1-T LONG-H	

#80

06#

001#

#110

#120

	7 COL 45 SEC. C. H. 165 750 10 SEC. AMERICAN		<ey in="" th="" v25<=""><th></th><th></th><th></th><th></th></ey>				
	OR NE DATA.	• •	· CASICAA · DESIRET				
•	.P .NEW		. LAT LONG				
	.R .DATA						
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•	· <u>· ·</u> ·	•		• •	*		
	.E STORE DATA	•	•	• •			#140
	.0						#140
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	EXTRAPOLATE STATE		•	•			
	VECTOR OF SELECTED		•	•			#150
	VEHICLE TO I LAT		•	•			,
	LONG. CALCULATE LATITUDE, LONGITUDE		•				
	AND ALTITUCE OF					*	
	VEHICLE AT T LAT		•				
	LONG.						
			•				
•	•		•	•			
							#150
	FLASH VERB-NOUN TO	•	:YXXC SCTINOM	•			
	REQUEST RESPONSE AND DISPLAY LATITUDE,		OBSERVE VERB-NOUN FLASH TO REQUEST RE	•			
	LUNGITUDE AND	•	SPONSE AND DISPLAY				
	ALTITUDE:		OF LATITUDE, LONGI-				
	V06 N43		TUDE AND ALTITUDE.				
	R1-LAT						
	R2-LONG R3-ALT		•	•			#170
	\3-AL1		:	•			#110
	LAT-LATITUDE OF						
	. VEHICLE. + IS NORTH.			•			
	IN DEGREES TO NEAR-		•	•			
	EST .01 DEGREE.		•	•			
•	LUNG-LONGITUDE OF						
	VEHICLE. + IS EAST.		•				
	IN DEGREES TO MEAR-		•	•			
•	FST .01 DEGREE.			•			#180
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	· ALT-ALTITUDE OF		•	• .			
	· VEHICLE ABOVE THE		•	:			
	. LAUNCH PAD PADIUS		•				1
	. (EARTH GRBIT) OR						
	. THE LUNAR RADIUS AT			•			
++ +06	 THE MOST RECENTLY DEFINED (SEE SECTION 		•	•			
++	. 5 OF R5571 LANDING		•	•			
	. SITE (LUNAR DEBIT).		:			#190	
	. IN NAUTICAL MILES						
	. TO NEAREST .1 NM.						
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			DO I WISH TO DETAIN				
	•		NEW PARAMETERS FOR				
			A T LAT LONG 10			#200	
	•		MINUTES FROM NOR OR NAME OF ANY OTHER THAN				
	: :		THAT WHICH APPLIES	•			
	: :		TO PRESENT DISPLAY?				
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	·			•		× *	
	. WAIT FOR KEYBOARD	-	WHEN FINISHED .	:		#210	
++	· FNTRY		WITH DISPLAY .			7.220	
+09	•	•	KFY IV .				
+	•		PROCEED .				
+	€ .			•			
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+							
+	. TERMINATE FLASH UPON	•	. WHEN FINISHED				
+	. RECEIPT OF PROSEED		. WITH DISPLAY KE			#220	
*	• OR RECYCLE	•	. IN RECYCLE V32E	-			
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P21/SUNDANCE

INCREMENT T LAT
LUNG BY 10
MINUTES

DO FINAL AUTOMATIC
PEQUEST TERMINATE
ROUTINE (ROO)

EXIT P21

EXIT P21

EXIT P21

EXIT P21

#250

#240

APOLLO COMPUTER LOGIC CHECKLIST INTERFACE

PREFEDED TRACKING ATTITUDE PROGRAM (P25)

LOGIC REV 11 06/13/68

PURPOSE:

- (1) TO COMPUTE THE PREFERRED TRACKING ATTITUDE OF THE LM WHICH ENABLES CSM TRACKING OF THE LM BEACON.
- (2) TO PERFORM THE MANEUVER TO THE PREFERRED TRACKING ATTITUDE.

- ASSUMPTIONS: (1) DURING THE PENDEZVOUS NAVIGATION PROGRAM (P20) THE LM ATTITUDE CONTROL IS INTIMATELY ASSOCIATED WITH THE RENDEZ-VOUS RADAR (RR). SHOULD RR MALFUNCTION PRECLIDE CORRECT OPERATION OF P20, THIS PROGRAM (P25) SHOULD BE SELECTED TO PROVIDE A LM PREFERRED TRACKING ATTITUDE.
 - (2) THE PREFERRED TRACKING ATTITUDE IS DEFINED AS FOLLOWS:
 - (A) THE LM +Z AXIS IS ALIGNED ALONG THE LOS TO THE CSM.
 - (B) THE ROLL ATTITUDE (ABOUT LM +Z AXIS) IS UNCONSTRAINED AND IS DEFINED IN 350 AS VECESSARY TO AVOID GIMBAL LOCK.
 - (3) THE ISS MAY BE IN STANDBY OR OPERATE. THE IMU WOULD NORMALLY BE ON AND THE IMU ORIENTATION DETERMINATION PROGRAM (P51) COMPLETED BEFORE THE SELECTION OF THIS PROGRAM. NO PREFERRED DRIENTATION IS SPECIFIED OR REQUIRED FOR THIS PROGRAM AS THE PREFERRED TRACKING ATTITUDE ROJIINE (R61) CAN ALWAYS CALCULATE A VEHICLE DRIENTATION ABOUT A SPECIFIED +Z LM VECTOR THAT CAN AVOID GIMBAL LOCK FOR ANY INERTIAL IMU ORIENTATION. THE ISS THUS MAY BE:
 - (A) OFF (STANDBY).
 - (B) ON, AND NOT ALIGNED SINCE TURN DN.
 - (C) ON AND AT AN INERTIAL ORIENTATION KNOWN ONLY INACCURATELY BY THE LGC. I.E. HAVING BEEN ALIGNED AT LEAST ONCE SINCE TURN ON BUT NOT WITHIN THE LAST 3 HRS.
 - (D) ON AND AT AN INERTIAL DRIENTATION KNOWN ACCURATELY BY THE LGC. I.E. HAVING BEEN ALIGNED WITHIN THE LAST 3 HRS.
 - IF (A) IS TRUE A PROGRAM ALARM WILL BE MADE BY THIS PROGRAM.
 - IF (B) IS TRUE A PROGRAM ALARM WILL BE MADE BY THIS PROGRAM.
 - IF (C) IS TRUE THE LGC MAY OR MAY NOT HAVE A SATISFACTORY INERTIAL REFERENCE TO ACCURATELY COMPLETE THE PROGRAM.
 - IF (D) IS TRUE THE LGC HAS A SATISFACTORY INFRTIAL REFERENCE TO ACCURATELY COMPLETE THE PROGRAM.
 - (4) THE LM TRACKING BEACON FIELD OF VIEW IS A 30 DEGREE HALF ANGLE CONE WITH THE CONE AXIS PARALLEL TO THE LM +Z AXIS.
- ++ +11
- (5) THIS PROGRAM IS SELECTED BY THE ASTRONAUT BY DSKY ENTRY. IT MAY BE TERMINATED BY THE SELECTION OF THE LGC IDLING PROGRAM (POO) V34E OR BY V56E. POO SELECTION WILL TERMINATE P25 AND THE PROGRAM IN PROCESS AND ESTABLISH POO.
- ALL OTHER PROGRAMS SELECTED WILL CHANGE THE PROGRAM NUMBER DISPLAYED ON THE DSKY BUT WILL NOT TERMINATE P25.

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	×	•SREW •PROGRAM •SELECTION				*
					•	
START PREFERRED TRACKING ATTITUDE PROGRAM (P25) DISPLAY P25	•	CEY IN PREFERRED TRACKING ATTITUDE PROGRAM (P25) V37E25E				,
	*	•				
		:				*
					4	
		MONITOR DSKY: OBSERVE DISPLAY OF PROGRAM 25.				
		•				
:						
DO IMU STATUS CHECK ROUTINE (RO2)	•	DO IMU STATUS CHECK ROUTINE (RO2)				
		•			* .	
•		•	*			
SET TRACK FLAG (SEE P20)		•				*
•		•				
•	*	•		*		
•		•				
SET P25 FLAG		•				
		•				
•		•				
						*
• •						
• •						
						P25/SUNDANCE
						P25/SUNDANCE

CPFW

GROUND

PPUG CONT

++ +10 + + + + +10 ++

66

LGC

TIME

TOTAL TIME

CHECKLIST

		9.		
P25/SUNDANCE				P25/SUNDANCE
	*	*		
	DO PREFERSED TRACK- ING ATTITUDE ROUTINE (R61) (NOTE: AHENEVER THE CSW IS NOT WITHIN 30 DEGREES OF THE LW +Z AXIS THE CGL WILL CALL R51.)			
	RED TSACK- UDE ROUTINE	5 FLAG SET?	EXIT P25 FLA3 SET?	
	DO PPEFERED ING ATTITUDE (R61)	IS THE P25	Y. Y. IS TRACK	

#80

06#

#50

IS LOS MORE THAN 30
DEGREES FROM THE
LM+Z AXIS?

.Y
.N

WAIT 60
SECONDS

DO I DESIRE TO
TERMINATE P25?
.Y
.N

DO I DESIRE TO SELECT LGC IDLING PROGRAM (POO)?

WAIT FOR KEY3 MARD

ENTRY.

SELECT LGC
IDLING PROGRAM
(P00).

KEY IN
V37E005

#110

#120

#130

#140

#150

P25/SUNDANCE

		•	. •					
		•				1	25/SUNDANCE	
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		•	٠					
PESPOND TO V56E						*	1941	
OR V37EOOF			EY IV					*
IMMEDIATELY.	•	•	V56E		*			
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0		•					*	#150
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RESET THE TRACK .		•	•				*	
FLAG, P25 FLAG .			•				*	
AND TERMINATE .	*							
THE PREFERRED .		•	•					#170
ATTITUDE TRACK ING ROUTINE .		•	•					
(R61).			•		*			
		•	•					
•		•	•					
: :		•	•					
IS P25 THE ONLY . PROGRAM RUNNING? .		. IS P25 TH						#180
								7100
.Y .N .		· · · · · · · · · · · · · · · · · · ·	Y .					
			•					*1
			•					
• EXIT 225 .	-	• EXIT	•					
		• P25	•					
			•					
								#190
DO FINAL AUTOMATIC		QUEST TERMI						
REQUEST TERMINATE POUTINE (ROD).		UTINE (ROD)						
(NOTE: ENTRY INTO		DTE: ENTRY					*	
ROO DIFFERS FOR		O DIFFERS F						
CREW PROGRAM SE- LECTION AND LGC		PASSESS WE CTION AND L		*				
ROUTINE SELECTION.)		UTINE SELEC				-20		
								# 2 2 2
:		•						#230
•		•						
•••								
EXIT P25		EXIT P25	5					
200 V C C C		2011 17						

PROG

TVEC

APOLLO COMPUTER LOGIC CHECKLIST INTERFACE

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LGC

LOGIC PEV 06 11/21/67

PURPOSE:	(1) TO INSERT INFORMATION INTO THE LGC VIA THE DIGITAL UPLINK BY TRANSMISSION FROM THE GROUND OR VIA THE DSKY KEYBOARD BY CREW MANUAL INPUT.
ASSUMPTIONS:	(1) THE LGC MUST OF IM THE OPERATE CONDITION. THE 1FJ MAY BE IN STANDBY OR OPERATE CONDITION.
	(2) LGC JPDATES ARE DE EDUR CATEGORIES:
	(A) PROVIDE A DECREMENT FOR THE LSC CLOCK AND THE ORBITAL INTEGRATION STATE VECTOR TIME TAGS, AND AN INCREMENT FOR TEPHEM (V70).
	(B) PROVIDE LOAD CAPABILITY FOR A BLOCK OF SEQUENTIAL ERASABLE LOCATIONS (1-18 INCLUSIVE LOCATIONS WHOSE ADDRESS IS SPECIFIED) (V71).
	(C) PROVIDE LOAD CAPABILITY FOR 1-9 INCLUSIVE INDIVIDUALLY SPECIFIED ERASABLE LOCATIONS (V72).
	(D) PROVIDE AN OCTAL INCREMENT FOR THE LGC CLUCK DNLY (V73).
	(3) A COMPLETE DESCRIPTION OF THE LGC UPLINK FORMAT IS INCLUDED IN SECTION 2 OF R557.
++	(4) THE JPLINK MAY BE BLOCKED BY PLACING THE VOICE/OFF/VOICE BU SWITCH TO VOICE BU.
++	(5) UPDATE IS ALLOWED IN THE LM ONLY WHEN THE LGC IS IN THE LGC IDLING PROGRAM (POO). P27 EXIT IS ALWAYS TO POO.
++ +03 ++	(6) THE PROGRAM IS MANUALLY SELECTED BY THE ASTRONAUT BY DSKY ENTRY OR BY THE GROUND BY UPLINK TRANSMISSION.

. CREW . PROG .SELECTION

. . .

CREW

CONFIRM UPDATE

APPAMETERS AND . SPECIFY PARAMETERS SYMISSION TIME AND CODRINATE TIME PREARE PARA . DE XMISSION. ENSUPE ACCEPT.

SARY GRUUND ACCEPT.

GROUND

#10

TOTAL

TIME

CHECKLIST

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. GR 1.1*VD · ppng .SILECTION #20 . NOTIFY CREW OF . VERIFY THAT UP-. INTENTION TO DATE WILL BE . UPDATE. SPECIFY . SATISFACTORY . PARAMETERS AND N.P.T. TIME, . COORDINATE TIME. WORK IN PRO-GRESS, AND LGC ACTIVITY. #30 -----WILL UPDATE BE DONE HILL JPDATE BE -ITAMOTUA -ITAMOTUA AUTOMATICALLY BY LCC CALLY BY LGC UP-UPLINK FROM GROUND LINK FROM GROUND OR MANUALLY BY CREW IR MANUALLY BY DSKY INPUT #40 CPFW DSKY INPUT ______ AUTO. . MAN CTUA. GO TO 13 V 12 BELOW #50 . RECEIVE AND TPANSMIT UP-DATE BY VOICEPECOPD UPDATE LINK TO CREW #50

P27/SUNDANCE

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#90

#100

#110

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P27/SUNDANCE

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		MONITOR DSKY: DDFS DISPLAY CF PROGRAW 27 INDICATE THAT AN JPDATE IS		SET UPLINK COAPONENT COLNTER TO CNE	
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#150

#170

#140

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•	OF INDEX IN	•	FROM	DISPLAY OF JPRUFF		
•	DRESS SPEC-	•	ABOVE			
	IFIED IN F3		•			
	AND DISPLAY:		•	•	*	#220
HOLD	V21 N01	•		•		
	R1-3LAVK	•	• • •	•		
SNAD	R2-UN-	•	•	•		
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27/SJNDANCE

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	. IN R3 AND			•		
HOLD .				•		
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•	FLASH VERBINOUN	• • • • • • • • • • • • • • • • • • • •	. MONITOR DSKY:	
	TO REQUEST LOAD		OBSERVE VERBINDUN FLASH TO REQUEST	
•	FIER IN MACHINE		LOAD OF OCTAL IDENT-	4505
	ADDRESS SPECIFI ED IN R3 AND		IFIER.	#500
HOLD	DISPLAY:	MUNITOR DOWN		¥
SNAP		. LINK: OBSERVE VERB/NOUN FLASH .	•	
SNAP	R2 UNCHANGED	. THE REQUEST LAND .	•	
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P27/SUNDANCE

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#630

#610

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#180

062#

008#

P27/SUNDANCE

MONITOR OSKY:
DBSERVE TERMINATION
OF P27 AND FISPLAY
OF PROSRAM OO

TERMINATE P27 AND GO TO POO *

... LINK: OBSERVE . TERMINATION JF 227, THE PETURN TD POO, AND REVESTON TO OPIGINAL (I.E. CJAST AND ALIGN JOWNLINK FORMAT). EXIT P27

EXIT P27

XX

APOLLO COMPUTER LOGIC CHECKLIST INTERFACE

EXTERNAL CELTA V PROGRAM (P3C)

LCGIC PEV 11 01/17/69

PURPOSE:

- (1) TO ACCEPT TARGETING PARAMETERS OBTAINED FROM A SOURCE(S) EXTERNAL TO THE LGC AND COMPUTE THEREFROM THE REQUIRED VELOCITY AND OTHER INITIAL CONDITIONS REQUIRED BY THE LGC FOR EXECUTION OF THE DESIRED MANEUVER. THE TARGETING PARAMETERS INSERTED INTO THE LGC ARE THE TIME OF IGNITION(TIG) AND THE IMPULSIVE DELTA V ALONG LM LOCAL VERTICAL AXES AT TIG.
- (2) TO DISPLAY TO THE ASTRONAUT AND THE GROUND CERTAIN SPECIFIC DEPENDENT VARIABLES ASSOCIATED WITH THE DESIRED MANEUVER FOR APPROVAL BY THE ASTRONAUT/GROUND.

- ASSUMPTIONS- (1) THE TARGET PARAMETERS (TIG AND DELTA V(LV)) MAY HAVE BEEN LOADED FROM THE GROUND DURING A PRIOR EXECUTION OF P27.
 - (2) THE ISS MAY BE IN STANDBY OR OPERATE. THE IMU WOULD NORMALLY BE ON AND THE IMU DRIENTATION DETERMINATION PROGRAM (P51) COMPLETED BEFORE THE SELECTION OF THIS PROGRAM UNLESS THIS PROGRAM IS SELECTED ONLY FOR DATA LOADING AND THRUST-ING PARAMETER COMPUTATION. TIME AND RCS FUEL MAY BE SAVED AND SUBSEQUENT IMU ALIGNMENT DECISIONS GREATLY SIMPLIFIED IF P51 IS PERFORMED IN SUCH A WAY AS TO LEAVE THE IMU INERTIALLY STABILIZED AT AN ORIENTATION CLOSE TO THE PREFERPED ORIENTATION. THIS PROGRAM GENERATES THE MANEUVER INITIAL CONDITIONS FROM WHICH THE PREFERRED IMU ORIENTATION CAN BE DETERMINED IN PREGRAM 40. 41. CR 42. THE ISS THUS MAY BE:
 - (A) CFF (STANEBY).
 - (B) ON, AND NOT ALIGNED SINCE TURN ON
 - (C) ON AND AT AN INERTIAL ORIENTATION KNOWN ONLY INACCURATELY BY THE LGC, I.E. HAVING BEEN ALIGNED AT LEAST CNCE SINCE TURN ON BUT NOT WITHIN THE LAST 3 HRS.
 - (C) ON ANC AT AN INERTIAL ORIENTATION KNOWN ACCURATELY BY THE LGC, I.E. HAVING BEEN ALIGNED WITHIN THE LAST 3 HRS.
 - IF (A) IS TRUE A PRCGRAM ALARM WILL BE MADE BY THIS PROGRAM.
 - IF (8) IS TRUE A PRCGRAM ALARM WILL BE MADE BY THIS PROGRAM.
 - IF (C) IS TRUE THE LGC MAY OR MAY NOT HAVE A SATISFACTORY INERTIAL REFERENCE TO ACCURATELY COMPLETE THE MANEUVER.
 - IF (D) IS TRUE THE LGC HAS A SATISFACTORY INERTIAL REFERENCE TO ACCURATELY COMPLETE THE MANEUVER. CASES (B), (C) AND (D) HOWEVER ARE FURTHER SUBJECT TO THE CONSTRAINT OF LARGE MIDDLE GIMBAL ANGLE, I.E. THE EXISTING INERTIAL ORIENTATION MAY CAUSE A MIDCLE GIMBAL ANGLE GREATER THAN 45 DEGREES AT THE THRUSTING ORIENTATION OF THE LM, WHICH IS UNSATISFACTORY.

++ +11

(3) IT IS NORMALLY REQUIPED THAT THE ISS BE ON FOR A MINIMUM OF 15 MINUTES PRIOR TO A THRUSTING MANEUVER.

+401

(4) THIS PROGRAM IS SELECTED BY THE ASTPONAUT BY DSKY ENTRY AT LEAST 15 MIN REFORE THE TIME OF IGNITION.

		*	• CREW PROG • SELECTION •	2	
	START EXTERNAL DELTA V PROGRAM (P30) DISPLAY PROGRAM 30		EXTERNAL DELTA V PROGRAM (P30) V37E 30E		#
			•		
		•	MCNITOR DSKY: OBSERVE DISPLAY OF PROGRAM 30		
	•		•		
	•		•		
	SET TRACK FLAG (SEE P20)		•		
	•		•		
	•		•		
	SET UPCATE FLAG (SEE P20)				1
	TEAG (SEE F207		•		
	•		•	*	
	•	***	•		
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	• •	•	• •	•	4
	FLASH VERB-NOUN TO REQUEST RESPONSE AND DISPLAY STORED TIG: VO6 N33 R1-TIG-HRS		MCNITOR DSKY: OBSERVE VERB-NOUN FLASH TO REQUEST RESPONSE AND DISPLAY OF STORED TIG.	• • • • • • • • • • • • • • • • • • •	
) .	R2-TIG-MIN R3-TIG-SEC	•		•	
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TOTAL

TIME

CHECKLIST

PROG CONT Lec

GREUND

CREW

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	TIG-	TIME CF			•			
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		TE FLASH UPCN	• •		V25E AND .			
	RECEIP	CF PROCEED .		LOAD T	HE DESTRED .			
	OR NEW	DATA	• •	. TIG.	•			
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	. P	. NEW	•					
	• R	. DATA		•				#80
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•	FLASH '	VERB-NCUN TC	•	. MONITOR (SKY:			
		T RESPONSE AND .		CBSERVE V	/ERB-NOUN .			
HOLD .		Y THREE STOREC	2	. FLASH TO	REQUEST .			
HOLD .		ENTS OF DELTA	•		AND CISPLAY .			#100
		LAIS CF DELIA	• ,					#200
	(LV):	2	•	OF THREE				
	V06N		•	COMPONENT				
		ELTA VX (LV)	•	IMPULSIVE				
		ELTA VY (LV)	•	ALONG TH				
	R3-D	ELTA VZ (IV)	•	VFFTICAL	AXFS AT .			
			•		•		P30/SUNDANCE	

		TIG.		
DELTA VX (LV):				
COMPONENT OF	•		•	
	•	•	•	
IMPULSIVE DELTA V AT	•	•	•	
TIG ALONG (RXV)XR. IN	•	•	•	#110
FPS TO NEAREST .1	•			
FPS.		AM I SATISFIED WITH .		
	-	THESE VALUES?		
DELTA VY (LV):	•	THESE TRESES.		
	•		•	
COMPONENT OF	•	.Y	•	
IMPULSIVE DELTA V AT	•	•	•	
TIG ALONG VXR, IN FPS	•		•	
TO NEAREST .1 FPS.	•		•	
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DELTA VZ (LV):	Ĭ.	- 1		#120
COMPONENT OF	•	•	•	#120
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IMPULSIVE DELTA V AT	•	•	•	
TIG ALCNG -R. IN FPS	•			
TO NEAREST .1 FPS	•		•	
WHERE R IS LM GEC-	•			
CENTRIC (EARTH ORBIT)	-			
	•	•	•	
OR SELENOCENTRIC	•	•	•	
(LUNAR ORBIT) RACIUS	•	•		
VECTOR AND V IS LM	•		•	#130
INERTIAL VELOCITY	•		•	
VECTOR AT TIG.	•		•	
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WAIT FOR KEYBOARD	•			#140
WAIT FOR KEYBOARD				#140
WAIT FOR KEYBOARD				#140
WAIT FOR KEYBOARD				#140
WAIT FOR KEYBOARD ENTRY TERMINATE FLASH UPON		PRECEED		#140
WAIT FOR KEYBOARD ENTRY TERMINATE FLASH UPON RECEIPT OF PROCEED		PRCCEED		#140
WAIT FOR KEYBOARD ENTRY TERMINATE FLASH UPON RECEIPT OF PROCEED OR NEW DATA		PROCEED KEY IN V25E AND LOAD THE DESIRED COMPONENTS OF		#140
WAIT FOR KEYBOARD ENTRY TERMINATE FLASH UPON RECEIPT OF PROCEED OR NEW DATA		PRCCEED		#140
WAIT FOR KEYBOARD ENTRY TERMINATE FLASH UPON RECEIPT OF PROCEED OR NEW DATA P .NEW		PROCEED KEY IN V25E AND LOAD THE DESIRED COMPONENTS OF		
WAIT FOR KEYBOARD ENTRY TERMINATE FLASH UPON RECEIPT OF PROCEED OR NEW DATA P .NEW .R .CATA		PROCEED KEY IN V25E AND LOAD THE DESIRED COMPONENTS OF		#140 #150
TERMINATE FLASH UPON RECEIPT OF PROCEED OR NEW DATA P NEW R CATA		PROCEED KEY IN V25E AND LOAD THE DESIRED COMPONENTS OF		
WAIT FOR KEYBOARD ENTRY TERMINATE FLASH UPON RECEIPT OF PROCEED OR NEW DATA P .NEW .R .CATA		PROCEED KEY IN V25E AND LOAD THE DESIRED COMPONENTS OF		
WAIT FOR KEYBOARD ENTRY TERMINATE FLASH UPON RECEIPT OF PROCEED OR NEW DATA P .NEW R .CATA .C		PROCEED KEY IN V25E AND LOAD THE DESIRED COMPONENTS OF		
TERMINATE FLASH UPON RECEIPT OF PROCEED OR NEW DATA P		PROCEED KEY IN V25E AND LOAD THE DESIRED COMPONENTS OF		
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TERMINATE FLASH UPON RECEIPT OF PROCEED OR NEW DATA P .NEW R .CATA .CCE		PROCEED KEY IN V25E AND LOAD THE DESIRED COMPONENTS OF		
TERMINATE FLASH UPON RECEIPT OF PROCEED OR NEW DATA P .NEW R .CATA .CCE		PROCEED KEY IN V25E AND LOAD THE DESIRED COMPONENTS OF		#150
TERMINATE FLASH UPON RECEIPT OF PROCEED OR NEW DATA P .NEW R .CATA .CCE		PROCEED KEY IN V25E AND LOAD THE DESIRED COMPONENTS OF		#150 #160
TERMINATE FLASH UPON RECEIPT OF PROCEED OR NEW DATA P .NEW R .CATA .CCE		PROCEED KEY IN V25E AND LOAD THE DESIRED COMPONENTS OF		#150
TERMINATE FLASH UPON RECEIPT OF PROCEED OR NEW DATA P .NEW R .CATA .CCE		PROCEED KEY IN V25E AND LOAD THE DESIRED COMPONENTS OF		#150 #160
TERMINATE FLASH UPON RECEIPT OF PROCEED OR NEW DATA P .NEW R .CATA .CCE		PROCEED KEY IN V25E AND LOAD THE DESIRED COMPONENTS OF		#150 #160

P30/SUNDANCE

#170

#180

#190

#200

#210

P30/SUNDANCE

RESET LPCATE FLAG (SEE P20) BASED ON THE STORED TARGET PARAMETERS CCMPUTE NECESSARY DEPENDENT VARIABLES FOR EVALUATION OF THE THRUSTING MANEUVER INCLUDING PERILUNE ALTITUDE, APCLUNE ALTITUDE AND DELTA V REQUIREC (SEE SECT-ICN 5.3.3.3.1 OF R5571 SET UPCATE FLAG (SEE P20) FLASH VERB-NOUN TO MONITOR DSKY: HOLD . REQUEST RESPONSE AND OBSERVE VERB-NOUN DISPLAY CALCULATED FLASH TO REQUEST THRUSTING PARAMETERS: RESPONSE AND CISPLAY V06 N42 OF CALCULATED RI-APO ALT THRUSTING PARAMETERS R2-PER ALT R3-CELTA V APC ALT - ALTITUCE OF APOGEE ABOVE THE LAUNCH PAD RADIUS (FARTH ORBIT) OR ALTITUCE OF THE APOLUNE ABOVE THE LUNAR RADIUS AT THE MCST RECENTLY DE-FINED LANCING SITE (LUNAR GRBIT). IN NAUTICAL MILES TO

NEAPEST .1 NM.

PER ALT - ALTITUCE OF PERIGEE ABOVE THE LAUNCH PAC RACIUS (EARTH CRBIT) OR #220 ALTITUDE OF THE PERILUNE ABOVE THE LUNAR RADIUS AT THE MCST RECENTLY DE-FINEC LANCING SITE (LUNAR CRBIT). IN NAUTICAL MILES TO NEAREST . 1 NM. DELTA V - MAGNITUCE #230 OF IMPULSIVE DELTA V VECTOR AT TIG. IN FPS . IS A GROUND STATION TC NEAREST .1 FPS . AVAILABLE FOR CON-. FIRMATION OF THESE . PARAMETERS? . N #240 MONITOR LGCCOORDINATE DOWNLINK TELE- . . EVALUATION OF METRY CF APO . THE LGC COMPU-. TED PARAMETERS ALT. PER ALT .. WITH THE AND DELTA V RE-QUIRED. COCRDI-....GROUND NATE EVALUATION OF LGC CCMPUTED #250 PARAMETERS WITH **ASTRONAUT** . SELECT ONE OF THE . FOLLOWING FIVE . ALTERNATIVES: . (1) IF THE CALCU-#260 . LATED DATA IS . SATISFACTORY, . PERFCRM THE THRU-. STING MANEUVER . USING THE LGC . CALCULATED PARA-. METERS WITHOUT . GROUND CONFIRMA-. TION. . (2) IF THE CALCU-. LATED DATA IS NOT #270 P30/SUNDANCE

24/44

P30/SUNCANCE

P30/SUNDANCE

•	•	SATISFACTORY	/ AD-	
•	•			
•	•	JUST THE CAL		
		TED PARAMETE	T	
•		RESELECTING		
•		AS NECESSARY	MAND	
		CHANGING THE		
		LOADED AIM P	PARA-	
		METERS UNTIL		
•		COMPUTED PAR		
•				****
•		ERS ARE SATI	SEAC-	#280
•		TORY. THEN		
•	•	PERFORM THE	THRU-	
•		STING MANEUV	/ER.	
		(3) REMAIN A	T	
		THIS POINT I	N THE	
-		LGC PRCGRAM		
		GROUND CO-OR		
•				
•		TION IS AVAI		
		(4) SELECT A		
		PROGRAM AS D)F-	#290
	•	SIRED UNTIL		
•	•	GROUND CO-CR	EDINA-	
		TION IS AVAI	LABLE	
		THEN RESELEC	T	
		P 30, LEAVE		
		PARAMETERS		
•		UNCHANGED ET		
•				
•		(5) SELECT A		
•		PROGRAM AS D		
		STRED AND PE		#300
•	•	THRUSTING MA	NEU-	
•		VER USING BA	CKUP	
		PRCCEDURE.		
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				#310
	AR	E THESE		•
	PAI	RAMETERS		
	SA	TISFACTORY		
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		RUSTING	• •	
	MAI	NEUVER?	• •	
		N Y.		#320
		-		
		• •		

P30/SUNDANCE

SELECT ONE OF THE FOLLOWING FOUR ALTERNA-TIVES: #330 (1) ADJUST THE CALCULATED PARA- . . METERS BY RESEL- . . ECTING P 30 AS NECESSARY AND CHANGING THE LOADED AIM PARA- . . MFTERS UNTIL LGC . . COMPUTED PARA-METERS ARE #340 SATISFACTORY. (2) OBTAIN NEW AIM PARAMETERS FROM THE GROUND BY VOICE LINK, RESFLECT P 30, KEY IN NEW DATA, . . FTC. (3) SELECT THE LGC UPDATE #350 PROGRAM (P27). LOAD NEW AIM PARAMETERS FRCM THE GROUND VIA THE LGC UPLINK, OR BY CREW DSKY INPUT. OBSERVE NEW AIM PARAMETERS, ETC. (4) TERMINATE #360 P 30 BY SELECT- . . ING A NEW PRO-GPAM AS DESIRED . . AND PERFORM THR- . . USTING MANEUVER . . USING BACKUP PROCEDURES. 1. 2. #370 3. 4.

26/96)

P30/SUNDANCE WAIT FOR KEYBOARD KFY IN PROGRAM SELFCTION AS ENTRY. DESIRED #380 V37E--E GO TO PROGRAM SELECTED. #390 EXIT P30 #400 TERMINATE FLASH UPCN . RECEIPT OF PROCEED . KEY IN OR NEW PROGRAM. PROCEED . NEW . PROGRAM GC TC PRCGRAM #410 SELECTED. EXIT P30 #420 IS REFSMELAG SET?

P30/SUNDANCE

COMPUTE INU MID- . DLE GIMEAL ANGLE . AT TIG FOR THE PRESENT INU OR-IENTATION WITH THE LM +X AXIS ALIGNED WITH THE . INITIAL TERUST VECTOR.

. SET MGA CISPLAY . IN R3 (RELOW) =

· -00002.

FLASH VERB-NOUN TO REQUEST RESPONSE AND OBSERVE VERB-NOUN HOLD . DISPLAY MANEUVER

DATA: V16 N45 R1-M R2-TFI

R3-MGA

M-THE NUMBER CF MARKS MADE SINCE THE LAST THRUSTING MANEUVER CR INITIAT-ICN OF P2C. (NOTE-NORMALLY RF TRACKING DATA IS NOT BEING TAKEN DURING THIS PPCGRAM AND THIS

REGISTER WILL BE 00000.

TEI - TIME FROM TIG. IN MIN AND SEC TO NEAREST SEC. MAXIMUM PEACING IS 59859. (- BEFORE + AFTER TIG.)

MONITCR DSKY:

FLASH TC REQUEST RESPONSE AND CISPLAY OF MANEUVER DATA

P30/SUNDANCE

#430

#440

#450

#460

P30/SUNDANCE	Ę.		
	#489		
	#490		
	# 500		
	# 510 		
	#520		
	#530		

MGA-MIDDLE CIMBAL ANGLE AT TIC IF +X LM AXIS IS ALIGNED WITH INITIAL UNROTATED VG CURA-TIEN THRUST DIREC-TION. SIGN IS ALWAYS + EXCEPT WHEN THE IMU IS NOT ALIGNED THE VALUE IS -00002. IN CECREES TC NEAREST .CI DEGREE WAIT FOR KEYBOARD ENTRY TERMINATE FLASH UPCN RECEIPT OF PROCEED SET EXTERNAL DELTA V STEERING FLAG FCR USE BY THRUSTING PREGRAM DC FINAL AUTCMATIC DO FINAL AUTOMATIC REQUEST TERMINATE REQUEST TERMINATE RCUTINE (RGG). ROUTINE (RCO). (NOTE: CONSIDERING IF TIME AND VALUE OF DELTA V, LOCATION FUEL AVAILABLE, PERMIT STATUS OF PROPULSION ASSIST HAPDWARE, AND TIME AVAILABLE TC RE-AL-ASTRONAUT IN IGN THE IMU TO AVOID EXIT P30 SFLECTICA CF PROPULSION GIMBAL LOCK SELECT A SYSTEM. AT PROPULSION SYSTEM THIS TIME, AND THE APPROPRIATE CR EARLIFR THRUSTING PROGRAM IF FOSSIBLE (DPS-F40, APS-P42, THE ASTRONAUT RCS-P41) TO PEPFORM

P30/SUNDANCE

MUST LEAFN

OF THE

SYSTEM USEC
IN MCC CCMPUTATIONS
CF.CATA LCAD

EXIT P30

#540

CHANGE CONTROL NOTES: LOGIC REV 10 PCN-MIT-56 LOGIC REV 11 PCN 401.3

30/1001

APELLE COMPUTER LOGIC CHECKLIST INTERFACE

CO-FLLIFTIC SEQUENCE INITIATION (CSI) PROGRAM (P32) LCGIC REV 11 01/17/69

PURPOSE:

- (1) TO CALCULATE PARAMETERS ASSOCIATED WITH THE FOLLOWING CONCENTRIC FLIGHT PLAN MANEUVERS: THE CO-ELLIPTIC SEQUENCE INITIATION (CSI) AND THE CONSTANT DELTA ALTITUDE MANEUVER (CDH), FOR DELTA V BURNS,
- (2) TO CALCULATE THESE PARAMETERS BASED UPON MANEUVER DATA APPROVED AND KEYED INTO THE LGC BY THE ASTRONAUT.
- (3) TO DISPLAY TO THE ASTRONAUT AND THE GROUND DEPENDENT VARIABLES ASSOCIATED WITH THE CONCENTRIC FLIGHT PLAN MANEUVERS FOR APPROVAL BY THE ASTPONAUT/GROUND.
- (4) TO STORE THE CSI TARGET PARAMETERS FOR USE BY THE DESIRED THRUSTING PROGRAM.

- ASSUMPTIONS: (1) AT A SELECTED TPI TIME THE LINE OF SIGHT BETWEEN THE LM AND THE CSM IS SELECTED TO BE A PRESCRIBED ANGLE (F) FRCM THE HORIZONTAL PLANE DEFINED AT THE ACTIVE POSITION.
 - (2) THE TIME BETWEEN CSI IGNITION AND COH IGNITION MUST BE COMPUTED TO BE GREATER THAN 10 MINUTES FOR SUCCESSFUL CCMPLETICN OF THE PROGRAM.
 - (3) THE TIME BETWEEN CCH IGNITION AND THE IGNITION MUST BE COMPUTED TO BE GREATER THAN 10 MINUTES FOR SUCCESSFUL COMPLETION OF THE PROGRAM.
 - (4) CDF DELTA V IS SFLECTED TO MINIMIZE THE VARIATION OF THE ALTITUDE DIFFERENCE BETWEEN THE ORBITS.
 - (5) CSI BURN IS CEFINED SUCH THAT THE IMPULSIVE DELTA V IS IN THE LM HCFIZONTAL PLANE AT CSI IGNITION.
 - (6) THE PERICENTER ALTITUDE OF THE ORBIT FOLLOWING OSI AND COH MUST BE GREATER THAN 35,000 FT (LUNAR ORBIT) OR 85 NM (EARTH CRRIT) FOR SUCCESSFUL COMPLETION OF THIS PROGRAM.
 - (7) THE CST AND COH MANEUVERS ARE ORIGINALLY ASSUMED TO BE PARALLEL TO THE PLANE OF THE CSM ORBIT. HOWEVER CREW MODIFICATION OF CELTA V (LV) COMPONENTS MAY RESULT IN AN OUT-OF-PLANE OSI MANEUVER.
 - (8) LGC COMPUTED VARIABLES MAY BE STORED FOR LATER VERIFICATION BY THE GROUND. THESE STORAGE CAPABILITIES ARE NORMALLY LIMITED ONLY TO THE PARAMETERS FOR ONE THRUSTING MANEUVER AT A TIME EXCEPT FOR CONCENTRIC FLIGHT PLAN MANEUVED SEQUENCES.
 - (9) THE RENDEZVOUS PACAR MAY OR MAY NOT BE USED TO UPDATE THE LM OR CSM STATE VECTORS FOR THIS PROGRAM. IF RADAR USE IS CESIFED THE RADAR WAS TURNED ON AND LOCKED ON THE CSM BY PREVIOUS SELECTION OF P20. RADAR SIGHTING MARKS WILL BE MADE AUTOMATICALLY APPROXIMATELY ONCE 4 MINUTE WHEN ENABLED BY THE TRACK AND UPDATE FLAGS (SEE P20). THE RENDEZVOUS TRACKING MARK COUNTER IS ZEROED BY THE SELECTION OF P20 AND AFTER EACH THRUSTING MANEUVER.
 - (10) THE ISS NEED NOT BE ON TO COMPLETE THIS PROGRAM.
 - (11) THE OPERATION OF THE PROGRAM UTILIZES THE FOLLOWING FLAGS:

ACTIVE VEHICLE FLAG-DESIGNATES THE VEHICLE WHICH IS DOING RENDEZVOUS THRUSTING MANEUVERS TO THE PROGRAM WHICH CALCULATES THE MANEUVER PARAMETERS. SET AT THE START OF EACH RENDEZVOUS PRE-THRUSTING PROGRAM.

FINAL FLAG - SELECTS FINAL PROGRAM DISPLAYS AFTER CREW HAS COMPLETED THE FINAL MANEUVER COMPUTATION AND DISPLAY CYCLE.

EXTERNAL DELTA V STEERING FLAG - CESIGNATES THE TYPE OF STEERING REQUIRED FOR EXECUTION OF THIS MANEUVER BY THE THRUSTING PROGRAM SELECTED AFTER COMPLETION OF THIS PROGRAM.

	THE THRUSTING PROGRAM SELECTED AFTER COMPLETION OF THIS PROGRAM.											
++ +11	(12) IT IS NORMALLY REQUIRED THAT THE ISS BE ON FOR A MINIMUM OF 15 MINUTES PRIOR TO A THRUSTING MANEUVER.											
+ +11 ++	(13) THIS PROGRAM IS SELECTED BY THE ASTRONAUT BY DSKY ENTRY.											
401 54 0												
PROG CONT	Lec	GROUND	CREW		CHECKLIST	TIME	TOTAL TIME					
			• CREW PROG.									
			. SELECTION									
			•									
			• • •									
			•									
	START CO-ELLIPTIC SEQUENCE INITIATION (CSI) PROGRAM (P32) DISPLAY P32	•	KEY IN CO-ELLIPTIC SEQUENCE INITIATION (CSI) PROGRAM (P32) V37E 32E		*		#10					
			,									
			•									
			MCNITOR DSKY: OBSERVE DISPLAY OF PROGRAM 32				#20					
	•		•									
	•											
	•		•	*								
			•									
	SET ACTIVE VEHICLE		•									
	FLAG TO LM.		•				#30					
	•		•									
	•		•									
	•		•									
		•	•		9							
		•	•									
	RESET FINAL FLAG	•	•									
	•	•	•				#40					
	•	•	•			P32/SUNDANCE						
	•	•	•									
)	•	•	•									

P32/SUNDANCE

#50

#60

#70

#80

#90

					KEY IN V25E AND LOAD DESIR	RED .		
	• P • R • O	• NEW • CATA	• •		•			
	• C	•	• •					#100
	•E •E	STORE DATA	• •					
	• D							
	•	•						
	•	•	• •					
	•			• •				
			:					
	•	•	• •		•	•		#110
	•	•	• •	• •	•	•		
	•	•	• •		•	•		
HOLD .	FLASH	VERB-NOUN TO	• •	M C	NITOR DSKY:			
		T RESPONSE AND			SERVE VERB-NOU	v .		
SNAP .		Y STORED N	• •		ASH TO REQUEST			
	AND E;				SPONSE AND DIS	PLAY .		
	V06		• •	• OF	N AND E.	•		
	R1-N R2-E		• •	•				#120
		LANK		•	•	•		-120
	N - TH	E FUTURE					9	
		L CROSSING		•				
	(APCLU		• •		I SATISFIED W	ITH .		
	0. 100000000000000000000000000000000000	NE) OF THE VEHICLE AT	• •		ESE VALUES?	•		
		TIG(CCF)			. Y	.N .		
		CCCUR.						
		FIRST,		•	•			#130
	0.0002=	SECCNE, ETC.		•				
			• •		CCRD THESE			
		EVATION ANGLE.			UFS			
		IGLE PETWEEN						
		LCCAL HORIZ-						
		PLANE AT TIG		•	•			
		PEFERENCED TO	• •	•	•			
		RECTION OF		•	•			****
		(SEE SECTION		•	•	• •		#140
		CF R557 TAILEC CF-	• •	•	•			
		ICN). IN						
		S TO NEAREST		•	•			
	.01 DE			•	•			
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		•		•	•	• •	222.4	CHAIDANCE
		•		•	•	• •	032/5	SUNDANCE
		•		•	•			
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500 HTM								

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	•				P32/SU!
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	WAIT FOR KEYBOAPD		KEY IN PROCEE	C • •	
	ENTRY				
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	TERMINATE FLASH UPC		• •		
	PECEIPT OF PROCEED		KEY IN V25	F .	
	OR NEW CATA		AND LOAD T		
		-	. DESIRED PA		
	.P .NEW		• • ERS	•	
	.R .EATA				
	•C •				
	•C •				
	•E •			•	
	•E			•	
	D STORE DATA				
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HOLD .	FLASH VERB-NOUN TO		. MONITOR DSKY:		
	REQUEST RESPONSE AND		OPSERVE VERB-	NOUN .	
SNAP .	DISPLAY STORED TIG		TC REQUEST RE		
	(TPI):		AND DISPLAY O		
	V06 N37		. STORED TIG (T		
	R1-TIG(TPI)-HRS				
	R2-TIG(TPI)-MINS			•	
	R3-TIG(TPI)-SECS			•	
				•	
	TIG(TPI) - TIME CF				
	TPI IGNITION (GET).		. AM I SATISFIE		
	IN HRS, MINS, SECS,	• •	. WITH THIS VAL	UF? •	
	TC NEAREST .01 SEC	• •			
			Y	.N .	
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	•		. RECOPD THIS		
	-		. VALUE		
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	•				P32/SU
	•				

P32/SUNDANCE

#150

#160

#170

#180

#190

#200

P32/SUNDANCE

	•	•	•						
	IT FOR KENROARD		•			•			
	IT FOR KEYBOARD			K	EY IN PROCEED .	•			
EIN	101	• • •	•			•			
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TE	RMINATE FLASH UPON		•			•			
RE	CEIPT OF PROCEED			• • •	. KEY IN V25E	•			#210
OR	NEW CATA		•		. AND LOAD THE	•			
		•	•	•	. DESIRED TIG (TPI)	•			
	P .NEW	•	•	•		•			
	R .CATA	•		•	•	•			
	0 • C •	•	•	•	•	•			
	E	•	•	•	• • • • • • • • • • • • • • • • • • • •	• •			
	E STORE DATA		•	•	•				
	D		•		•				
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	RESET UPCATE				•				#230
	FLAG.			•	•				,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,
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•	BASED ON THE STC-		• •	•	•				
	RED TARGET PARA-		• •	•	•				
	METERS, CCMPUTE								
	THE PARAMETERS				•				#240
•	ASSOCIATED WITH		• •	•	•				
	CSI AND CDH AS		• •	•	•				
	DESCRIBED IN SEC-		• •	•	•				
	TION 5.4.4 OF		• •	•	•				
•	R557. ESTABLISH ALARM		• •	•	•				
•	IF;	,	• •	•	•				
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36(104)

P32/SUNDANCE

(A) CN FIRST
ITERATION THERE
IS NO INTERSECTION OF
THE DESIRED LOS
AT TPI WITH THE
CIRCLE DESCRIBFD IN SECTION
5.4.4.2 OF R557.
(ALARM CODE
CO6CC)

(B) CN ANY TWO CONSECUTIVE ITERATIONS THE MAGNITUDE OF DELTA V(CSI) IS GREATER THAN 1000 FPS. (ALARM CODE D0606)

IC) THE ITERA-TION COUNTER EXCEEDS 15 WITHOUT ARRI-VING AT A PRC-BLEM SCLUTION. (ALARM CODE 00605)

(C) PFPICENTER
ALT (PCST CSI)
IS LESS THAN
35,000 FT.
(LUNAR CRBIT)
OR 85 NM (EARTH
OPRIT).
(ALARM CCDF
OC601)

(F) PFRICENTER
ALT (PCST CDH)
IS LESS THAN
35,000 FT
(LUNAF CPBIT)
CR 85 NM (EAPTH
CRBIT) (ALAPM
CCDE (CC622)

#260

#250

#270

#280

#290

	•									
	•	(F) TIG(CCH) -								
		TIG(CSI) IS						w:		#300
		LESS THAN 10	• •	• •						# 5170
			• •							
		MIN. (ALARM	• •							
		CODE 00603)	• •							
	٠									
	•	(G) TIG(TPI) -								
		TIG(CDH) IS								
		LESS THAN 10								
		MIN CR CCM-	• •							
			• •							
		PUTED CDH	• •							
		TIME IS	• •							#310
		GREATER	• •							
	•	THAN INPUT								
		TPI TIME.								
		(ALARM CODE								
		00604)								
	•	000047	• •					×	-	
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		. A								#320
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POSS							•			
HOLD .		FLASH VERB-			MONITOR	DSKY:				
		NOUN TO RE-				LARM CODE				
SNAP .		QUEST RESPON-			DISPLAY		•			#330
JIMAI .			• •				•			#330
		SE AND DIS-	• •		COMPUTAT	IUNAL	•			
	. • •	PLAY ALARM	• •	0 0	DIFFICUL	143	•			
		CODE:	• •				•			
		VC5 NO9			. Y	N.	•			
		R1-XXXXX			•	•	•			
		RZ-XXXXX					•			
		R3-XXXXX			-					
		1.2 00000	• •		•	•	•			
	• •	ANOTE: UD TO	• •		•	•	•			
		(NCTE: UP TC		0 . •	•	•	•			
		THREE ALARM	• •	0 0	•		•			#340
		CODES CAN BE	• •		•	•	•			
		CISPLAYED			•	•	•			
		SIMULTANEOUS-			•		•			
		LY. THOSE					-			
		REGISTERS NCT				•	-			
		CONTAINING AN			•	•	•			
	• •		• •	0 0	•	•	•			
		ALARM CODE	• •	0 •	•	•	•	18		
		WILL BE	• •	0 0	•	•	•			
		BLANK.)			•	•	•			
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		• •			P32/SUNDANCE	
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		• •				
	WAIT FOR	• • •	. RETURN			
	• • KEYPOARD			CF PRO		
	• • ENTRY		• GPAM			
	. TERMINATE	• •		T INPUT		
*	. FLASH UPON	• •	· · PARAME		4	360
	. RECEIPT OF	• •	V32		*	200
	. RECYCLE.	• •	• • • • •			
	• • R					
	E					
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	c	• •				
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	• • • E				#	370
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	. IS FINAL FLAG	•	•			
	• SET?	•	•			
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	N Y.	•	•	• •		
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		•	•		#	380
		•	•	• •		
	. SET LPCATE .	•	•			
	. FLAG (SEF .	•	•			
	. P201	•	•	• •		
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HOLD .	. FLASH VERR-NOUN	•	MONITO	OR DSKY:	4	390
	. TO REQUEST RES-	•		FRVE VERR-	•	370
	. PENSE AND DISPLAY			FLASH TO RE		
	. DELTA ALT (CDH),			RESPENSE .		
	. DELTA T(CSI/CDF)	-		ISPLAY OF .		
	. AND DELTA TICCH!			ALT (CDH) .	4	
	. TPI);			T (CSI/CDH) .		
	. VOE NEO		. AND DE	ELTA T (CDF/ .		
	. RI-DELTA ALT	•	. TPI).			
	· (CCF)	•				
	. P2-DELTA T(CST/	•	•			400
	· CDH)	•	•			
	. P3-DFLTA T(CCF/	•	•			
	· TPI)	•	•			
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	•		•				
	• DELTA ALT(CDF) - • THE ALTITUDE PE-	•		•			
	. TWEEN THE ACTIVE			•	•		
	. AND PASSIVE VE-						
	HICLE CREITS AT	•	•	•	•		1
	 TIG(CDH). SIGN IS + WHEN THE ACTIVE 		•	•	•		#410
	. VEHICLE IS BELCH			•			12 13
	. THE PASSIVE		•	•	•		
	• VEHICLE. IN NAUT- • ICAL MILES TO	•	•	•	•		
	NEAREST .1 NM.	•	•	•	•		
	•						
	DELTA T(CSI/CDH)-	•	•	•	•		
	• TIG(CCH) MINUS • TIG (CSI)•	•	•	•	•		#420
	. CCMPUTED IN HRS,	•					472 U
	MINS, SECS OF	•	•	•	•	*	
	 WHICH CNLY THE MINS AND SECS 	•	•	•	•		
	ARE DISPLAYED. TO			•			,
	NEARFST SEC. MAX	•		•	•		
•	READING IS 59859.	•	•	•	•		
	DELTA T(CDH/TPI)-	•	•				
	TIG(TPI) MINUS		•	•			#430
	. TIG (CCH). . CCMPUTED IN HRS,	•	•	•	•		
	MINS SECS OF	•	•	•	•		
	WHICH CNLY THE			•			
	MINS AND SECS ARE	•	•	•	•		
	• CISPLAYEC. TO • NEAREST SEC. MAX		•	•	•		
	REACING IS 59859.						
•		•	•	•	•		
	•	•		•	•		#440
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	• •	•	•				σ
		•		RECORD THESE VALUES	•	**	** 3
			•		· :		
		•	. •	•	•		
	•	•	•	•	•		
* 1		-		•			#450
•	WAIT FOR KEYBOARD						use distribution
	. FNTPY		• • • • • • • • • • • • • • • • • • • •	KEY IN PROCEED			
•	TERMINATE FLASH		•	•			
	. UPCN PECEIPT OF	•		•	•		
•	PROCEEC	•	•	•	•		
	P	•	•	:			
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			• •	•		•	• •			4.70
HOLD .	•	FLASH VERB-NOUN	• •		MONTTOD DE	· · ·				#470
1.020	•	TO PEGLEST RES	•		MONITOR DSH					
SNAP .	•				CBSERVE V					
SNAP .		PENSE AND DISPLAY	• •	• •	NOUN FLASH					
	•	CALCULATED COM-	•	•	QUEST RESPO					
	•	PCNENTS OF DELTA	• •	•	AND DISPLAY					
	•	V(LV) FOR CSI;	•	•	DELTA V(LV)	FOR				
	•	V06 N81	•	•	CSI		• •			
	•	RI-DELTA VX(LV)	•							
	•	R2-DELTA VY(LV)	• •	•			• •			
	•	R3-DELTA VZ(LV)	•		٠					#480
					•					
	•	CELTA VX(LV) -					• •			
	•	CCMPCMENT OF IM-	•		AM I SATISF	IED	• •			
	•	PULSIVE CELTA V	•		WITH THESE					
	•	AT TIG(CSI) ALCNG			VALUES?		• •			
	•	(RXV)XR. IN FPS			(NCTE: CREW	HAS	• •			
		TO NEAREST .1			THE CPTION					
		FPS.			THIS TIME T					
					DEFINE THE		• •			
	•	DELTA VY(LV) -			VILV) CCMPC		• •			#490
		COMPONENT OF IM-			FOR THE SUE		• •			# 170
		PULSIVE DELTA V					• •			
		AT TIG(CSI) ALCNG			MANFUVER. 1		• •			
		VXR. IN FPS TO		•	CAPABILITY					
		NEAPEST .1 FPS.			NORMALLY BE		• •			
					EXERCISED 1		• •			
		CELTA VZ (LV) -			CORPECT CUT		• •			
		COMPONENT OF IM-	•		PLANENESS E		• •			
		PULSIVE CELTA V	•	•	FIRST SELEC		• •			
		AT TIG(CSI) ALPNG	• •	•	THE RENDEZY					#500
		-P. IN FPS TO	• •	•	OUT-OF-PLAN		• •			#500
		NEAREST .1 FPS	• •	•						
	•	NEAPEST .I TPS	• •	•	PLAY POUTIN					
	•	WEDE D IS IN	• •	•	(R36) (V90E			· P		
		WHERE R IS LM	•	•	THEN MODIFY					
		GECCENTRIC (EAPTH	•	•	DELTA VY(L)	///				
		CRBITI OR SELENC-	•	•						
		CENTRIC (LUNAR	• •	•	. Y	• N				
		OPRITA PACIUS	• •	•	•	•				
		VECTEP AND V IS	•	•	•	•	• •			
		LM INFRTIAL VELC-	•	•	• -	•				#510
		CITY VECTOR AT	• •	•	•	•	• •			
	•	IIG(CcI).	• •	•	•	•				
	•		•	•	•	•				
	•	•	• •	•	•	•				
	•	•			•	•			P32/SUNDANCE	
	•									

	•					
	. WAIT FOR KEYBCARD		KFY	IN V25F		
	. ENTRY			LOAD DE		
				D DELTA V		#520
			VALU			#320
	•	• •	· · VALU			
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						#530
			. RECORD	THESE -		#230
	_		· VALUES	The St.	*	
		• •	• VALUES	•		
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	•	• •	•	•		
	. TERMINATE FLASH					
	. UPON RECEIPT OF		KEY IN	PROCEED .		
	. PROCEED OF NEW					
	. DATA.		•			#540
	P .NEW					
	R .DATA		ž.			
	C	• •	•	•		
	C STORE DATA	• •	•	•		
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	• •	•	•	•		
HOLD .		•				
	. FLASH VERB-NOUN	•	MONITOR			
SNAP .	. TO PEGUEST RES-		····· TBSFR	VE VERB		#560
	. PCNSE AMD DISPLAY	•	NOUN FL	ASH TO RE		
	. CALCULATED COM-		. QUEST R	ESPCNSE .		
	. PCNENTS OF DELTA	•	. AND DIS			
	. V(LV) FOR COH;		. DELTA V			
	. VO6 N22	•	. CDH.			
	. RI-DELTA VX(LV)	•	. (NCTE:	•		
		•		DEL TA V		
	. R2-DELTA VY(LV)	•	. IF THE			
	. R3-DELTA VZ(LV)	•		R CSI (SFF .		
	•	•	· VSUAE)	HAS REEN .		
	•	•	•	• "		P32/SUNDANCE
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•		•	•	P32/SUNDANCE	
	DELTA VY(LV) - CCMPCNENT OF IM- PULSIVE DELTA V AT TIG(CCF) ALCNG (RXV)XR. IN FPS TO NEAREST .1 FPS.		MODIFIED BY THE CPEW, THE MODIF— ICATION WILL NOT BE REFLECTED IN THE LGC COMPUTED VALUES FOR DELTA V (LV) FOR CDH DISPLAYED HERE.)	#5	570
•	CELTA VY(LV) - CCMPCNENT OF IM- PULSIVE CELTA V AT TIG:CCH) ALONG VXR. IN FPS TC NEAREST .1 FPS.			* #5	80
•	CELTA VZ(LV) - CCMPCNENT OF IM- PULSIVE CELTA V AT TIGICCH) ALCNO -P. IN FPS TO NEAREST .1 FPS		RECORD THESE VALUES. (NCTE: UNLIKE DELTA V(LV) FOR CSI ABOVE, THESE VALUES CANNOT BE WRITTEN CVER.)	* * * * * * * * * * * * * * * * * * *	590
•	WHERE R IS LW GECCENTRIC (EARTH ORBIT) OR SELENC- CENTRIC (LUNAR CRBIT) RACIUS VECTOR AND V IS LM INERTIAL VELC- CITY VECTOR AT TIG(CD-).			* * * * * * * * * * * * * * * * * * *	500
•	WAIT FOR KEYBOARD ENTRY TERMINATE FLASH UPCH RECEIPT OF PROCEED		KEY IN PROCEED	#6	510
• • • • • • • • • • • • • • • • • • • •	. P . R . C . C . E . F . C			***************************************	520

P32/SUNDANCE

P32/SUNDANCE IS THE FINAL FLAC SET? · N #630 SET MGA DISPLAY IN R3 (BELOW) = -00001. #640 . IS REFSMFLAG . SET? . CCMPUTE IMU . . MIDCLE GIMBAL . #650 . ANGLE AT TIG . . (CSI) FCP THE . . PRESENT IMU . ORIENTATION . WITH THE LM . +X AXIS ALIG- . . NED WITH THE . . INITIAL . THREST VECTOR . #660 SET MGA DIS-. PLAY IN R3 · (PELCW) = -00002. #670 P32/SUNDANCE

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ENTRY

• TERMINATE FLASH
• UPCN RECEIPT OF
• PROCEED

P32/SUNDANCE #570

#600

#610

#620

P32/SUNDANCE

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	MGA;	•	RESPONSE AN	D CISPLAY .
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	MARKS MACE SINCE THE LAST THRUSTING MAN-	•	•	•
	EUVER CR INITIATION	•	•	•
	OF P20.	•	•	•
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P32/SUNDANCE

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P32/SUNDANCE

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APCLLC COMPUTER LOGIC CHECKLIST INTERFACE

CONSTANT DELTA ALTITUDE (CDF) PROGRAM (P33)

LEGIC REV 15 01/17/69

PUR POSE:

- (1) TO CALCULATE PARAMETERS ASSOCIATED WITH THE CONSTANT DELTA ALTITUDE MANEUVER (CDH), FOR DELTA V BUPNS.
- (2) TO CALCULATE THESE PARAMETERS BASED UPON MANEUVER DATA APPROVED AND KEYED INTO THE LGC BY THE ASTRONAUT.
- (3) TO DISPLAY TO THE ASTRONAUT AND THE GROUND DEPENDENT VARIABLES ASSOCIATED WITH THE CDH MANEUVER FOR APPROVAL BY THE ASTRONAUT/GROUND.
- (4) TO STORE THE CCH TARGET PARAMETERS FOR USE BY THE DESIRED THRUSTING PROGRAM.

ASSUMPTION:

- (1) THIS PROGRAM IS BASEC UPON PREVIOUS COMPLETION OF THE CO-FLLIPTIC SEQUENCE INITIATION (CSI) PROGRAM (P32). THEREFORE:
 - (A) AT A SELECTED TPI TIME (NOW IN STORAGE) THE LINE OF SIGHT BETWEEN THE LM AND THE CSM WAS SELECTED TO BE A PRESCRIBED ANGLE (E) (NOW IN STORAGE) FROM THE HORIZONTAL PLANE DEFINED AT THE ACTIVE POSITION.
 - (B) THE TIME RETWEEN CSI IGNITION AND COM IGNITION WAS COMPUTED TO BE GREATER THAN 10 MINUTES.
 - (C) THE TIME BETWEEN COH IGNITION AND TPI IGNITION WAS COMPUTED TO BE GREATER THAN 10 MINUTES.
 - (D) THE VARIATION OF THE ALTITUDE DIFFERENCE BETWEEN THE ORBITS WAS MINIMIZED.
 - (E) CSI BURN WAS DEFINED SUCH THAT THE IMPULSIVE DELTA V WAS IN THE LM HORIZONTAL PLANE AT CSI IGNITION.
 - (F) THE PERICENTER ALTITUDES OF THE ORBITS FOLLOWING CSI AND CDH WEPE COMPUTED TO BE GREATER THAN 35,000 FT (LUNAR ORBIT) OP 85 NM FOR EARTH ORBIT.
 - (G) THE CSI AND CCH MANEUVERS WERE ASSUMED TO BE PARALLEL TO THE PLANE OF THE CSM OPRIT. HOWEVER, CREW MODIFICATION OF DELTA V (LV) COMPONENTS MAY HAVE RESULTED IN AN OUT-OF-PLANE CSI MANEUVER.
- (2) LGC CCMPUTED VARIABLES MAY BE STORED FOR LATER VERIFICATION BY THE GROUND. THESE STORAGE CAPABILITIES ARE NORMALLY LIMITED ONLY TO THE PARAMETERS FOR ONE THRUSTING MANEUVER AT A TIME EXCEPT FOR CONCENTRIC FLIGHT PLAN MANEUVER SEQUENCES.
- (3) THE PENDEZ VOUS PADAR MAY OR MAY NOT BE USED TO UPDATE THE LM OR CSM STATE VECTORS FOR THIS PROGRAM. IF RADAR USE IS DESIRED THE RADAR WAS TURNED ON AND LOCKED ON THE CSM BY PREVIOUS SELECTION OF P20. RADAR SIGHTING MARKS WILL BE MADE AUTOMATICALLY APPROXIMATELY ONCE A MINUTE WHEN ENABLED BY THE TRACK AND UPDATE FLAGS (SEE P20). THE RENDEZVOUS TRACKING MARK COUNTER IS ZEROED BY THE SELECTION OF P20 AND AFTER EACH THRUSTING MANEUVER.
- (4) THIS ISS NEED NOT BE ON TO COMPLETE THIS PROGRAM.
- (5) THE CPERATION OF THE PROGRAM UTILIZES THE FOLICWING FLAGS:

ACTIVE VEHICLE FLAG - CESIGNATES THE VEHICLE WHICH IS DOING RENDEZVOUS THRUSTING MANEUVERS TO THE PROGRAM WHICH CALCULATES THE MANEUVER PARAMETERS. SET AT THE START OF EACH RENDEZVOUS PRE-THRUSTING PROGRAM.

FINAL FLAG - SELECTS FINAL PROGRAM DISPLAYS AFTER CREW HAS COMPLETED THE FINAL MANEUVER COMPUTATION AND DISPLAY CYCLE.

EXTERNAL CELTA V STEERING FLAG - CESIGNATES THE TYPE OF STEERING REQUIRED FOR EXECUTION OF THIS MANEUVER BY THE THRUSTING PROGRAM SELECTED AFTER COMPLETION OF THIS PROGRAM. +15 (6) IT IS NORMALLY REQUIRED THAT THE ISS BE ON FOR A MINIMUM OF 15 MINUTES PRIOR TO A THRUSTING MANEUVER. + 401 + 540 +15 (7) THIS PROGRAM IS SELECTED BY THE ASTRONAUT BY DSKY ENTRY. ++ PROG LGC GREUND CREW CHECKLIST TIME TOTAL CONT TIME .CREW PRCG. . SELECTION START CONSTANT DELTA KEY IN CONSTANT ALTITUDE PREGRAM DELTA ALTITUDE (CDH) PROGRAM (P33) #10 (P33) DISPLAY P33 V37E 33E MCNITCR DSKY: OBSERVE DISPLAY CF PROGRAM 33 #20 SET ACTIVE VEHICLE FLAG TO LM #30 RESET FINAL FLAG #40 P33/SUNDANCE

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1101.5	FLASH VERB-NOUN TO	• •	MONITOR DSKY:	7.18	• •		
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	DISPLAY STORED TIG		FLASH TO REQUES		• •		
SNAP .	(CCH):	• •	RESPONSE AND DI	ISPLAY			
	V06 N31	• •	OF STORED TIG		• •		
		• •	(CDH).		• •		
	R2-TIG(CCH)-MIN	• •			• •		
	R3-TIG(CCH)-SECS	• •	•		• •		
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	. REC TARGET PARA	-		•					#130
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	. THE PARAMETERS								
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	. CAN BE REACHED			•	(1)				#140
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HOLD .	. FLASH VERP-NOUN		. MONITOR DSKY:	•	
600000000	. TO PECLEST RES-		CRSERVE VERB-	•	
SNAP .	. PCNSE AND DISPLAY		. NOUN FLASH TO RE-	•	
	 DELTA ALT (CCH); DELTA T(CCH/TPI) 	•	 QUEST RESPONSE AND DISPLAY OF 	•	
	. AND DELTA TITPI	•	. DELTA ALT (CDH)	•	
	· TPI);		. DELTA T (CCH/TPI)	•	#270
	 V06 N5C 	•	. AND DELTA T (TPI/	•	
	. RI-DELTA ALT	•	· TPI).	•	
	· (CD+)	•		•	
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	. THE ALTITUDE RE-	•			#280
	. TWEFN THE ACTIVE	•		•	
	. AND PASSIVE VE-	•		•	
	. HICLE OPEITS AT	•	• •	•	
	 TIG(CCH). SIGN IS + WHEN THE ACTIVE 	•	• •	•	
	. VEHICLE IS BELOW	•	•	•	
	. THE PASSIVE	*			
	. VEHICLE.	•		•	
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	. DELTA T(CDH/TPI)-	•		•	#290
	. TIG(TPI) AS CE-	•	• , •	•	
	• FINEC BY THIS	•	• •	•	
	• PROGRAM MINUS • TIG(CDH)• COM-	•	• •	•	
	. PUTFC IN HRS,	•		•	
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	. MINS AND SECS ARE	•		•	
	. DISPLAYED. MAX	•		•	
	. READING IS 59859.			•	#300
(40)	DELTA TARRATOR	•	•	•	190
	. DELTA T(TPI/TPI) TIG(TPI) AS CE-	•	•	•	
	. FINEC BY THIS			•	
	. PREGRAM MINUS	•		•	
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	. FINED EARLIER BY	•	•	•	
	. P32. CEMPUTED IN	•	• •	•	
	. HRS, MINS, AND	• .	•	•	2210
	. SECS OF WHICH . CALY THE MINS AND	•	•	•	#310
	. SECS ARE DIS-	•		•	
	. PLAYED.	•		•	
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	TO REQUEST RES-			CBSERVE VERB-	- • • #3	50
	PENSE AND DISPLAY			NOUN FLASH TO		
	CALCULATED COM-			REQUEST RE-		
	PENENTS OF DELTA	• •	•	SPENSE AND DIS-		
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•	V(LV) FOR CDH;	• •	•	PLAY OF DELTA	• •	
	VG6 NE1	• •	•	V (LV) FCP CDH	• •	
•	R1-DELTA VX(LV)	• •	•		• •	
	R2-DELTA VY(LV)		•	•	• •	
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	ROTUELIA VILLVI					
	R3-CELTA V7(LV)		•		XU U	
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•	DELTA VY(LV) -	• •	•		*30	60
•	DELTA VX(LV) - CCMPCNENT OF IM-	• •	•	AM I SATISFIED	#3:	60
•	DELTA VY(LV) - CCMPCNENT OF IM- PULSIVE CELTA V	• •	•	WITH THESE	#3(************************************	60
	DELTA VY(LV) - CCMPCNENT OF IM- PULSIVE DELTA V AT TIG(CCH)	• •	•	WITH THESE VALUES?	• •	60
	DELTA VY(LV) - CCMPCNENT OF IM- PULSIVE DELTA V AT TIG(CCH)	• •	•	WITH THESE VALUES?	• •	60
	DELTA VY(LV) - CCMPCNENT OF IM- PULSIVE CELTA V		•	WITH THESE VALUES? (NOTE: CREW HAS	• • • • • • • • • • • • • • • • • • • •	60
•	DELTA VY(LV) - CCMPCNENT OF IM- PULSIVE CELTA V AT TIG(CCH) ALCNG (FXV)XP.	• •	•	WITH THESE VALUES? (NOTE: CREW HAS THE OPTION AT	• • • • • • • • • • • • • • • • • • • •	60
•	DELTA VX(LV) - CCMPCNENT CF IM- PULSIVE CELTA V AT TIG(CCH) ALCNG (FXV)XP. CELTA VY(LV) -		•	WITH THESE VALUES? (NOTE: CREW HAS THE OPTION AT THIS TIME TO		60
•	DELTA VX(LV) - CCMPCNENT CF IM- PULSIVE CELTA V AT TIG(CCH) ALCNG (FXV)XR. DELTA VY(LV) - CCMPCNENT CF		•	WITH THESE VALUES? (NOTE: CREW HAS THE CPTION AT THIS TIME TO PEDEFINE THE	• • • • • • • • • • • • • • • • • • • •	60
•	DELTA VY(LV) - CCMPCNENT CF IM- PULSIVE CELTA V AT TIG(CCH) ALCNG (FXV)XR. DELTA VY(LV) - CCMPCNENT CF IMPULSIVE DELTA		•	WITH THESE VALUES? (NOTE: CREW HAS THE CPTION AT THIS TIME TO PEDEFINE THE CELTA V (LV)		60
•	DELTA VX(LV) - CCMPCNENT CF IM- PULSIVE CELTA V AT TIG(CCH) ALCNG (FXV)XR. DELTA VY(LV) - CCMPCNENT CF		•	WITH THESE VALUES? (NOTE: CREW HAS THE CPTION AT THIS TIME TO PEDEFINE THE CELTA V (LV)		60
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•	DELTA VY(LV) - CCMPCNENT CF IM- PULSIVE CELTA V AT TIG(CCH) ALCNG (FXV)XR. DELTA VY(LV) - CCMPCNENT CF IMPULSIVE DELTA		•	WITH THESE VALUES? (NOTE: CREW HAS THE OPTION AT THIS TIME TO PEDEFINE THE CELTA V (LV) COMPONENTS FOR	P33/SUNDANCE	160
•	DELTA VY(LV) - CCMPCNENT CF IM- PULSIVE CELTA V AT TIG(CCH) ALCNG (FXV)XR. DELTA VY(LV) - CCMPCNENT CF IMPULSIVE DELTA		•	WITH THESE VALUES? (NOTE: CREW HAS THE OPTION AT THIS TIME TO PEDEFINE THE CELTA V (LV) COMPONENTS FOR	P33/SUNDANCE	160

36 (124)

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57 (125)	•			i e	
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	· ALONG VXP.	9 9	. THE SUBSEQUENT		#370
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	· DELTA VZ(LV) -		FILLY E.D. TILLY C		
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	 PULSIVE DELTA V 	• •	. NORMALLY BE		
	AT TIG(CSH)		. EXERCISED TO	i	
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	• GECCENTRIC (EARTH	• •	. THE RENDEZVOUS		
	• ORBIT) OR SELENC-	• •	. OUT-CF-PLANE	ř	#380
	· CENTRIC (LUNAR		. DISPLAY ROUTINE		
	· ORBIT) RACIUS		• (R36) (V90E) • •		
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	. LM INERTIAL VELC-		. YING DELTA VY		
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P33/SUNCANCE

IS FINAL FLAG SET? SET MGA DIS-PLAY IN R3 (BELCW) -00001. IS REFSMFLAG SET? . CCMPUTE IMU . MIDDLE GIMBAL . ANGLE AT TIG . (CDF) FOR THE . PRESENT IMU . CRIENTATION . WITH THE LM +X . . AXIS ALIGNED . WITH THE . INITIAL THRUST . VECTCR SET MGA DIS-PLAY IN R3 (BELCW) = -00CD2.

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HOLD .							#480
	FLASH VERB-NOUN TO		MCHITCE DS	KY:			
MON .	REQUEST RESPONSE AND			VERB-NOUN .			
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P33/SUNDANCE

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P33/SUNDANCE

CHANGE CONTROL NOTES LOGIC REV 14 FCN MIT - 65 LOGIC REV 15 PCN MIT 401.3,540.2

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APOLLO COMPUTER LOGIC CHECKLIST INTERFACE

TRANSFER PHASE IMITIATION (TPI) PROGRAM (P34)

LOGIC REV 12 06/13/68

PURPOSE:

- (1) TO CALCULATE THE REQUIRED DELTA V AND OTHER INITIAL CONDITIONS REQUIRED BY THE LGC FOR LM EXECUTION OF THE TRANSFER PHASE INITIATION (TPI) MANEJVER. GIVEN:
 - (A) TIME OF IGNITION TIG (TPI) OR THE ELEVATION ANGLE (E) OF THE LM/CSM LOS AT TIG(TPI)
 - (B) CENTRAL ANGLE OF TRANSFER (CENTANG) FROM TIG(TPI) TO INTERCEPT TIME (TIG(TPF)).
- (2) TO CALCULATE TIG (TPI) GIVEN E DR E GIVEN TIG (TPI).
- (3) TO CALCULATE THESE PARAMETERS BASED UPON MANEUVER DATA APPROVED AND KEYED INTO THE LGC BY THE ASTRONAUT.
- (4) TO DISPLAY TO THE ASTRONAUT AND THE GROUND CERTAIN DEPENDENT VARIABLES ASSOCIATED WITH THE MANEUVER FOR APPROVAL BY THE ASTRONAUT/GROUND.
- (5) TO STORE THE TPI TARGET PARAMETERS FOR USE BY THE DESIRED THRUSTING PROGRAM.

- ASSUMPTIONS: (1) THIS PROGRAM IS BASED JPON PREVIOUS COMPLETION OF THE CONSTANT DELTA ALTITUDE (CDH) PROGRAM (P33). THEREFORE:
 - (A) AT A SELECTED TPI TIME (NOW IN STORAGE) THE LINE

OF SIGHT BETWEEN THE LM AND THE CSM WAS SELECTED TO BE A PRESCRIBED ANGLE (E) (NOW IN STORAGE) FROM THE HORIZONTAL PLANE DEFINED AT THE LM POSITION.

- (B) THE TIME BETWEEN COH IGNITION AND TPI IGNITION WAS COMPUTED TO BE GREATER THAN 10 MINUTES.
- (C) THE VARIATION OF THE ALTITUDE DIFFERENCE BETWEEN THE ORBITS WAS MINIMIZED.
- (D) THE PERICENTER ALTITUDES OF THE ORBITS FOLLOWING CSI AND COH WERE COMPUTED TO BE GREATER THAN 35,000 FT. (LUNAR ORBIT) OR 85 NM (EARTH ORBIT)
- (F) THE CSI AND COM MANEUVERS WERE ASSUMED TO BE PARALLEL TO THE PLANE OF THE CSM OPBIT HOWEVER CREW MODI-FICATION OF DELTA V(LV) COMPONENTS MAY HAVE RESULTED IN AN OUT-OF-PLANE CDH MANEUVER.

+12 ++

- (2) LGC COMPUTED VARIABLES MAY BE STORED FOR LATER VERIFICATION BY THE GROUND. THESE STORAGE CAPABILITIES ARE LIMITED ONLY TO THE PARAMETERS FOR DNE THRUSTING MANEJVER AT A TIME EXCEPT FOR CONCENTRIC FLIGHT PLAN MANEJVER SEQUENCES.
- THE RENDEZVOUS RADAR MAY OR MAY NOT BE USED TO UPDATE THE LM OR CSM STATE VECTORS FOR THIS PROGRAM. IF RADAR USE IS DESIRED THE RADAR WAS TURNED ON AND LOCKED ON THE CSM BY PREVIOUS SELECTION OF P20. RADAR SIGHTING MARKS WILL BE MADE AUTOMATICALLY APPROXIMATELY ONCE A MINUTE WHEN ENABLED BY THE TRACK AND UPDATE FLAGS (SEE P20). THE RENDEZVOUS TRACKING MARK COUNTER IS ZEROED BY THE SELECTION OF P20 AND AFTER EACH THRUSTING MANEJVER.
- (4) THE ISS NEED NOT BE ON TO COMPLETE THIS PROGRAM.
- (5) THE OPERATION OF THE PROGRAM UTILIZES THE FOLLOWING FLAGS:

ACTIVE VEHICLE FLAG - DESIGNATES THE VEHICLE WHICH IS DOING RENDEZVOUS THRUSTING MANEUVERS TO THE PROGRAM WHICH CALCULATES THE MANEUVER PARAMETERS. SET AT THE START OF EACH RENDEZVOUS PRE-THRUSTING PROGRAM.

++ +12 +12 ++

PROG

CUNT

FINAL FLAS - SELECTS FINAL PROGRAM DISPLAYS AFTER CREW HAS SELECTED THE FINAL MANEUVER COMPUTATION CYCLE.

EXTERMAL DELTA V FLAG - RESET BY THIS PROGRAM WHICH DESIGNATES THAT LAMBERT STEERING IS REQUIRED FOR EXECUTION OF THIS MANEUVER BY THE THRUSTING PROGRAM.

(6) ONCE THE PARAMETERS REQUIRED FOR COMPUTATION OF THE MANEUVER HAVE BEEN COMPLETELY SPECIFIED. THE VALUE OF THE ACTIVE VEHICLE CENTRAL ANGLE OF TRANSFER IS COMPUTED AND STORED. THIS NUMBER WILL BE AVAILABLE FOR DISPLAY TO THE ASTRONAUT THROUGH THE USE OF VO6N52.

THE ASTRONAUT WOULD CALL THIS DISPLAY TO VERIFY THAT THE CENTRAL ANGLE OF TRANSFER OF THE ACTIVE VEHICLE IS NOT WITHIN 170 TO 190 DEGREES. IF THE ANGLE IS WITHIN THIS ZONE THE ASTRONAUT SHOULD REASSESS THE INPUT TARGETTING PARAMETERS BASED UPON DELTA V AND EXPECTED MANEJVER TIME.

(7) THIS PROGRAM IS SELECTED BY THE ASTRONAUT BY DSKY ENTRY.

L GC	GROUND	CREW		CHECKLIST	TIME	TOTAL TIME
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START TRANSFER PHASE		KEY IN TRANSFER		21 th		
INITIATION PROGRAM	•	PHASE INTIATION				***************************************
(P34)		PROGRAM (P34)			187	#10
DISPLAY PROGRAM 34		V37E 34F				
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		•		86		
		MONITOR DSKY:				
	•	OBSERVE DISPLAY OF				
	•	PROGRAM 34				*
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SET ACTIVE VEHICLE		•				
FLAG TO LM		•				
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HOLD .	FLASH VERB-NOUN TO		•	MONITOR	1CVV.	•	
			•		VERB-NOUN	•	
SNAP .	DISPLAY STORED TIG	· •				•	#
SNAF .	(TPI) CALCULATED			FLASH TO	AND DISPLAY	•	*
	FROM PREVIOUS	• •				•	
	PROGRAMS:		•	OF TIG (ROM PREVIOUS	•	
	V06 N37	• •	: • :			•.	
				PROGRAMS	•	•	
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	R3-TIG (TPI)-SEC		•	3	•	•	
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P34/SUNDANCE

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AM I SATISFIED WITH . THIS VALJE? (NDTE: THIS PADGAM ALWAYS REDUIRES AN . INITIAL VALJE DF . IIG(TPI) AHICH IS . MITHIN 30 MINUTES . DF THE ACTUAL VALUE . EVEN IF TIG (TPI) IS . TO BE CALCULATED .	CORD THIS	KEY IN PROCEED KEY IN V25E AND LOAD THE DESIRED TIG		
	••••••	WAIT FOR KEYSOARD ENTRY TERMINATE FLASH UPON RECEIPT OF PROCEED OR, NEW DATA	O DATA C STORE DATA DATA C STORE DATA C STORE DATA	

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P34/SUNDANCE

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HOLD .	FLASH VERB-NOUN	• •	• •		OR DSKY: .			
6000000	. TO REQUEST PRO-				. VUCK-ERRY BV			
SNAP .	CEED AND DISPLAY		• •		TO REQUEST			#140
	STORED 5 AND				ED AND DISPLAY .			
	CENTANG:	• •	•		ORED E AND .			
	VO6 N55 P1-BLANK		•	CENTA	· · · · · · · · · · · · · · · · · · ·			
	R2-E	• •	•		•			
	R3-CENTANG		•					
	K3-CENTANG		•					
	E-ELEVATION ANGLE.		•					
	BETWEEN THE LM/	• •	•		•			
	CSM LOS AND THE				•			#150
	LM LOCAL HORI-						*	#120
	ZONTAL AT TIG				: :			
	(TPI) REFERENCED			18				
	TO THE DIRECTION							
	OF FLIGHT (SFE				:			
	SECTION 5.4.4 OF			20 1	WISH THE LGC TO .			
	R 557 FOR				LATE E? .			
	DETAILED DESCRIPT-							
	ION) . IN DEGREES			. N	.Y .			
	TO NEAREST .01							#150
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	CENTANG-THE ORBIT-		•					
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	TRANSFER FROM	• •	•	•				
	TIG(TPI) TO TIME	• •			• •			
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	DEGREES TO NEAREST		•					#170
	.01 DEGREE.		•	•		*		
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P34/SUNDANCE

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			KEY IN V25E	#200
e car			• AND LOAD THE • DESIRED F IN • R2 AND CEN- • TANG AS DE- • SIRED IN R3	
	•			#210
27 28			RECORD THIS VALUE	#210
TERMINATE FLASH UPON			:	
RECEIPT OF PROCEED OR NEW DATA	•••	•	KEY IN PROCEED	#220
.P .NEW .R .DATA .O .	•	•		
.E STORE DATA .E				
	•			#230
IS E SPECIFIED TO BE +00000?				
.N Y.				#240
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137	•	•	• •	
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	· SET COMP E FLAG	•	• •	
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	. RESET NEW TARGET			
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	•		DID I SPECIFY E	#260
			TO BE +00000? .	
	. RESET UPDATE FLAG			
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	TIG(TPI)			
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POSS				
HOLD .	FLASH VERB-		MONITOR DSKY:	
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SNAP .	QUEST RESPONSE		VERB-NOUN	
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	· . V06 V55		. SE AVD DIS	
	R1-B_AVK		PLAY OF CAL	
	R2-E		. CULATED F	#290
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P34/SUNDANCE

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COONCE AND	•			. INDICATE THAT			
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138

POSS HOLD . SNAP .

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	. FLASH JPON			. METERS		#350
	RECEIPT OF			. KEY IN		
	PROCEED			. PROCEED		
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HOLD .	• FLASH VER3-			. YOVITOR DSKY: .		
	. NOUN TO RE-			. OBSERVF .		
SNAP .	. QUEST RESPONSE			. VERB-NOUN .		
	. AND DISPLAY			. FLASH TO RE	3	
	. CALCULATED	•		. QJEST PE		
2	. TIG(TPI):			. SPONSE AND .		
	. V06N37	•		. DISPLAY OF .		
	. R1-TIG(TPI)		•	. CALCULATED .		
	-HRS		•	. TIG(TPI)		4270
	. R2-TIG(TPI		•			#370
	-MINS	•	•	•. • •		* 1
	R3-TIG(TPI)	•	•			
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P34/SUNDANCE

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• FLASH VER3-NOUN		MON	ITOR DSKY:	•			
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. TO REQUEST RE	•		BSERVE VERB-	•			
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• TO REQUEST RE- • SPONSE AND DIS- • PLAY CALCULATED	•		BSERVE VERB- V FLASH TO JEST RESPONSE	•			
• TO REQUEST RE- • SPONSE AND DIS- • PLAY CALCULATED • PER ALT, DELTA	•		BSERVE VERB- IN FLASH TO JEST RESPONSE I DISPLAY OF	•			
• TO REQUEST RE- • SPONSE AND DIS- • PLAY CALCULATED	•		BSERVE VERB- V FLASH TO JEST RESPONSE	•			
• TO REQUEST RE- • SPONSE AND DIS- • PLAY CALCULATED • PER ALT, DELTA • V(TPI), AND DELTA	•	0	BSERVE VERB- N FLASH TO JEST RESPONSE DISPLAY OF CJLATED PER		,		
. TO REQUEST RE SPONSE AND DIS PLAY CALCULATED . PER ALT, DELTA . V(TPI), AND DELTA . V(TPF):	•	O	BSERVE VERB- N FLASH TO JEST RESPONSE DISPLAY OF CJLATED PER	•			4470
. TO REQUEST RE SPONSE AND DIS PLAY CALCULATED . PER ALT, DELTA . V(TPI), AND DELTA . V(TPF): . V06N58	•	0 . VJJ . REQ . AVD . CAL . ALT . V(T	BSERVE VERB- N FLASH TO JUST RESPONSE DISPLAY OF CULATED PER DISPLAY DELTA.	•			#430
. TO REQUEST RE SPONSE AND DIS PLAY CALCULATED . PER ALT, DELTA . V(TPI), AND DELTA . V(TPF):	•	0 . VJJ . REQ . AVD . CAL . ALT . V(T	BSERVE VERB- N FLASH TO JEST RESPONSE DISPLAY OF CJLATED PER				#430
TO REQUEST RE- SPONSE AND DIS- PLAY CALCULATED PER ALT, DELTA V(TPF): V06N58 R1-PER ALT	•	0	BSERVE VERB- N FLASH TO JUST RESPONSE DISPLAY OF CULATED PER DISPLAY DELTA.				#430
. TO REQUEST RE SPONSE AND DIS PLAY CALCULATED . PER ALT, DELTA . V(TPI), AND DELTA . V(TPF): . V06N58 . R1-PER ALT . R2-DELTA V(TPI)	•	0	BSERVE VERB- N FLASH TO JEST RESPONSE DISPLAY OF CJLATED PER , DELTA PI), AND TA V(TPF).				#430
TO REQUEST RE- SPONSE AND DIS- PLAY CALCULATED PER ALT, DELTA V(TPF): V06N58 R1-PER ALT	•	0	BSERVE VERB- N FLASH TO JEST RESPONSE DISPLAY OF CJLATED PER , DELTA PI), AND TA V(TPF).				养430
. TO REQUEST RE SPONSE AND DIS PLAY CALCULATED . PER ALT, DELTA . V(TPI), AND DELTA . V(TPF): . V06N58 . R1-PER ALT . R2-DELTA V(TPI)	•	0	BSERVE VERB- N FLASH TO JEST RESPONSE DISPLAY OF CJLATED PER , DELTA PI), AND TA V(TPF).				#430
TO REQUEST RE- SPONSE AND DIS- PLAY CALCULATED PER ALT, DELTA V(TPI), AND DELTA V(TPF): V06N58 R1-PER ALT R2-DELTA V(TPI) R3-DELTA V(TPF)	•	0	BSERVE VERB- N FLASH TO JEST RESPONSE DISPLAY OF CJLATED PER , DELTA PI), AND TA V(TPF).				#430
TO REQUEST RE- SPONSE AND DIS- PLAY CALCULATED PER ALT, DELTA V(TPI), AND DELTA V(TPF): V06N58 R1-PER ALT R2-DELTA V(TPI) R3-DELTA V(TPF) PER ALT-ALTITUDE	•	0	BSERVE VERB- N FLASH TO JEST RESPONSE DISPLAY OF CJLATED PER , DELTA PI), AND TA V(TPF).				#430
TO REQUEST RE- SPONSE AND DIS- PLAY CALCULATED PER ALT, DELTA V(TPI), AND DELTA V(TPF): V06N58 R1-PER ALT R2-DELTA V(TPI) R3-DELTA V(TPF) PER ALT-ALTITUDE OF POST TPI PERI-	•	0	BSERVE VERB- N FLASH TO JEST RESPONSE DISPLAY OF CJLATED PER , DELTA PI), AND TA V(TPF).				#430
TO REQUEST RE- SPONSE AND DIS- PLAY CALCULATED PER ALT, DELTA V(TPI), AND DELTA V(TPF): V06N58 R1-PER ALT R2-DELTA V(TPI) R3-DELTA V(TPF) PER ALT-ALTITUDE OF POST TPI PERI-	•	0	BSERVE VERB- N FLASH TO JEST RESPONSE DISPLAY OF CJLATED PER , DELTA PI), AND TA V(TPF).				#430
TO REQUEST RE- SPONSE AND DIS- PLAY CALCULATED PER ALT, DELTA V(TPF): V06N58 R1-PER ALT R2-DELTA V(TPI) R3-DELTA V(TPF) PER ALT-ALTITUDE OF POST TPI PERI- GEE ABOVE	•	0	BSERVE VERB- N FLASH TO JEST RESPONSE DISPLAY OF CJLATED PER , DELTA PI), AND TA V(TPF).				#430
TO REQUEST RE- SPONSE AND DIS- PLAY CALCULATED PER ALT, DELTA V(TPF): V06N58 R1-PER ALT R2-DELTA V(TPI) R3-DELTA V(TPF) PER ALT-ALTITUDE OF POST TPI PERI- GEE ABOVE THE LAUNCH PAD	•	0	BSERVE VERB- N FLASH TO JEST RESPONSE DISPLAY OF CJLATED PER , DELTA PI), AND TA V(TPF).				#430
TO REQUEST RE- SPONSE AND DIS- PLAY CALCULATED PER ALT, DELTA V(TPF): V06N58 R1-PER ALT R2-DELTA V(TPI) R3-DELTA V(TPF) PER ALT-ALTITUDE OF POST TPI PERI- GEE ABOVE	•	0	BSERVE VERB- N FLASH TO JEST RESPONSE DISPLAY OF CJLATED PER , DELTA PI), AND TA V(TPF).				#430
TO REQUEST RE- SPONSE AND DIS- PLAY CALCULATED PER ALT, DELTA V(TPI), AND DELTA V(TPF): V06N58 R1-PER ALT R2-DELTA V(TPI) R3-DELTA V(TPF) PER ALT-ALTITUDE OF POST TPI PERI- GEE ABOVE THE LAUNCH PAD RADIUS (EARTH	•	0	BSERVE VERB- N FLASH TO JEST RESPONSE DISPLAY OF CJLATED PER , DELTA PI), AND TA V(TPF).				*.
TO REQUEST RE- SPONSE AND DIS- PLAY CALCULATED PER ALT, DELTA V(TPI), AND DELTA V(TPF): V06N58 R1-PER ALT R2-DELTA V(TPI) R3-DELTA V(TPF) PER ALT-ALTITUDE OF POST TPI PERI- GEE ABOVE THE LAUNCH PAD RADIUS (EARTH ORBIT) OR ALTI-	•	0	BSERVE VERB- N FLASH TO JEST RESPONSE DISPLAY OF CJLATED PER , DELTA PI), AND TA V(TPF).				#430 #440
TO REQUEST RE- SPONSE AND DIS- PLAY CALCULATED PER ALT, DELTA V(TPI), AND DELTA V(TPF): V06N58 R1-PER ALT R2-DELTA V(TPI) R3-DELTA V(TPF) PER ALT-ALTITUDE OF POST TPI PERI- GEE ABOVE THE LAUNCH PAD RADIUS (EARTH ORBIT) OR ALTI- TUDE OF PERILUNE	•	0	BSERVE VERB- N FLASH TO JEST RESPONSE DISPLAY OF CJLATED PER , DELTA PI), AND TA V(TPF).				*.
TO REQUEST RE- SPONSE AND DIS- PLAY CALCULATED PER ALT, DELTA V(TPI), AND DELTA V(TPF): V06N58 R1-PER ALT R2-DELTA V(TPI) R3-DELTA V(TPF) PER ALT-ALTITUDE OF POST TPI PERI- GEE ABOVE THE LAUNCH PAD RADIUS (EARTH ORBIT) OR ALTI- TUDE OF PERILUNE	•	0	BSERVE VERB- N FLASH TO JEST RESPONSE DISPLAY OF CJLATED PER , DELTA PI), AND TA V(TPF).				*.
TO REQUEST RE- SPONSE AND DIS- PLAY CALCULATED PER ALT, DELTA V(TPI), AND DELTA V(TPF): V06N58 R1-PER ALT R2-DELTA V(TPI) R3-DELTA V(TPF) PER ALT-ALTITUDE OF POST TPI PERI- GEE ABOVE THE LAUNCH PAD RADIUS (EARTH ORBIT) OR ALTI- TUDE OF PERILUNE ABOVE THE LUNAR	•	0	BSERVE VERB- N FLASH TO JEST RESPONSE DISPLAY OF CJLATED PER , DELTA PI), AND TA V(TPF).				*.
TO REQUEST RE- SPONSE AND DIS- PLAY CALCULATED PER ALT, DELTA V(TPF): V06N58 R1-PER ALT R2-DELTA V(TPF) R3-DELTA V(TPF) PER ALT-ALTITUDE OF POST TPI PERI- GEE ABOVE THE LAUNCH PAD RADIUS (EARTH ORBIT) OR ALTI- TUDE OF PERILUNE ABOVE THE LUNAR RADIUS AT THE	•	0	BSERVE VERB- N FLASH TO JEST RESPONSE DISPLAY OF CJLATED PER , DELTA PI), AND TA V(TPF).				*.
TO REQUEST RE- SPONSE AND DIS- PLAY CALCULATED PER ALT, DELTA V(TPI), AND DELTA V(TPF): V06N58 R1-PER ALT R2-DELTA V(TPI) R3-DELTA V(TPF) PER ALT-ALTITUDE OF POST TPI PERI- GEE ABOVE THE LAUNCH PAD RADIUS (EARTH ORBIT) OR ALTI- TUDE OF PERILUNE ABOVE THE LUNAR	•	0	BSERVE VERB- N FLASH TO JEST RESPONSE DISPLAY OF CJLATED PER , DELTA PI), AND TA V(TPF).				*.
TO REQUEST RE- SPONSE AND DIS- PLAY CALCULATED PER ALT, DELTA V(TPF): V06N58 R1-PER ALT R2-DELTA V(TPI) R3-DELTA V(TPF) PER ALT-ALTITUDE OF POST TPI PERI- GEE ABOVE THE LAUNCH PAD RADIUS (EARTH ORBIT) OR ALTI- TUDE OF PERILUNE ABOVE THE LUNAR RADIUS AT THE MOST RECENTLY DE-	•	0	BSERVE VERB- N FLASH TO JEST RESPONSE DISPLAY OF CJLATED PER , DELTA PI), AND TA V(TPF).				*.
TO REQUEST RE- SPONSE AND DIS- PLAY CALCULATED PER ALT, DELTA V(TPI), AND DELTA V(TPF): V06N58 R1-PER ALT R2-DELTA V(TPI) R3-DELTA V(TPF) PER ALT-ALTITUDE OF POST TPI PERI- GEE ABOVE THE LAUNCH PAD RADIUS (EARTH ORBIT) OR ALTI- TUDE OF PERILUNE ABOVE THE LUNAR RADIUS AT THE MOST RECENTLY DE- FINED LANDING	•	0	BSERVE VERB- N FLASH TO JEST RESPONSE DISPLAY OF CJLATED PER , DELTA PI), AND TA V(TPF).				*.
TO REQUEST RE- SPONSE AND DIS- PLAY CALCULATED PER ALT, DELTA V(TPI), AND DELTA V(TPF): V06N58 R1-PER ALT R2-DELTA V(TPI) R3-DELTA V(TPF) PER ALT-ALTITUDE OF POST TPI PERI- GEE ABDVE THE LAUNCH PAD RADIUS (EARTH ORBIT) OR ALTI- TUDE OF PERILUNE ABOVE THE LUNAR RADIUS AT THE MOST RECENTLY DE- FINED LANDING SITE (LUNAR	•	0	BSERVE VERB- N FLASH TO JEST RESPONSE DISPLAY OF CJLATED PER , DELTA PI), AND TA V(TPF).				*.
TO REQUEST RE- SPONSE AND DIS- PLAY CALCULATED PER ALT, DELTA V(TPI), AND DELTA V(TPF): V06N58 R1-PER ALT R2-DELTA V(TPI) R3-DELTA V(TPF) PER ALT-ALTITUDE OF POST TPI PERI- GEE ABOVE THE LAUNCH PAD RADIUS (EARTH ORBIT) OR ALTI- TUDE OF PERILUNE ABOVE THE LUNAR RADIUS AT THE MOST RECENTLY DE- FINED LANDING	•	0	BSERVE VERB- N FLASH TO JEST RESPONSE DISPLAY OF CJLATED PER , DELTA PI), AND TA V(TPF).				*.
TO REQUEST RE- SPONSE AND DIS- PLAY CALCULATED PER ALT, DELTA V(TPI), AND DELTA V(TPF): V06N58 R1-PER ALT R2-DELTA V(TPI) R3-DELTA V(TPF) PER ALT-ALTITUDE OF POST TPI PERI- GEE ABDVE THE LAUNCH PAD RADIUS (EARTH ORBIT) OR ALTI- TUDE OF PERILUNE ABOVE THE LUNAR RADIUS AT THE MOST RECENTLY DE- FINED LANDING SITE (LUNAR	•	0	BSERVE VERB- N FLASH TO JEST RESPONSE DISPLAY OF CJLATED PER , DELTA PI), AND TA V(TPF).				*.
TO REQUEST RE- SPONSE AND DIS- PLAY CALCULATED PER ALT, DELTA V(TPI), AND DELTA V(TPF): V06N58 R1-PER ALT R2-DELTA V(TPI) R3-DELTA V(TPF) PER ALT-ALTITUDE OF POST TPI PERI- GEE ABDVE THE LAUNCH PAD RADIUS (EARTH ORBIT) OR ALTI- TUDE OF PERILUNE ABOVE THE LUNAR RADIUS AT THE MOST RECENTLY DE- FINED LANDING SITE (LUNAR	•	0	BSERVE VERB- N FLASH TO JEST RESPONSE DISPLAY OF CJLATED PER , DELTA PI), AND TA V(TPF).				#440
TO REQUEST RE- SPONSE AND DIS- PLAY CALCULATED PER ALT, DELTA V(TPI), AND DELTA V(TPF): V06N58 R1-PER ALT R2-DELTA V(TPI) R3-DELTA V(TPF) PER ALT-ALTITUDE OF POST TPI PERI- GEE ABDVE THE LAUNCH PAD RADIUS (EARTH ORBIT) OR ALTI- TUDE OF PERILUNE ABOVE THE LUNAR RADIUS AT THE MOST RECENTLY DE- FINED LANDING SITE (LUNAR	•	0	BSERVE VERB- N FLASH TO JEST RESPONSE DISPLAY OF CJLATED PER , DELTA PI), AND TA V(TPF).			P34/SUNG	#440
TO REQUEST RE- SPONSE AND DIS- PLAY CALCULATED PER ALT, DELTA V(TPI), AND DELTA V(TPF): V06N58 R1-PER ALT R2-DELTA V(TPI) R3-DELTA V(TPF) PER ALT-ALTITUDE OF POST TPI PERI- GEE ABDVE THE LAUNCH PAD RADIUS (EARTH ORBIT) OR ALTI- TUDE OF PERILUNE ABOVE THE LUNAR RADIUS AT THE MOST RECENTLY DE- FINED LANDING SITE (LUNAR	•	0	BSERVE VERB- N FLASH TO JEST RESPONSE DISPLAY OF CJLATED PER , DELTA PI), AND TA V(TPF).			P34/SUNE	#440
TO REQUEST RE- SPONSE AND DIS- PLAY CALCULATED PER ALT, DELTA V(TPI), AND DELTA V(TPF): V06N58 R1-PER ALT R2-DELTA V(TPI) R3-DELTA V(TPF) PER ALT-ALTITUDE OF POST TPI PERI- GEE ABDVE THE LAUNCH PAD RADIUS (EARTH ORBIT) OR ALTI- TUDE OF PERILUNE ABOVE THE LUNAR RADIUS AT THE MOST RECENTLY DE- FINED LANDING SITE (LUNAR	•	0	BSERVE VERB- N FLASH TO JEST RESPONSE DISPLAY OF CJLATED PER , DELTA PI), AND TA V(TPF).			P34/SUNE	#440
TO REQUEST RE- SPONSE AND DIS- PLAY CALCULATED PER ALT, DELTA V(TPI), AND DELTA V(TPF): V06N58 R1-PER ALT R2-DELTA V(TPI) R3-DELTA V(TPF) PER ALT-ALTITUDE OF POST TPI PERI- GEE ABDVE THE LAUNCH PAD RADIUS (EARTH ORBIT) OR ALTI- TUDE OF PERILUNE ABOVE THE LUNAR RADIUS AT THE MOST RECENTLY DE- FINED LANDING SITE (LUNAR	•	0	BSERVE VERB- N FLASH TO JEST RESPONSE DISPLAY OF CJLATED PER , DELTA PI), AND TA V(TPF).			P34/SUNE	#440
TO REQUEST RE- SPONSE AND DIS- PLAY CALCULATED PER ALT, DELTA V(TPI), AND DELTA V(TPF): V06N58 R1-PER ALT R2-DELTA V(TPI) R3-DELTA V(TPF) PER ALT-ALTITUDE OF POST TPI PERI- GEE ABDVE THE LAUNCH PAD RADIUS (EARTH ORBIT) OR ALTI- TUDE OF PERILUNE ABOVE THE LUNAR RADIUS AT THE MOST RECENTLY DE- FINED LANDING SITE (LUNAR	•	0	BSERVE VERB- N FLASH TO JEST RESPONSE DISPLAY OF CJLATED PER , DELTA PI), AND TA V(TPF).			P34/SUNE	#440

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	IN FPS TO NEAREST -	•	•	•	•			
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	DELTA V(TPF)-RE-	•			•			
	QUIRED IMPULSIVE				•			#460
	DELTA V TO ACCOM-						W-	
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P34/SJNDANCE

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+	IN R3(BELOW) .	•		•	
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P34/SUNDANCE

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DO FINAL AUTHWATIC REQUEST TERMINATE ROUTINE (ROO)

CHANGE CONTROL NOTES LOSIC PEV 12 PCN MIT - 65

... EXIT P34

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PESET THE EXTERNAL DELTA V FLAG.

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SET?

. SET THE FINAL . FLAG

APOLLO COMPUTER LOGIC CHECKLIST INTERFACE

TRANSFER PHASE MIDCOURSE (IPM) PROGRAM (P35)

LOGIC REV 11 05/13/68

PURPOSE:

(1) TO CALCULATE THE REQUIRED DELTA V AND OTHER INITIAL CONDITIONS REQUIRED BY THE LGG FOR LM EXECUTION OF THE NEXT MIDCOURSE CORRECTION OF THE TRANSFER PHASE OF AN ACTIVE LM RENDEZVOUS.

ASSUMPTIONS: (1) THE ISS NEED NOT BE ON TO COMPLETE THIS PROGRAM.

++ +11 ++

(2) THE RENDEZVOUS RADAR IS ON AND IS LOCKED ON THE CSM. THIS WAS DONE DURING PREVIOUS SELECTION OF P20. RADAR SIGHTING MARKS WILL BE MADE AUTOMATICALLY APPROXIMATE_Y ONCE A MINUTE WHEN ENABLED BY THE TRACK AND JPDATE FLAGS (SEE P20). THE RENDEZVOUS TRACKING MARK COUNTER IS ZEROED BY THE SELECTION OF P20 AND AFTER EACH THRUSTING MANEUVER.

(3) THE OPERATION OF THIS PROGRAM UTILIZES THE FOLLOWING FLAGS:

ACTIVE VEHICLE FLAG - DESIGNATES THE VEHICLE WHICH IS DOING RENDEZVOUS THRUSTING MANEUVERS TO THE PROGRAM WHICH CALCULATES THE MANEUVER PARAMETERS. SET AT THE START OF EACH RENDEZVOUS PRE-THRUSTING PROGRAM.

FINAL FLAG - SELECTS FINAL PROGRAM DISPLAYS AFTER CREW HAS SELECTED THE FINAL MANEJVER COMPUTATION CYCLE.

EXTERNAL DELTA V FLAG - RESET BY THIS PROGRAM WHICH DESIGNATES THAT LAMBERT STEERING IS REQUIRED FOR EXECUTION OF THIS MANEUVER BY THE THRUSTING PROGRAM SELECTED AFTER AFTER COMPLETION OF THIS PROGRAM.

- (4) THE TIME OF INTERCEPT (T(INT)) WAS DEFINED BY PREVIOUS COMPLETION OF THE TRANSFER PHASE INITIATION (TPI) PROGRAM (P34) AND IS PRESENTLY AVAILABLE IN LGC STORAGE.
- (5) ONCE THE PARAMETERS REQUIRED FOR COMPUTATION OF THE MANEUVER HAVE BEEN COMPLETELY SPECIFIED. THE VALUE OF THE ACTIVE VEHICLE CENTRAL ANGLE OF TRANSFER IS COMPUTED AND STORED. THIS NUMBER WILL BE AVAILABLE FOR DISPLAY TO THE ASTRONAUT THROUGH THE USE OF VO6N52.

THE ASTRONAUT WOULD CALL THIS DISPLAY TO VERIFY THAT THE CENTRAL ANGLE OF TRANSFER OF THE ACTIVE VEHICLE IS NOT WITHIN 170 TO 190 DEGREES. IF THE ANGLE IS WITHIN THIS ZONE THE ASTROVAUT SHOULD REASSESS THE INPUT TARGETTING PARA-METERS BASED UPON DELTA V AND EXPECTED MANEUVER TIME.

(6) THE PROGRAM IS SELECTED BY THE ASTRONAUT BY DSKY ENTRY PRIOR TO ANY ANTICIPATED RENDEZVOUS MIDCOURSE CORRECTION.

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		SFLECTION				
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START TRANSFER PHASE		KEN IN LSVAZLES				
MIDCHURSE (TPM)		PHASE MIDCOURSE				
PROGRAM (P35).		(TPM) PROGRA4 (P35)				#10
DISPLAY PROGRAM 35.		V37E 35E				
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		YOVITOR DSKY:				
		DBSERVE DISPLAY OF				
		PROGRAM 35				
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SET ACTIVE VEHICLE		•				
FLAG TO LM		•				
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P35/SUNDANCE

• RESET NEW TARGET
• FLAG

RESET UPDATE FLAG

DEFINE TIG(MID) =T + "A" MIN.WHERE:

. "A" WILL BE
. STORED IN ERAS. ABLE STORAGE AND
. MAY BE CHANGED BY
. PRELAUNCH ERAS. ABLE LOAD OR LGC
. UPDATE BY P27.

EXTRAPOLATE LM
STATE VECTOR TO
TIG(MID)

EXTRAPOLATE CSM
STATE VECTOR TO
T(INT) (NOTE:
REFER ASSUMPTION
(4) ABOVE).

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• •	•		• •	٠	•	• •	•	•	ERMINATE .	LASH UPON .	PROCEED OR	EW DATA	- MHN	y		י. י. וויי								FIAGE					,	•	- AV L MUN VI	GET FLAG	SET?				. CALCULATE	. NEW TAR-	· GET VEC-	ON VEWLY	. LOAJED	. DELTA V	. (LV) FUK	:			•	
									-	<u>.</u>	α α.	Z	i .				, ,																			•												
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+		1	1 1 1	:	P35/SUNDANCE	
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+11		•		•		
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**		•	• • •	•		
HOLD .	. FLASH VFR3-NOUN		. YONITOR DSKY:	•		
				•		
CNAD	. REQUEST RESPONSE	•	. OBSERVE VERB-	•		
SNAP .	. AND DISPLAY DELTA	•	. NOUN FLASH TO RE-	•		#270
	. V(LOS) FOR TPM:	•	. QUEST RESPONSE	•		#210
	. V06N59	•	. AND DISPLAY OF	•		
*	RI-DELTA	•	. DELTA V (LDS).	•		
	V1 (LOS)	•		•		
	R 2-DFLTA	•	• • •	•		
	. V2(LOS)	•	• •	•		
	. R3-DFLT4	•	•	•		
	V3 (L3S)	•		•		
	•	•	. RECORD THESE	•		
	. (NOTE: FOR DEFIN-		· VALJES.	•		
	. ITION SEE SECTION	•	. (NOTE: UNLIKE	•		#280
	. 5.4.4.4 D= R557).	•	. DELTA V(LV) FOR	•		
			. TPM ABOVE, THESE	•		
		•	. VALUES CANNOT BE	•		
		•	. WRITTEN DVER.	•		
		•		•		
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		•		•		•
		•		•		
		• •		•		
	. WAIT FOR KEYBOARD		. KEY IN PROCEED	•		#290
	• ENTRY	• •		•		
	. TEPMINATE FLASH		•	•		
	. UPON RECEIPT OF			•		
	· PROCEED.			•		
				•		
	•	•				
			: :			
	IS THE FINAL FLAG	•	•	•		#300
	SET?	•	•	•		2300
	361.5	•		•		
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*		•	•	•		
	•	•	•	•		
	•	•	•	•		
	CET MCA DICDLAY	•		•		
++	SET MGA DISPLAY .	•		•		
+11	IN R3(BELTW) = .	•	• •	•		
+11	-02001.	•	•	•		#210
++		•	•	•		#310
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P35/SUNDANCE

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		•	•.	•		
	 IS REFSMELAG SET? 	•	• •	•		
		•		•		
	Y N.		•	•		
		•		•		
		_				#320
	. COMPUTE INU .	-		•		# 320
		•		•		*
	. MIDDLE GIMBAL .	•		•		
	. ANGLE AT TIG .	•	• •	•		
	. (TPM) FOR THE .	•		•		
	. PRESENT IMU .	•	• •	•		
	 ORIENTATION 	•		•		
	. WITH THE LM .	•		•		
	. +X AXIS ALIG					
	. NED WITH THE		1 1	1		
	· INITIAL .	•	•	•		#330
		•	• •.	•		#330
	. THRUST VECTOR .	•		•		
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				•		
	. SET MGA DIS-				×	
++	. PLAY IN R3	•		•		
		•	•	•		
+11	. (BELOW) =			•		4340
+11	00002.	•	• •	•		#340
++		•		•		
		•		•. 1	*	
		•		•		
				•		
HOLD .				•		
	FLASH VERB-NOUN TO	•	MONITOR DSKY:	**		
MON		•		•		
MON .	REQUEST RESPONSE AND		OBSERVE VERB-NOUN	•		
	DISPLAY OF M, TFI		FLASH TO REQUEST	•		
	AND MGA;	•	RESPONSE AND DISPLAY	•	*	
++	V16N45	•	OF M, TFI AND MGA.	•		#350
+11	R1-M	•	NOTE: ON FIRST PASS	•		
+	R2-TFI		THROUGH TFI WILL BE			
+	R3-MGA		TIME FROM TIG (TPI)			
+	7.5	•	UNTIL THE FIRST RE-			
+		•	CYCLE DEFINES TIS	•		
	M THE MIMBER OF	•		•		
+	M-THE NUMBER OF		(MID).	•		
+11	MARKS MADE SINCE THE			•		
++	LAST THRUSTING MAN-			•		
	EUVER OR INITIATION	•	•	•		
	OF P20.	•		•	v.	#350
		•	•	•		
			#1 €	-		
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156

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	TEI-TIME FROM TIG									
	(TOM) IN MIN AND SEC		IN A S	THIS THE L	ACT					
		•				•				
	TO NEARFST SEC. MAX	•		S THROJGH T	HE	•				
	READING IS 59859.	•	PROG	GRAM?	-	•				
	SIGN IS - BEFORE +	•								
*	AFTER TIG(TPM).		. Y		٧.					
	ALTER TROUTE	•	• 1		4.	•				
A		•	•		•	•				
		•	•		•	•				#370
	MG4-MIDDLE GIMBAL	•				•				
	ANGLE AT TIG(TPM) IF			T HEIN I CO	rn					
	LM + X AXIS IS ALIG-	•		TERMINATE T		•				
		•				•				
	NED WITH INITIAL	•		MARK PROCES		•				
	THRUST DIRECTION.	•	• 17	OT THE FINA	IL PASS	•				
	SIGN IS ALWAYS +		. T	THROUGH THE	PRJ-					
	FXCEPT:			RAY?						
	LAGEITE	•	• 0).(A):		•				
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	(A) WHEN DISPLAY-	•	•	. Y	1.	•				
	ED AT ANY TIME			•						#380
	OTHER THAN THE	_		-						
++		•	•	•	•	•				
	LAST PASS THROUGH	•	•	•	•	•				
+11	THE PROGRAM THE	•			•	•				
+11	THE VALUE IS	•				•				
++	-00001				-					
	. 03001		•	•		•				
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	(B) ON THE LAST	•	•	•	•	•				
	PASS WHEN THE IMU	•		•		•				
++	IS NOT ALIGNED					_				
+11	THE VALUE IS	•	•	•	•	•				#220
		•	•	•	•	•				#390
+11	-00002.	•	•	•	•	•				
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	WAIT FOR KEYBOARD		KEY	IN PROCEED) -					
	ENTRY									
	F.41 K.	• •			•	•				
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		•	•		•	•				#400
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		•	• K	KEY IN RECY	LE	•				
	TERMINATE FLASH UPON	•	•	V32E		•				
	RECEIPT OF PROCEED.					•				
	OR RECYCLE	_	-							
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	.0		-			_				#410
	.c .y	7	•			-				# 110
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	.FL	•	WAS	THIS THE L	AST	•				
	.D .E		PASS	THROUGH T	-IF	•				
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		PROGRAM?		×
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				#420
IS THE FINAL FLAG SET?	:	•		i i
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SET THE FINAL	:			
· FLAG	•	• 1		
	•	•		#430
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•	•	•		10.65
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SERET THE SUTERINA		•		
RESET THE EXTERNAL DELTA V FLAG				
		•		#440
•				
•				* 2 **
•		•		
DO EINAL AUTOMATIC		DO FINAL AUTOMATIC	*	
DO FINAL AUTOMATIC REQUEST TERMINATE	•	REQUEST TERMINATE		
ROUTINE (ROO)	•.	ROUTINE (ROO).		
•				7450
		•		#450
•				
	*	•		F . N
EXIT 235		EXIT P35		*

CHANGE CONTROL NOTES LOGIC REV. 11 PCN-MIT-65

. ++ +11 +11

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APCLLC COMPUTER LOGIC CHECKLIST INTERFACE

CPS PPOCPAM (P4C)

LCGIC PFV 21 01/17/59

PURPOSE:

- (1) TO COMPUTE A PREFERRED INU CPIENTATION AND A VEHICLE ATTITUDE FOR A LM DPS THRUSTING MANEUVER.
- (2) TO BO THE VEHICLE MANEUVER TO THE THRUSTING ATTITUDE.
- (3) TO CONTROL THE PENCS DURING COUNTDOWN, IGNITION, THRUSTING, AND THRUST TERMINATION OF A PENCS CONTROLLED DPS MANEUVEP.

- ASSUMPTIONS: (1) THE TARGET PARAMETERS HAVE BEEN CALCULATED AND STORED IN THE LGC BY PRIOR EXECUTION OF A PRE-THRUSTING PROGRAM.
 - (2) THE PEQUIRED STEERING EQUATIONS ARE IDENTIFIED BY THE PRICE PRE-THRUST PROGRAM, WHICH FITHER SET (EXT DELTA V) OR RESET (LAMBERT) THE EXTERNAL DELTA V FLAG. FOR EXTERNAL DELTA V STEEPING, VG IS CALCULATED ONCE FOR THE SPECIFIED TIME OF IGNITION. THEREAFTER BOTH DURING THRUSTING AND UNTIL THE CREW NOTIFIES THE LGC THAT DPS AND RCS TRIM THPUSTING HAS BEEN COMPLETED, THE LGC UPDATES VG ONLY AS A RESULT OF ACCELEROMETER INPUTS.

FOR LAMBERT STEERING VG IS CALCULATED AND UPCATED SIMILARLY, HOWEVER IT IS ALSO UPDATED PERIODICALLY BY LAMBERT SOLUTIONS TO CORRECT FOR CHANGES IN THE LM STATE VECTOR.

++ +21

(3) IT IS NORMALLY REQUIRED THAT THE ISS BE ON FOR A MINIMUM OF 15 MINUTES PRIOR TO A THRUSTING MANEUVER.

+401 ++

- (4) THE EVENT TIMER IS SET TO COUNT ZERO AT TIG.
- (5). ENGINE IGNITION MAY BE SLIPPED BEYOND THE ESTABLISHED TIG IF DESIRED BY THE CREW.
- (6) IN THE EVENT THAT THE GUIDANCE CONTROL SWITCH IS CHANGED FROM PGNCS TO AGS DURING A THRUSTING MANEUVER. THE LGC WILL CONTINUE COMPUTATION OF POSITION AND VELOCITY, THE DESIRED THRUST VECTOR AND THE DESIRED ATTITUDE ERRORS, BUT IS NO LONGER RESPONSIBLE FOR THE MANEUVER.

+21 +EDIT

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(7) THE X-AXIS CVERRIDE CPTICN PROVIDES THE CREW WITH THE ABILITY TO EXERCISE MANUAL CONTROL ABOUT THE LM X AXIS WITH THE ATTITUDE CONTROLLER EVEN THOUGH THE PGNCS ATTITUDE CONTROL MODE IS AUTO. WHEN THE CONTROLLER IS RETURNED TO DETENT THE PGNCS DAMPS THE YAW RATE TO APPROXIMATELY I DEGREE/SECOND, STORES THE YAW ATTITUDE WHEN THE YAW RATE IS DAMPED, AND THEN MAINTAINS THAT ATTITUDE.

THE X-AXIS OVERRIDE OPTION IS ALWAYS AVAILABLE TO THE CREW EXCEPT WHEN THE LGC IS SPECIFYING A DESIRED YAW ATTITUDE. THUS THE CPTICN IS INFIBITED BY THIS PROGRAM ONLY DURING THE ATTITUDE MANEUVER TO THE THRUSTING ATTITUDE (SFE REC).

WHEN THE ATTITUDE MODE CONTROL SWITCH IS SET TO AUTO AND X-AXIS OVERRIDE IS PERMITTED THE YAW ATTITUDE CONTROL SUR MCDE IS RATE COMMAND/ATTITUDE HOLD.

- (8) THE DOCKED CONFIGURATION OF THE VEHICLE(S) HAS BEEN PREVIOUSLY ENTERED IN THE LGC.
- (9) WHEN THE THPUST/TRANSLATION CONTROLLER IS SET TO MINIMUM THRUST POSITION AND THE LGC THROTTLE COMMAND IS ZERO THE DPS WILL START AT 10 PER CENT THRUST.
- (10) THE LOAD CAP DATA ROUTINE (RO3) HAS BEEN PERFORMED PRICE TO SELECTION OF THIS PROGRAM AND THE DPS ENGINE GIMBAL HAS BEEN PREVIOUSLY CRIVEN TO THE CORRECT TRIM POSITION. IF THIS BURN IS OF SUFFICIENT DURATION THAT VEHICLE TRANSIENTS AT IGNITION DUE TO CONTHRUST DOES NOT AFFECT ACCOMPLISHMENT OF MANEUVER AIM CONDITIONS, THEN GIMBAL DRIVE TO TRIM POSITION NEED NOT BE DONE BEFORE TIG. GIMBAL DRIVE TO TRIM POSITION IN WORST CASE COULD REQUIRE 2 MINLTES.

- (11) FOR EACH BURN AN IGNITION TOTAL ALLOWABLE TIME CELAY WILL BE SPECIFIED IN THE MISSION RULES. THIS DELAY TIME IS THE TOTAL TIME WHICH THE THRUSTING MANEUVER MAY BE DELAYED BEYOND THE LGC CALCULATED TIME OF IGNITION. IF ENGINE RESTARTS ARE INVOLVED, THE ACCOUNTING OF THIS TOTAL TIME DELAY IS UP TO THE CREW.
- (12) THIS PROGRAM SHOULD BE SELECTED BY THE ASTRONAUT BY DSKY ENTRY AT LEAST 5 MIN. BEFORE THE ESTIMATED TIME OF IGNITION.
- (13) FLAGS USEC IN THIS PROGRAM:
 NO THROTTLE FLAG INHIBITS THROTTLING BEYOND 10 PERCENT IF TEC IS LESS THAN 95 SECONDS.

PROG

CONT

41						
LGC	GROUND	CREW	CHECK	(LIST	TIME	TOTAL
		• CREW PROG. • SELECTION				
START DPS PRCGRAM (P40) DISPLAY PROGRAM 4C	•	KEY IN DPS PROGRAM (P40) V37E 40F		*		#10
		•				
		MONITOR DSKY: OBSERVE DISPLAY OF PROGRAM 40				#20
:	_	•			* *	
DCES STAGE VERIFIED DISCRETE INCICATE THAT THE CPS HAS BEEN STAGEC?		•				
. N . Y		•				#30
		•		P4	O/SUNDANCE	
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65 (161)	•		-			
(161)			•			
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	•		•			P40/SUNDANCE
			•			
HOLD .						
	. FLASH VERR-MOUN		DOES VERB-NOUN F	LASH	*	
SNAP .	. TO REQUEST RE-	•	TO PEQUEST PESPOI			
	. SPENSE AND DIS-		AND DISPLAY OF AL	LARM		
	. PLAY ALARM CODE		CODE INDICATE TH			
	. TO INCICATE THAT		THE STAGE VERIFI			
	. THE STAGE VERIFIE		DISCRETE INDICAT			#40
	. DISCRETE INDICATE		THAT DPS HAS BEEN	N		
	 THAT CPS HAS BEEN STAGEC; 	\	STAGEC?			
	• V05NC9			• N		
	• R1-01706		• 1	• IX		
	. R2-XXXX		•	•		
	. R3-XXXXX		•	•		
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			•	•		
			•	•		#50
			•	•		
		•		•		
	. WAIT FOR KEY-	• • • • • • • • • • • • • • • • • •	KEY IN TERMINATE	•		
	. BOARD ENTRY	•	V34F	•		
	. TERMINATE FLASH			•		
	. UPCN RECEIPT CF		•	•		
	. TERMINATE		•			
				•		
	•					#60
			•	•		
			•	•		
		•		•		
	. DO FINAL AUTO-	• • • • • • • • • • • • • • • • • • • •	DO FINAL AUTO-	•		
	. MATIC REQUEST		MATIC REQUEST	•		
	· TERMINATE		TERMINATE	•		
	. RCUTINE (ROO)		ROUTINE (RCC)	•		
				•		
			•	•		#70
				•		410
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	. EXIT P40		EXIT P40	•		
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	DO INH STATES CLECK	•	DO IMI STATUS CUI			
•	DO IMU STATUS CHECK ROUTINE (RO2)		DO IMU STATUS CH	LCK		
		•	- COTTRE (NC21			#80
	•					#00
	•					
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	RESET NO THROT FLAG					
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P40/SUNDANCE

CCMPUTE INITIAL
THRUST CIRECTION
AND INITIAL VALUE CF
VG VECTOR AND STCRE
VG(LV) IN N86 FCR
PCSSIBLE MANUAL
SELECTION:

R1-VGX(LV) R2-VGY(LV) R3-VGZ(LV)

VGX(LV)-CCMPCNENT CF VG AT TIG ALCNG (RXV)XR. IN FPS TC NEAREST .1 FPS.

VGY(LV)-CCMPCNENT CF VG AT TIG ALONG VXR. IN FPS TO NEAREST .1 FPS.

VGZ(LV)-CCMPCNENT CF VG.AT TIG ALCNG -R. IN FPS TC NEAREST .1 FPS.

WHERE R IS GEC-CENTRIC (EARTH ORBIT) OR SELENC-CENTRIC (LUNAR ORBIT) RACIUS VECTOR AND V IS VEHICLE INERTIAL VELCCITY VECTOR AT TIG.

CCMPUTE PREFERRED IMU ORIENTATION:

X = UNIT (T)

Y = UNIT (T X R) -SM - -

Z = LNIT(X X Y) -SM - SM - SM

#90

#100

#110

#120

#130

#140

P40/SUNDANCE

66 (162)

P40/SUNDANCE

WHERE:

T = THE INITIAL

THRUST VECTOR
AT TIG

R = THE CEOCENTRIC

- (EARTH ORBIT)

CR SELEND
CENTRIC (LUNAR

ORBIT) RADIUS

VECTOR AT TIG.

SET PREFERRED

ORIENTATION FLAG

STORE DESIRED ATTI-TUDE SPECIFICATION FOR USE BY ATTITUDE MANEUVER ROUTINE (R60). THE FINAL ATTITUCE WILL BE CCMPUTED DURING REC AND WILL POINT THE LM +X AXIS IN THE INITIAL THPUST DIRECTION. HOWEVER, IN CRDER TO CONSERVE RCS FUEL AND NOT CENSTRAIN THE NON-CRITICAL ATTITUCE ABOUT THE THRUST VECTOR, WINGS MAY NCT BE LEVEL IN THE CCMPUTED FINAL ATTITUCE.

ZERO ATTITUCE ERRCR AND SET 1 DEGREE DEADBAND IN PCS DAP. #150

#160

#170

#180

#190

		•			•				
*		•			•				
					•				#200
	RESET	3 AXIS FLAG			•				
	FOR U	SE BY THE ATTI-							
		MANEUVER							
		NE (R6C).			•				
		NE (ROU).			•				
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		. •			•				
	DO AT	TITUDE MANEUVER			DO ATTITUDE MANE	IIVER			#210
		NE (R6C)			RCUTINE (R60)	OFER			# C 1 0
	11000	NE (NOU)	•		KCOTTNE (KCO)				
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		PGNCS CONTRCL,	•		•				#220
		ATTITUDE	•		•		*		
	CENTR	OL AND AUTC	•		•				
	THROT	TLE MOCES	•						
		SELECTED?							
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	. Y	• N	•		• • • •				
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POSS			• •	•					
HOLD .	. F	LASH VEPB-NOUN	•	0 0	MONITOR DSKY:				#230
	. T	O REQUEST			DOES VERB-NOUN				
SNAP .		LEASE PERFORM			FLASH TO REQUEST				
0.000		GNCS CONTROL,			PLEASE PERFORM				
		UTO ATTITUDE	•		PGNCS CONTROL, A	UTO			
			•	•					
		CHTRCL AND AUTO	•	•	ATTITUDE CONTROL				
		HRCTTLE MODE	•		AND AUTC THROTTL				
	. S	ELECTION:	•		MODE SELECTION I	N-			
		V50 N25	•		DICATE THAT MCDE			*	
		R1-00203			SELECTION IS				
		R2-EL ANK			INCORRECT?				#240
	•	R3-BL ANK	•	•	THEORNEOTT				WE 40
	•	K3-CLANK	•	•	У	A1			
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(164)		•	•	•					

59		-			· ·	
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		•			•	
		•	•	SET GUIDANCE .		
	•	•	•	CENTREL SWITCH .	•	
	•	•		TO PGNCS, AT	•	
	•	•		TITUDE CONTROL . SWITCH TC AUTC .	•	
		:		AND THROTTLE .	•	
				SWITCH TO .		#260
		•		AUTO		*200
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	•	WAIT FOR KEY- BOARD ENTRY	• •		•	
	•	BEARD ENTRY		KEY IN PROCEED .	•	#270
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		TERMINATE FLASH	•		•	
	•	UPON RECEIPT OF		KEY IN ENTER	•	
	•	PROCEED OR ENTER	•		•	
	•	.E .PROCEED	•	•	•	#280
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	•	.F	•	•		
	•	.F	•	•		
		•F ••••••••	•			
		.F	•			#290
	ENGI	R IME TO GO TO RE IGNITION LESS	•			#290
	ENGI	.F	•			#290
	ENG I	F	•			#290
	ENGI THAN	R IME TO GO TO RE IGNITION LESS				#290
	ENG I	F				#290
POS S	ENGI THAN	F	•			#290
	ENGI THAN	F	•	MCNITCR DSKY:	,	#290
POS S HOLD	ENGI THAN	IME TO GO TO NE IGNITION LESS 1 45 SECONDS? Y FLASH VERR-NOUN TO REQUEST PES-		MCNITOR DSKY: DOES VERB-NOUN FLA	ΔSH	
POSS HOLD •	ENGI THAN	F		MCNITOR DSKY: DOES VERB-NOUN FLA TO REQUEST RESPONS	A SH SE	#290 #300
POS S HOLD	ENGI THAN	F		MCNITOR DSKY: DOES VERB-NOUN FLA TO REQUEST RESPONS AND DISPLAY OF ALA	ASH SE ARM	
POS S HOLD	ENGI THAN	F. R.	•	MCNITOR DSKY: DOES VERB-NOUN FLA TO REQUEST RESPONS AND DISPLAY OF ALA CODE INCICATE THAT	Δ SH SE ARM T	
POS S HOLD	ENGITHAN	F. R.	•	MCNITOR DSKY: DOES VERB-NOUN FLA TO REQUEST RESPONS AND DISPLAY OF ALA CODE INCICATE THAT CHECKLIST HAS NOT	A SH SE ARM T	
POS S HOLD	ENGITHAN	FLASH VERR-NCUN TO REQUEST PES- PLASH ALAPM CODE TO INDICATE THAT IGNITION TIME IS LESS THAN 45	•	MCNITOR DSKY: DOES VERB-NOUN FLA TO REQUEST RESPONS AND DISPLAY OF ALA CODE INCICATE THAT CHECKLIST HAS NOT BEEN COMPLETED ON	A SH SE ARM T	
POS S HOLD	ENGITHAN	F	•	MCNITOR DSKY: DOES VERB-NOUN FLA TO REQUEST RESPONS AND DISPLAY OF ALA CODE INCICATE THAT CHECKLIST HAS NOT	ASH SE ARM T	
POS S HOLD	ENGITHAN	FLASH VERR-NCUN TO REQUEST PES- PLASH ALAPM CODE TO INDICATE THAT IGNITION TIME IS LESS THAN 45	•	MCNITOR DSKY: DOES VERB-NOUN FLA TO REQUEST RESPONS AND DISPLAY OF ALA CODE INCICATE THAT CHECKLIST HAS NOT BEEN COMPLETED ON TIME?	ASH SE ARM T	
POS S HOLD	ENGITHAN	F	•	MCNITOR DSKY: DOES VERB-NOUN FLA TO REQUEST RESPONS AND DISPLAY OF ALA CODE INCICATE THAT CHECKLIST HAS NOT BEEN COMPLETED ON TIME?	ASH SE ARM T	
POS S HOLD	ENGITHAN	F	•	MCNITOR DSKY: DOES VERB-NOUN FLA TO REQUEST RESPONS AND DISPLAY OF ALA CODE INCICATE THAT CHECKLIST HAS NOT BEEN COMPLETED ON TIME? • Y	ASH SE ARM T	#300

		•	•		
R2-XXXXX		•	•		
		•	•		
R3-XXXXX		•	•		
		•	•		#310
		~			
•		•	•		
•			•		
•		REFER TO EVENT	•		
		TIMER AND	•		
		MANEUVER			
· •			•		
•		RULES. SHALL	•		
•		I SLIP ENGINE	•		
•		IGNITION TO	•		
		45 SECONDS			
•			•		****
•		FROM THE	•		#320
•		COMPLETION OF	•		
		A PROCEED IN-			
- W		STRUCTION?	•		
•		STRUCTION	•		
•			•		
•		•N •Y	•		
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•		• •	•		
			•		
WAIT FOR KEY-	•	. KEY IN	•	*	
BOARD ENTRY		PROCEED	~		#330
2011 2 2117111		THOUSE THOUSE			#330
	•		•		
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*		•	•		
		•	•		
TERMINATE FLASH			•		
UPCN RECEIPT OF		KEY IN TERMINATE	-		
			•		#240
PROCEED OR	•	V34E	•		#340
TERMINATE			•		
		•			
•P •T		-	-		
		•	•		
•R •E		•	•	*	
•0 •R		•	•		
.C .M		•	•		
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T		•	•		#350
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		20 51444	•		
. CC FINAL		DO FINAL	•		
. AUTOMATIC		AUTOMATIC RE-	•		
. REQUEST TERM-	•	QUEST TERMINATE			
			•		
. INATE ROUTINE		ROUTINE (RCO)	•		
· (ROO)			•		#360
			•		
		-	And the second s		
•		•	•		IDANICE
		•	•	P40/SUN	WANCE
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70 (166

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	•		•	•	P40/SUNDANCE	
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	EXIT P40		FXIT P40	•		
	CX11 -40		FXII P40	•		
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				•	#370	0
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	ABLISH NEW EQUAL TO			•		
	SENT TIME			•		
	S 45 SECENES			•		
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	CPS CFF			•		
	LPS UFF			•	#380)
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7500.00	C 4U70			•		
ZERO DP THRCTTL				•		
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•	•			•	#390	0
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-	DAROLATE CTATE			•		
	RAPOLATE STATE TOR TO TIG-30			•		
	. USING PRE-			•		
	ICN INTEGRA-		¥			
 TIC 	N .			•		
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•	•			•	12.2	_
•	•			•	#400	J
	•	2				
. IS T	IME FROM IG-			•		
	CN NEGATIVE			•	,	
	GREATER THAN			•		
	ECCNCS?			•		
v	• N			•		
	•			•		
	•				#410	0
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71 (167)

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	•		TIME FROM						
	•		ITICN NEG-						
	•	. ATI	VE. LESS			•			
	•		N 35 AND			•			
	•		ATER THAN			•			
	•		SECONDS?			•			
	•	•				•			
	•		Y .N						
	•	• •	•			•			#420
POSS	•		•			•			
HOLD .	•	• •							
• • • • • • •	•		FLASH	•	MCNITCR				
SNAP .	•		VFPB-NCUN	• • • • • • • • • • • • • •		VERB-NCUN			
	•		TO REQUEST	•		C REQUEST			
	•		RESPONSE			E AND CISPLA			
	•		AND CIS-			ODE INDICAT-			
	•		PLAY ALARY			T INTEGRATIO			
	•		CCDE TC			RLAPPEC AVE			
	•		INCICATE		AGE G T	URN CN TIME?	?		#430
	•		THAT STATE				-		
	•		VECTOR IN-		. Y	N.			
	•		TEGRATION		•	•			
	•		HAS OVER-		•	•			
	•		LAPPED		•	•			
	•		AVERAGE G		•	•			
	•		TURN ON		•	•			
	•	• •			•	•		4	
	•	• •	VOSNOS		•	•			
	•	• •			•	•			#440
	•	• •	P2-XXXXX		•	•			
	•	• •	R3-XXXX		•	•			
	•	• •			•	•			
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	•		WAIT FOR .		KFY IN	•			
	•				TERMIN-	•			
	•				ATF	•			#150
	•		EN 131		V34E	•			#450
					V J 7 f.	•			
			TERMINATE		-	•			
			FLASH UPCA			•			
	-				-	•			
			TERMINATE						
			•						
			•						#460
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	•				•	•		P40/SUNDANCE	
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(148)	•		•		•	•			

72 (168)

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73 (169)		v .	
		s •	
			P40/SUNDANC
		, e	
	· · · CC FINAL	DO FIN	
	AUTCMATI	C AL AUT	
	PEQUEST	OMATIC .	
	TERMINAT		
	ROUTINE	TERMIN	
	· . (ROO)	ATE .	
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		(ROO) .	
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	* * * EVIT DA	* * *	
	 EXIT P4 		
		P40 •	
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	0 0		
	DISPLAY	 MCNITER DSKY: 	
	ON DSKY:	OBSERVE DISPLAY OF	
	V06 N40	. TFI AND VG.	
	R1-TFI		
	R2-VG	_	
	R3-DELTA	•	
	VM .	٥	
		•	
	TFI-TIME	UDDATE FUENT TIMES	
	FROM DPS	UPDATE EVENT TIMER	
	IGNIT	IF DESIRED. TIMER	
	ICN. IN	WILL NOT AGREE WITH	
	MIN. SEC	DSKY R1 IF IGNITION	
	TC NEAR	HAS REEN SLIPPED AS	
	EST SEC	RI WILL DISPLAY TFI	
	MAX	TO NEW TIG.	
	PEADING		
	15	•	
	59859	•	
	SIGN IS	•	
	- PEFCRF		
	NCRMAL	VERIFY/SET THRUST/	
	TIG, +	TRANSLATION CONTROL-	
	THERE	LER TC MINIMUM	
	AFTER	THPUST POSITION.	
		Chrost FCSTTICNs	
	VC-MAGN-		
	ITUCE CF	•	
		•	
	THE VEL	•	
	OCITY IC	ACM DDC /AUTC	
	BE GAIN	AFM DPS. (AUTC	0.010.000
	• •		P40/SUNDANC

	ED BY				THPOT	TLE SI	GNAL IS			
	THRUST-	•	•				DPS AND			
	ING MAN- EUVER.	•	•		THRUS	T INCI	CATOR.)			
	IN FPS	•	•							# 500
	TC NEAR-		•			•				#520
	EST .1									
	FPS	•	•							
		•	•		CHECK	THRUST	T INDICA-			
	DELTA	•	•				SICE) TO			
	VM-MEAS-	•	•				THROTTLE			
	DELTA V	•	•				ZEROED (O			
	MAGNIT-	•	•		PERCEI	NI INC	ICATION).			
	UCE. IN				. '	Υ	• N			#530
	FPS TC	•	•				•			# JJ0
*	NEAREST	•	•				•			
	.1 FPS.	•	•		•					
	THIS	•	•		•		BACKUP			
	DISPLAY WILL BE	•	•		•	PROCEI	DURES.			
	00000	•	•		•					
	UNTIL		•		•					
	TIG-30									
	SEC AND	•	•		CHECK	STATUS	S OF C/W			#540
	THEN	•	•		LAMPS					
	SHCULD	•	•							
	CHANGE ONLY DUE	•	•			•			*	
	TC PIPA	•	•			•				
	BIAS UN-	-	•			•				
	TIL ULL-									
	AGE IS	•	•							
	STARTEC.	•	•			•				
		• -				•				#550
	•	-	PLANK			•				
	•		CSKY IM-			•				
	•	• 1	CLIAICET			•				12
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	•	•	•			•				×
				•						
	AT TIG-35		· .			OR DSK				
	DSKY DISP		, •	•			5 SEC Y CISPLAY			#560
	(V,N,R1,R		•			BLANK				
	AND R3) F		5 .				TE: IF			
	SECONDS.		•				R INTEG-			
					RATIO	N HAS F	RUN INTO			
		•	•				RICD TIG			
		•	•			C TIG-				
		•	•				ND DURA-			
		•	•			CF BLAI T BE DI				#530
		•	•	*9	CANNO	ו סכ טו	ELINEA		P40/SUNDANCE	#570
			•						+ TU/ SUNDANCE	
		-	-							

74 (170)

					OVO (CHADANCE	
• •					P40/SUNDANCE	
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			IFSS THA	Y E		
		SECENI				
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• •			•			
AT TIG-30 SEC RETURN VO6N4C DISPLAYS		DESFOR	OR OSKY: TIG-30 VF PETUP O DISPLA	SEC N OF	#5	80
•			ATE THAT			
			GE G INT			
		TICN	HAS STAR	TED.		
•			•			
•			•			
			•			
CALL AVERAGE G					#5	90
INTEGRATION ON AT						
TIG - 30 SEC			•			
			•			
•			•			
:			OR DSKY:			
			E PERICO			
•			-00B30 U	NTIL		
•			-0CB15			
•			DELTA VM		#6	00
•			ER THAN ATING EX			
•			BIAS ERR			
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•		•		PACKUP		
			PROCE		#6	10
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•		•				
AT TEL - 7 E SEC			I = -00P			
AT TEL =-7.5 SEC CCMMAND 2 JET +X	*					
TRANSLATION	*		LATION.	4.4		
•			•			
•			•		#6	20
•			•			
•			•			

P40/SUNDANCE

WAIT INTIL
TFI = -5 SEC.
.

CALCULATE DURATION OF BURN

IS BURN DURATION LESS THAN 95 SECCNDS?

SET NC THROT
FLAG TC
INHIBIT THROTTLE CCMMAND TC
MAXIMUM
AT TIC + XX (A
PAD LCADEC
ERASAELE
MEMCRY
CCNSTANT)

#630

#640

#650

#660

P40/SUNDANCE

76 (172)

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77	3)		•		•			
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		•	•		•		P40/SUNDANCE	
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		•	•		•			
		•	•				#	670
			•	MONITOR				
		CHANGE VERB BUT	•		VERB-NO			
	•	RETAIN PRESENT NOUN	• • • • • • • • • • • • • • • • • • • •		C RECUES	T		
		AND DISPLAYS IN RI,		PLEASE				
	HOLD .	R2, R3, FLASH VERB-		ENGINE	CN ENABL	E		
		NOUN TO REQUEST	•					
		PLEASE PERFCRM	•	•	•			
		ENGINE ON ENABLE:	•	·	•			
		V99N4C	•		•			
			•		•		#	680
		•	•		•			
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		•	•		•			
		•	•		•			
		•	•	i e	•			
		•	•					
		•	•	IS THIS	AN ATTE	MPTED		
			•	ENGINE	RESTART?			
		•						
		•		. N		. Y	#	690
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		•		. MONI	TOR STAR	T OF		
		•		. +X T	RANSLATI	CN		
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		•						
		•						
		•					#	700
				MCNITCR	DSKY:			
		•			R INCREA	SE OF		
		•			M INDICA			
				SUFFICI				
		•		RECUIRE				
		•		DELTA V	IS A			
		•			N OF VEH	ICLE		
		•		WFIGHT.				
		•						
		•	•		•		#	710
		•		1	•			
		•			•			
		WAIT FOR KEYBOARD		SHALL I	PERMIT	14		
		ENTRY		IGNITIO	N CF			
			•	REIGNIT	ICV?			
				. N		. Y		
						•		
						•		720
				KFY	IN PROCE	FD		
						•		
						•	P40/SUNDANCE	

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	SHALL I ATTEMPT .	
	TO COMPLETE .	
		730
•	• MANEUVER WITH • • THE RCS? •	
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• •	• • • • • • • • • • • • • • • •	
• •	• ENTER • •	
•	• • • #	740
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•	. GO TO	
•	BELOW	
•	• •	2000-0-07
•	· · · · *	750
TERMINATE FLASH UPON	. KEY IN	
RECEIPT OF ENTER, PROCEED OR TERMINATE	• TERMINATE • • • • • • • • • • • • • • • • • • •	
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•P •E •T •	• • •	
•R •N •E •		
.C .E .M .	• •	
E R I .	* • • • *	760
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TURN TURN .	• •	
. OFF OFF .	•	
. ULLAGE ULLAGE .	• •	1770
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GC TO	• • •	
. BELCW .	• •	
	P40/SUNDANCE	
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(174

79 (175)							
(175)							
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		•	•				#780
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	. DC FINAL AUTO-		DO FINAL ALTO-	•			
	 MATIC REQUEST TERMINATE ROU- 	• • • • • • • • • • • • • • • • • • •	MATIC REQUEST TERMINATE ROU-	•			
	. TINE (ROC).		TINE (POO).	•			
	•		•	•			
	•		•	•			
		•	•	•			#790
	• • • • •	•	• • •	•			
	. EXIT P40		EXIT P40				
	•						
	•			•			
	DECLINE CLATIC DIC		MCMITCO DCKY.				
	RESUME STATIC DIS- PLAY OF VC6N40		MONITOR DSKY: CBSERVE RETUR	N CE			
			STATIC VERB-NCU				
			(V06N40)				#800
	•				*		
	•	•	•				
	•	•	•				
	IS TEL NEGATIVE AND		MCNITOR DSKY:				
	GREATER THAN ZFRC?		IS RI DISPLAY C				
			NEGATIVE AND GRI	EATER			
	٠, ٢		THAN ZERC?				#810
			. Y	• N			,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,
	•		•	•			
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			•	•			
	WAIT UNTIL .		STANDBY FCR				
	TFI= -00800 .		THRUST CN				
			WHEN TFI= -0080	0.			
	•	•	•	•			#820
			•	•			
			. STANDBY FOR				
			. THRUST CN				
	•	•	. IMMECIATELY				
	•						
	CCMMANT DES EN						#830
			•				
	•						
	•						

P40/SUNDANCE

P40/SUNDANCE	
	#840
	# 850
	#860
	#870

HAS FNGINE IGNITED?
CHECK THRUST INDI—
CATOR (LEFT SIDE) TO
INDICATE 10 PERCENT
CHAMBER PRESSURE
(CORPESPONDING TO
THRUST/TRANSLATION
CONTROLLER SETTING).

MCNITCR DSKY:

. . TFI DISPLAY TC TFC

..... OBSERVE CHANGE OF

. IN RI

. N . Y

P40/SUNDANCE

80(176)

WAIT 0.5 SEC.

TURN CFF LLLAGE

TURN ON DAP TVC FUNCTIONS

CHANGE TEL CISPLAY

ESTABLISH DELTA V MCNITCR (REFER SECTION 5.3.3.4 CF

(NOTE: IF THE CELTA

R557).

TO TFC IN R1;

V06 N40

CUTOFF.

R1 - TFC
R2 - VG
R3 - CELTA VM

TFC - TIME FRCM
FNGINE CUTOFF. IN
MIN AND SEC TO NEAREST SEC. SIGN IS
- BEFORE + AFTER

#880

P40/SUNDANCE

#890

#900

#910

#920

#930

#940

P40/SUNDANCE

V MCNITCR DCES NCT DETECT THRUST IN 8-10 SECCNDS FROM REC- . EIPT OF ENGINE CN COMMAND IT IS CONS-ICERED THRUST FAIL. IF THE DELTA V MCTI-TOR DOES NOT DETECT THRUST FOR 2-4 SEC-ONDS DURING NORMAL THRUSTING PERIODS IT . IS CONSIDERED A THRUST FAIL. IN THE EVENT OF A THRUST FAIL, THE PROGRAM WILL RETURN TO THE TIG-5 SEC PCINTI.

•THRUST •NC •THRUST •

COMMAND ENGINE

TURN CFF DAP TVC FUNCTIONS

MAINTAIN VG CCM-PUTATIONS FOR POSSIBLE FURTHER THRUSTING.

CCMMANC +X ULLAGE TPANS-LATION (2 JFT) RESET TEC DIS-PLAY IN RI TO 59859.

AT TIG +XX SEC (A PAC LCACEC ERASABLE MEMORY CONSTANT.) COMMAND THEOTILE TC MAXIMUM. IF NC THRCT FLAG IS RESET. (I.E. BURN DURATION WAS CALCU-LATED TO BE GREATER THAN 95 SEC 1.

. AFTER XX SECONDS

. THROTTLE COMMAND

. PERCENT CHAMBER

. TFC WILL START . COUNTING DOWN.

. . PEPCENT AUTO

..... CATOR TO INDICATE

. . CBSERVE THRUST INDI-

. (FIGHT SIDE) AND 100

. PRESSURE (LEFT SIDE)

. ALSO AT THIS TIME

. BURN DURATION WAS . CALCULATED TO BE . LESS THAN 95

SECCNDS.

. THEREFORE MAXI-. MUM THROTTLE WILL

NOT BE COMMANDED.

THROUGHOUT THE THRUSTING MANEUVER THE LGC WILL MCNITCR THE ANGLE BETWEEN THE DESIRED THRUST VECTOR AND THE

MEASURED THPUST VECTOR. IF THIS ANGLE BECEMES

GREATER THAN 45 PE-GREES TURN ON PRC-GRAM ALARM PUT DO

NCT CHANGE THE DSKY

MONITOR DPS THRUSTING:

1. DSKY: R1-TFC SHCULD BE CECREASING

> R2-VG SHOULD RE DECREASING

R3-DELTA VM SHOULD INCREASE #950

#960

#970

#980

#990

P40/SUNDANCE

DISPLAY. STORE ALARM CCDE (1407). (REFER SECTION 5.3.3.4 CF

R557).

P40	151	INC	AN	11

P40/SUNDANCE

ATT	EDAI-ATT ULD BE LI CEGREE RATES SI S THAN CO	ESS THAN HOULD BE REQUAL		#1000
. 3. LEF MAX RIGI THP! PERI	CEGREI THRUST III T SIDE: CHAMBER HT SIDE: DITTLE COI CENT FULI TE: A PRE ANGLE PI	NDICATOR PERCEN PRESSUP LGC MMAND L THRUST OGRAM CCCUR IF		#1010
VFC: SUR! BECC: 45 I IDE! KEY EXPI	DESTRED TOR AND TOR AND ED THRUS OMES GRE DEGREES. NTIFY THE IN VOSNI ECTED ALI 01407.)	THRUST THE MEA- T VECTOR ATER THA TO E ALARM 09E•		#1020
NORENGASSIDISI		LATE FF FROM		#1030
L	.M .C .U .T .O .F	• F • C • U • T • C • F • F		#10 4 0
• • •	. ST1	SH ENGIN OP PUSH- TTCN		#1050

•	• • •	•	
•			P40/SUNDANCE
•			
•		•	
•		•	
•		•	
•		GC TC	
•		BACKUP	
		PRCC FDURES.	
•			
•			W1040
•	• • •		#1060
•	• • • •		
•			
	•		
LGC COMMANDS ENGINE . OFF WHEN INCICATED BY CUTDEF EQUATION	•		
•	•	w.	
•	•		#1070
•	•		
REMOVE CAP TVC FUNCTIONS			
•	•		
•			
TERMINATE CELTA V			#1080
•	•		
•	•		
•	•		
MAINTAIN VG			
CCMPUTATIONS AFTER	:		
CUTOFF FOR POSSIBLE			
NULLING BY PCS			
TRIMMING MANEUVER	•		#1090
(NOTE: SEE ASSUMP-	•		
TICN (2) APCVE).	•		
	•		
•			
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•			
•	DISARM		
•			#1100
•		•	*1100
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•	н∨и	•	
• "A"	EP.CM.	•	
. FD[N	ARCVE	•	
· ABCVE	•	•	
	•	•	P40/SUMDANCE
•	•		1 - O/ Still DANCE
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		•	

84 (180)

85 (181)				
	• •		0 4	
	• •		•	P40/SUNCANCE
	•		• •	
			•	
			: :	
			•••	
	• • • •			#1110
•				
			MCNITCR DSKY:	
HOLD .	FLASH VERB-NOUN TO		DESERVE VERE-NOUN	
	REQUEST PROCEED.	•	FLASH TO REQUEST	
	HCLD DISPLAY OF TEC AT ITS FINAL VALUE:		OF TEC, VG AND DELTA	
	V16 N4C		VM.	
	R1 - TFC		VM•	
	R2 - VG			
	R3 - DELTA VM			#1120
				71120
	NOTE: SEE ASSUMP-		•	
	TICN (2) AREVE).		•	
			•	
	•		•	
	•		•	
	•		•	
	•		•	
	•		255022 74555 444456	
	•		RECORD THESE VALUES	#1130
	•		AS DESIRED.	
	•			
	:		•	
	WAIT FOR KEYBOARD	•		
	ENTRY		KEY IN PROCEED	
	TERMINATE FLASH UPCN	•		
	RECEIPT OF FROCEED		•	#1140
			•	
	• P		•	
	• ¤		•	
	• C		•	
	• (• F		•	
	• • • • • • • • • • • • • • • • • • •		•	
	• [•	
	• •		•	90
				#1150
	•		•	
			•	
	ZERO ATTITUCE FRECE		•	
	AND SET .3 CFGREE		•	
	DEACBANG IN FCS CAP		•	
			•	
	•		•	a a
	•		•	
	•		•	****
	•		•	#1160
	•		•	
	•		•	

P40/SUNDANCE

v.	•		•		
HOLD .	FLASH VERB-ACUN TO		MCMITCE DSKY:		
	REQUEST RESPONSE AND		CRSERVE VERR-NOUN		
	DISPLAY COMPONENTS	9	FLASH TO REQUEST		
	OF VG(LM):	•	RESPONSE AND CISPLAY		
	V16 N85				
			COMPONENTS OF VO(LM)		
	R1-VGX(LM)	2			
	R2-VGY(LM)		•		#1170
	R3-VG7(LM)		•		
	COMPONENTS OF THE VG				
	VECTOR RESOLVED				
	ALCNG THE PRESENT		TO NULL OUT VG		
	X, Y, AND Z AXES.		COMPONENTS COMMAND	· ·	
	THE VG VECTOR WILL		MANUAL TPANSLATIONS		
	BE UPCATED BY THE		AND ROTATIONS.		
	STEERING LOCPS		(NOTF: THIS MANEUVER		
	DURING EACH COMPUTA-		IS AT THE OPTION OF		#1180
	TICH CYCLE. IN FPS .		THE CREW.)		
	TC NEAREST .1 FPS.		THE CREWS		
	(NOTE: SEE ASSUMP-		•		
	TION (2) ABOVE).				
	•				
	•		THE ODDITAL DADA		
	•		THE ORBITAL PARA-		
	•		METER DISPLAY		
	•		ROUTINE (R30) MAY BE		#1190
	•		SELECTED AT THIS		
			TIME (V82E) TC		
	-		MCNITCR CCNTINUOUSLY		
	•		UPDATED VALUES OF		
	•				
	•		APO ALT, PER ALT,		
	•		AND TEF.		
	•				*
			•		
	-		2		
	•		•		#1200
	•		•		#1200
			•		
	WAIT FOR KEYBOARD	•			
	ENTRY		KFY IN PROCEED		
	TERMINATE FLASH UPCN	•			
	RECEIPT OF PROCEED				
			2		
			•		
	•		•		
	•		•		
	•		•		
			•		#1210
	RESTORE ASTRONAUT				
	SPECIFIED DEATRAND		_		
	LIMITS IN PAP.				
	LIPIO IN TEFS		•		
			•		
	•				
	•		•		
	•				
	1				P40/SUNDANCE
	•		<u>*</u>		W. Servery F
	•		•		
(182)	•		•		
(182)	a		•		

87 (183)

ZERO RENDEZVOUS
TRACKING MARK
CCUNTER.

DO FINAL AUTOMATIC
REQUEST TERMINATE
RCUTINE (ROO)

DO FINAL AUTOMATIC
REQUEST TERMINATE
ROUTINE (ROO)

EXIT P40

P40/SUNDANCE

#1220

#1230

CHANGE CENTREL NETES

EXIT P40

APELLE CEMPUTER LOGIC CHECKLIST INTERFACE

PCS PRECRAM (P4]

LCGIC PFV 17 01/17/59

PUP POSF:

- (1) TO COMPUTE A PREFERRED IMU ORIENTATION AND A VEHICLE ATTITUDE FOR AN ROS THRUSTING MANEUVER.
- (2) TO DO THE VEHICLE MANEUVED TO THE THRUSTING ATTITUDE.
- (3) TO PROVICE SLITABLE DISPLAYS FOR MANUAL EXECUTION OF THE THRUSTING MANUAUVER IN THE ATTITUDE HOLD MODE.

- ASSUMPTIONS: (1) THE TARGET FARAMETERS HAVE BEEN CALCULATED AND STORED IN THE LGC BY PRIOR EXECUTION OF A PRE-THRUSTING PROGRAM.
 - (2) THE PECUIPER STEEPING EQUATIONS ARE IDENTIFIED BY THE PRICE PRE-THRUST PROGRAM, WHICH EITHER SET (EXT DELTA V) OR RESET (LAMBERT) THE EXTERNAL CELTA V FLAG. FOR EXTERNAL DELTA V STEERING, VG IS CALCULATED ONCE FOR THE SPECIFIED TIME OF IGNITICA. THEREAFTER BOTH DUPING THPUSTING AND UNTIL THE CREW NOTIFIES THE LOC THAT BOS THRUSTING HAS BEEN COMPLETED, THE LCC UPDATES VG ONLY AS A RESULT OF ACCELEROMETER INPUTS. FOR LAMBERT STEERING VG IS CALCULATED AND UPCATED SIMILARLY, HOWEVER IT IS ALSO UPDATED REPIDDICALLY BY LAMBERT

SOLUTIONS TO CORFECT FOR CHANGES IN THE LM STATE VECTOR.

++ +17

(3) IT IS NORMALLY REQLIRED THAT THE ISS BE ON FOR A MINIMUM OF 15 MINUTES PRICE TO THRUSTING MANEUVER.

+401

- (4) THE EVENT TIMER IS SET TO COUNT TO ZERO AT TIG.
- (5) THE IMU IS ON AND THE IMU CRIENTATION DETERMINATION PROGRAM (PSI) HAS BEEN COMPLETED REFORE SELECTION OF THIS PREGRAM.
- (6) PCS IGNITION MAY BE SLIPPED BEYOND THE ESTABLISHED TIG IF DESIFED BY THE CREW.

++ +17 +EDIT

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(7) THE X - AXIS OVERPIDE OPTION PROVICES THE CREW WITH THE ABILITY TO EXERCISE MANUAL CONTROL ABOUT THE LM X AXIS WITH THE ATTITUDE CONTROLLER EVEN THOUGH THE PONCS ATTITUDE CONTROL MODE IS AUTO. WHEN THE CONTROLLER IS RETURNED TO DETENT THE PONCS CAMPS THE YAW RATE TO APPROXIMATELY 1 DEGREE/SECOND, STORES THE YAW ATTITUDE WHEN THE YAW RATE IS CAMPEC, AND THEN MAINTAINS THAT ATTITUDE.

THE X - AXIS OVERPIDE OPTION IS ALWAYS AVAILABLE TO THE CREW EXCEPT WHEN THE LGC IS SPECIFYING A DESIRED YAW ATTITUDE. THUS THE OPTION IS INHIBITED BY THIS PROGRAM ONLY DURING THE ATTITUDE MAMEUVER TO THE THRUSTING ATTITUDE (SEE REC)

- (8) THE POCKED CONFIGURATION OF THE VEHICLE(S) HAS BEEN PREVIOUSLY ENTERED IN THE LGC.
- (S) THE LOAD DAR DATA ROUTINE (RO3) HAS BEEN PERFORMED PRICE TO SELECTION OF THIS PROGRAM.
- (10), THIS PROGRAM SHOULD BE SELECTED BY THE ASTRONAUT BY DSKY ENTRY AT LEAST 5 MIN. BEFORE THE ESTIMATED TIME OF IGNITION.

Lec	GPCUNC	CREW	CHECKLIST	TIME	TOTAL
		• CPEW PROG. • SELECTION			
		•			
		•			
		• • •			
		•			
START RCS PECGRAM (P41)		KFY IN RCS PREGRAM (P41)			#10
DISPLAY PROGRAM 41	•	V37E 41F			
		•			
		•			
		MCNITCP DSKY:			
		CBSERVE DISPLAY OF PROGRAM 41			#20
•		•			. ¥
•		•			
		•			
DC IMU STATUS CHECK REUTINE (RO2)		DO IMU STATUS CHECK RCUTINE (RO2)			*20
•		•			#30
•		•			
•		•			
•		•			
CCMPLTE INITIAL THRUST CIPECTION		•			
AND INITIAL VALUE					
OF VG VECTOR AND STORE VG(LV) IN N86		•			#40
FCR PCSSIPLE MANUAL		•			
SELECTION:		•			
R1-VCX(LV) R2-VCY(LV)		•			
R3-VG7(LV)					
		•			
		•			
		•			
		•		P41/SUNDANCE	
		•			
		•			

PROG CCNT

P41/SUNDANCE

#50

#60

#70

#80

#90

#100

P41/SUNDANCE

VCX(LV)-COMPONENT OF VC AT TIG ALONG (RXV)XP. IN FPS TO NEAREST .1 FPS.

VGY(LV)-CCMPCNENT CF VG AT TIG ALONG VXR. IN FPS TO NEAREST .1 FPS.

VGZ(LV)-COMPONENT OF VG AT TIG ALONG -R. IN FPS TO NEAREST .1 FPS.

WHERE R IS GEOCENT-RIC (EARTH CRBIT) CR SELENCCENTRIC (LUNAR ORBIT) RADIUS VECTOR AND V IS VEHICLE INERTIAL VELOCITY VECTOR AT TIG.

CCMPUTE PREFERRED IMU ORIENTATION:

X = UNIT T -SM -

Y = UNIT (T X R) -SM - -

Z > UNIT (X X Y)
-SM -SM -SM

WHERE:

T = THE INITIAL

THRUST VECTOR.

R = THE GECCENTRIC

(EARTH CRBIT) OR SELENCCENTRIC (LUNAR ORBIT) RACIUS VECTOR AT TIG.

110.

SET PREFERRED ORIEN-TATION FLAG.

STORE DESIRED ATTI-TUDE SPECIFICATION FOR USE BY ATTITUDE MANEUVER ROLTINE (R60). THE FINAL ATTITUDE WILL BE CEMPUTED DURING REC AND WILL PCINT THE L* +X AXIS IN THE INITIAL THPUST DI-RECTION. HCWEVER, IN CREER TO CENSERVE RCS FUEL AND NCT CONSTRAIN THE NCN-CRITICAL ATTITUDE ABOUT THE THRUST VECTOR, WINGS MAY NOT BE LEVEL IN THE COMPUTED FINAL ATTITUDE.

ZERO ATTITUCE FPPCP AND SET .3 CEGREES DEACBAND IN FCS DAP

RESET 3 AXIS FLAG FCR USF BY THE ATTI-TUDE MANEUVER ROU-TINE (REC)

#110

#127

#130

#140

#150

P41/SUNDANCE

25				•	•				
95 (191)				•	•				
	• •			•	•				
	• •			•	•			P41/SUNDANCE	
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		•		•	•				
		55 5 5 5 5 5 5 5			•				#270
		CC FINAL		DO FIN-					
		AUTOMATIC REQUEST		AL AUT-					
		TERMINATE		DMATIC					
		POUTINE		TERMIN-					
		(ROO)		ATE					
				ROUTINE	•				
		•		(ROO)	•				
		•			•				
		•		•	•				#280
		•		•	•				
		• • •			•				
		FXIT P41		EXIT	•				
		LAIT		P41	•				
	AT TIG		•	MCNITOP	DSKY:				
	35 SEC .				5 SEC OR-				
	BLANK .		•		KY DISPLAY				
	THE DSKY .				ANK FCR 5				#290
	DISPLAY . (V,N,R1, .			SECONDS					
	R2, AND .								
	R3) FOR .				•				
	5 SECONDS.				•				
					•				
					•	Dec.			*
					•				
	• •				•				
	AT TIG-30	CEC DETUDN	•	MCNITCO	DCKA.				#300
	V16N85 DIS		•	MCNITCR	O SEC OB-		×		
	VION05 613			SERVE RE					
		•	•	V16N85 D					
		•			ATE THAT				
		•		AVERAGE	G INTEGRAT-	*			
		•		ION HAS	STARTED.				
		•							
		•			•				"210
	CALL AVERAGE	CE C INTE			•				#310
	GRATION ON				•				
	SFC.	110 00							8
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*	WAIT UNTIL TEI =		•			
	00800		•			#320
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	•		•			
	FLASH PRESENT VERB-		MCNITCR DSKY:			
•	NCUN (V16N85) TC PF-		CBSERVE VERB-NOUN			
HOLD .	QUEST PESPONSF.	•	FLASH TO REQUEST			
11000	MAINTAIN CISPLAY CF	• > • • • • • • • • • • • • • • • • •	RESPONSE AT LCC	*		
	VG (LM) COMPONENTS.	•	ASSUMED TIG.			#330
	(NOTE: SEE ASSUMP-					4330
	TION (2) ARCVE).					
	•					
	•					
	•		COMMAND MANUAL			
	•		RCTATIONS AND			#340
	•		TRANSLATIONS TO NULL			
	•		VG COMPONENTS			
	•					
	•		•			
	•		•		×	
	•		•			
	•					
	•		THE OPRITAL PARAMET-			
	•		ER DISPLAY ROUTINE			
	•		(R30) MAY BE SELECT-			#350
	•		FD AT THIS TIME			
	•		(V82E) TO MONITOR			
	•		CENTINUOUSLY UPDATED			
			VALUES OF APO ALT,			
	•		PER ALT, AND TEF.			
	•					
	•					
	•		•			
	•		•			#2.0
	WAIT FOR KEYBOARD		WHEN MANEUVER IS			#360
	ENTRY	•	COMPLETE KEY IN			
	CIXIEL		PROCEED			
		•	PRINCE ED			
			_		*	
	TERMINATE VERB-NCUN		•			
	FLASH UPON RECEIPT		-			
	OF PROCEED					
			•			
	•		•			#370
	•		•			- Ex 11 15
	•		•			(4)
	H 100 100 100 100 100 100 100 100 100 10		•		P41/SUNDANCE	
			•			

96 (192)

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• .		•		
•		• ,		P41/SUNDANCF
•		•		
•		•		
•		•		
RESTORE ASTRONAUT	*	•		
SPECIFIED DEADBAND			<u>×</u>	
LIMITS IN DAP.		•		
	4	•		
•		•		
•		•		
•		•		#380
ZERO RENDEZVOUS		•		
TRACKING MARK		•		
COUNTER				
	i e	•		
•		•		
•		•		
•		•		
•		•.		#390
DC FINAL AUTOMATIC	•	DO FINAL AUTOMATIC	14	#390
REQUEST TERMINATE	• • • • • • • • • • • • • • • • • • • •	REQUEST TERMINATE		
ROUTINE (ROO).	•	ROUTINE (ROO).		
		•		
•		•		
•	*	•		
• • •		• • •		
•		•		***
EXIT P41		EXIT P41		#400

CHANGE CONTRCL NOTES:
LOGIC REV 16 PCR - NASA 86 + PCN-MIT-71
LOGIC REV 17 PCN MIT 401.3

97 (193)

APOLLO COMPUTER LOGIC CHECKLIST INTERFACE

APS PREGRAM (P42)

LCGIC REV 20 01/17/69

PURPOSE:

- (1) TO COMPUTE A PREFERRED IMU CRIENTATION AND A VEHICLE ATTITUDE FOR A LM APS THRUSTING MANEUVER.
- (2) TO BO THE VEHICLE MANEUVER TO THE THRUSTING ATTITUDE.
- (3) TO CONTROL THE PENCS DURING COUNTDOWN, IGNITION, THRUSTING, AND THRUST TERMINATION OF A PENCS CONTROLLED APS MANEUVER.

- ASSUMPTIONS: (1) THE TARGET PAPAMETERS HAVE BEEN CALCULATED AND STORED IN THE LGC BY PRIOR EXECUTION OF A PRE-THRUSTING PROGRAM.
 - (2) THE REQUIREC STEERING EQUATIONS ARE IDENTIFIED BY THE PRIOR PRE-THRUST PROGRAM. WHICH EITHER SET (EXT DELTA V) OR RESET (LAMBERT) THE EXTERNAL DELTA V FLAG. FOR EXTERNAL DELTA V STEERING, VG IS CALCULATED ONCE FOR THE SPECIFIED TIME OF IGNITION. THEREAFTER BOTH DURING THRUSTING AND UNTIL THE CREW NOTIFIES THE LGC THAT APS AND RCS TRIM THRUSTING HAS BEEN COMPLETED, THE LGC UPDATES VG ONLY AS A RESULT OF ACCELEROMETER INPUTS. FOR LAMBERT STEERING VG IS CALCULATED AND UPDATED SIMILARLY, HOWEVER IT IS ALSO UPDATED PERIODICALLY BY LAMBERT

SOLUTIONS TO CORRECT FOR CHANGES IN THE LM STATE VECTOR.

++ +20

.(3) IT IS NORMALLY REQUIRED THAT THE ISS BE ON FOR A MINIMUM OF 15 MINUTES PRIOR TO A THRUSTING MANEUVER.

+401

- (4) THE EVENT TIMER IS SET TO COUNT TO ZERO AT TIG.
- (5) ENGINE IGNITION MAY BE SLIPPED BEYOND THE ESTABLISHED TIG IF DESIRED BY THE CREW.
- (6) IN THE EVENT THAT THE GUIDANCE CONTROL SWITCH IS CHANGED FROM PRINCS TO AGS DURING A THRUSTING MANEUVER, THE LGC WILL CONTINUE COMPUTATION OF POSITION AND VELOCITY, THE DESIRED THRUST VECTOR AND THE DESIRED ATTITUDE ERRORS, BUT IS NO LONGER RESPONSIBLE FOR THE MANEUVER.

+20 +ED IT

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(7) THE X-AXIS GVERRIDE OPTION PROVIDES THE CREW WITH THE ABILITY TO EXERCISE MANUAL CONTROL ABOUT THE LM X AXIS WITH THE ATTITUDE CONTROLLER EVEN THOUGH THE PRICS ATTITUDE CONTROL MODE IS AUTO. WHEN THE CONTROLLER IS RETURNED TO DETENT THE PGNCS DAMPS THE YAW RATE TO APPROXIMATELY 1 DEGREE/SECOND, STORES THE YAW ATTITUDE WHEN THE YAW RATE IS CAMPED, AND THEN MAINTAINS THAT ATTITUDE.

THE X-AXIS CVERRIDE OPTION IS ALWAYS AVAILABLE TO THE CREW EXCEPT WHEN THE LGC IS SPECIFYING A DESIRED YAW ATTITUDE. THUS THE OPTION IS INHIBITED BY THIS PROGRAM ONLY DURING THE ATTITUDE MANEUVER TO THE THRUSTING ATTITUDE (SEE R6C).

WHEN THE ATTITUDE MODE CONTROL SWITCH IS SET TO AUTO AND X-AXIS OVERRIDE IS PERMITTED THE YAW ATTITUDE CONTROL SUB MODE IS RATE COMMAND/ATTITUDE HOLD.

- (8) THE DOCKED CONFIGURATION OF THE VEHICLE(S) HAS BEEN PREVIOUSLY ENTERED IN THE LGC.
- (9) FOR EACH BURN AN IGNITION TOTAL ALLOWABLE TIME CELAY WILL BE SPECIFIED IN THE MISSION PULES. THIS DELAY TIME IS THE TOTAL TIME WHICH THE THRUSTING MANEUVER MAY BE DELAYED BEYOND THE LGC CALCULATED TIME OF IGNITION. IF ENGINE RE-STARTS ARE INVOLVED, THE ACCOUNTING OF THIS TOTAL TIME DELAY IS UP TO THE CREW.
- (10) THE LOAD CAP DATA ROUTINE (RO3) HAS BEEN PERFORMED PRICE TO SELECTION OF THIS PROGRAM.
- (11) THIS PROGRAM SHOULD BE SELECTED BY THE ASTRONAUT BY DSKY ENTRY AT LEAST 5 MIN. BEFORE THE ESTIMATED TIME OF IGNITION.

PROG CONT	rcc	GREUND	CREW	CHECKLIST	TIME	TOTAL
			•CREW PROG. • SELECTION •			
	START APS PROGRAM (P42) DISPLAY PROGRAM 42	•	KEY IN APS PROGRAM (P42) V37E 42E			#10
		•	MCNITOP DSKY: OBSERVE DISPLAY OF PROGRAM 42			#20
	DOES STAGE VERIFIED DISCRETE INCICATE THAT THE CPS HAS		•			#20
POSS HOLD .	Y .N		DOES VERB-NOUN FLASH			#30
SNAP .	TO REQUEST RES- PCNSE AND DISPLAY ALARM CODE TO INDICATE THAT THE STAGE VERIFIED DISCRETF INDICAT- ES THAT THE DPS		TO REQUEST RESPONSE AND DISPLAY OF ALARM CODE INDICATE THAT THE STAGE VERIFIED DISCRETE INDICATES THAT THE DPS HAS NOT BEEN STAGED?			#40
	HAS ACT BEEN STAGED: VC5 NC9 R1-017C6 R2-XXXX R3-XXXX		.Y .N			
		*				#50
(196)	• •		•		P42/SUNDANCE	

			_			
101(199)			•			
(191)			•	•	•	
			•	•		P42/SUNDANCE
	•		•	•		
	•		•	•		
		_	•	•		
	. WAIT FOR KEYBOARD	K	CEY IN TERMINATE	•		
	• ENTRY	•	V34E	•		
	•		•	•		
	•			•		
	. TERMINATE FLASH		•	•		
	. UPON RECEIPT OF		•			
	. TERMINATE		•	•		#60
			•	•		
	•		•	•		
	• •		•	•		
		_	•	•		
	. DO FINAL AUTOMA-	D	C FINAL AUTO-	•		
	. TIC REQUEST TER-		MATIC REQUEST	•		
	. MINATE RCUTINE		FERMINATE	•		
	. (ROO)	R	ROUTINE (ROO)	•		
*		_		•		#70
			•	•		
			• • •			
			•	•		
	EXIT P42		EXIT P42	•		
	•			•		
	•			•		
	DO IMU STATUS CHECK		O IMU STATUS CHE	CK		#80
	RCUTINE (RO2)	• • R	ROUTINE (RO2)			
	•		•			
	•					
	•		•			
	•		•			
	COMPUTE INITIAL		•			
	COMPUTE INITIAL THRUST CIRECTION AND		•			
	INITIAL VALUE OF VG		•			#90
	VECTOR AND STORE					
	VG(LV) IN N86 FOR		•			
	POSSIBLE MANUAL SEL-		•			
	ECTION:		•	¥		
	R1-VGX(LV)		•			
	R2-VGY(LV)					
	R3-VGZ(LV)		•			
			•			
	VGX(LV)-CCMPCNENT CF		•			#100
	VG AT TIG ALONG (PXV)XR. IN FPS TC		•			
	NEAREST .1 FPS.					

P42/SUMPANCE

VGY(LV)-CCMPCNENT CF VG AT TIG ALCNG VXR. IN FPS TO NEAREST .1 FPS.

VGZ(LV)-CCMPCNENT OF VG AT TIG ALCNG -R. IN FPS TO NEAPEST .1 FPS.

WHERE R IS GECCENT-RIC (EARTH CRBIT) OR SELENOCENTPIC (LUNAR CRBIT) RACIUS VECTOR, AND V IS VFHICLE INFRTIAL VELCCITY VECTOR AT TIG.

.

COMPUTE PREFERRED INU ORIENTATION:

X = UNIT(T) -SM -

Y = UNIT(T X R) -SM - -

Z = UNIT(X X Y) -SM -SM -SM

WHERE:

T = THE INITIAL

THRUST VECTOR
AT IGNITION

R = THE GECCENTRIC (EARTH ORBIT) CR SELENCENT-RIC (LUNAR (RBIT) RACIUS VECTOR AT TIG. #110

#120

#130

#140

#150

P42/SUNDANCE

P42/SUNDANCE SET PREFERRED ORIENTATION FLAG #160 STORE DESIRED ATTI-TUDE SPECIFICATION FOR USE BY ATTITUDE MANEUVER ROUTINE (R6C). THE FINAL #170 ATTITUCE WILL BE COMPUTED DURING R60 AND WILL POINT THE LM +X AXIS IN THE INITIAL THRUST DIRECTION. HOWEVER, IN CRDER TO CONSERVE RCS FUEL AND NOT CCNSTRAIN THE NON-CRITICAL ATTITUDE #180 ABOUT THE THRUST VECTOR, WINGS MAY NOT BE LEVEL IN THE COMPUTED FINAL ATTITUDE. #190 ZERC ATTITUCE ERROR AND SET 1 DEGREE DEACBAND IN RCS DAP. RESET 3 AXIS FLAG FOR USE BY THE ATT-#200 ITUDE MANEUVER ROUT-INE (R6C) DO ATTITUDE MANEUVER DO ATTITUDE MANEUVER RCUTINE (R6C) ROUTINE (R60) #210

P42/SUNDANCE

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	HAS PGN			•			•					
	AUTC MC		SE-	•			•					****
	LECTED?			•			•					#220
	.Y	. N		•			•					
	• T			•	•		•					
	•	•		•		•	•					
POSS				•								
HOLD .	. FLA	SH VEPE	-NCUN			MONIT	OR DSKY:					
		REQUEST					VERB-NOUN	FLASH				
SNAP .		ASE PER		•	•		QUEST PLE					
		CS A/P					RM PGNCS					
	. AUT	O MODE	SELEC-			AND A	UTC MODE	SELEC-				#230
	. TIC	N:		•		TION	INDICATE	THAT				
	. V	50 N25		•		MCDE	SELECTION	IS				
		1-00203		•		INCOR	RECT?					
		2-BLANK		•								
	• R	3-BL ANK		•	,	. · · ·		N.				
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						SFT G	UIDANCE					
							OL SWITCH					
	•						NCS, AT-					
	•						E CONTROL					#250
		•				SWITC	H TO					
	•	•		•		. AUTO.			121			
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											P42/SUNDAN	NCF
04												
(200)												
92.01 22	5000			P. C. C.								

105 (201)	•	:				
	•	•	•	•	P42/SUNDANCE	
	•	•	•	•		
	•	•		•		
	· TEDMINATE ELACI	•	•	•		
	 TERMINATE FLASH UPCN RECEIPT CF 	••	KEY IN ENTER	•	#	270
	. PROCEED OR ENTER	••		- •	"	2.0
		•	•	•		
	• E • PROCEEC	•	•	•		
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	• •E •••••••	• • •	•	•		
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			•	•		
	• •		•	•	#	280
	IS TIME TO GO TO		•	•		
	ENGINE IGNITION LESS		•	•		
	THAN 45 SECONDS?		•	•		
	.N .Y		•	•		
	• •		•	•		
POSS			•	•		
HOLD .	. FLASH VFRB-NOUN	•	MONITOR DSKY:			1290
SNAP .	. TO REQUEST RES-	••••••	DOES VERB-NOUN		*	
SNAP .	 PCNSE AND DIS- PLAY ALARM CODE 	•	FLASH TO REQUEST RESPONSE AND CISP	PLAY		
	. TO INCICATE THAT		OF ALARM CODE			
	 IGNITION TIME IS LESS THAN 45 	*	INDICATE THAT CHECKLIST HAS NOT	r .		
	. SECONES AWAY:		BEEN COMPLETED ON			
	. V05 NC9		ON TIME?			
	 R1-01703 R2-XXXXX 		. Y	. N	#	¥300
	. R3-XXXXX		•	•		,,,,,
			•	•		
			•	•		
			•	•		
	•		REFER TO EVENT	•		
			TIMER AND MANEU-	•		
	•		VFR RULES.	•		
			SHALL I SLIP ENGINE IGNITION	•	*	¥310
			TO 45 SECONDS			
			FROM THE COM-	•		
	: :		PLETICN OF A PROCEED INS-	•		
			TRUCTION?	•		
	•		M V	•		
			.N .Y	•		
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				•		
		,		•	P42/SUNDANCE	

P42/	SUNDANCE	
		#320
		#330
		#340
	,	
		#350
		#3 60

EXIT P42

#370

P42/SUNDANCE

WAIT FOR KEY-BOARD ENTRY TERMINATE FLASH UPON RECEIPT OF KEY IN TERMINATE PROCEED CR V34F TERMINATE . CO FINAL AUTC-DO FINAL AUTOMA-. MATIC REQUEST TIC PEQUEST . TERMINATE TERMINATE . ROUTINE (ROO). ROUTINE (ROO). EXIT P42 ESTABLISH NEW TIG EQUAL TO PRESENT TIME PLUS 45 SECONDS COMMAND APS CFF

106 (202)

++ +20

+ED IT

107(203)	: :	•	
		•	P42/SUNDANCE
	EXTRAPCLATE STATE VECTOR TO TIG-3C SEC. USING PRE- CISION INTEGRA-	•	#380
	. TICN	•	
	IS TIME FROM IG- NITION NEGATIVE AND GREATER THAN 35 SECONDS?	• • •	#390
	IS TIME FROM IGNITION NEG- ATIVE, LESS THAN 35 AND,	•	#400
POSS	GREATER THAN 30 SECONDS?	•	
HOLD .	FLASH VERB-NCUN TO REQUEST RESPONSE AND DIS- PLAY ALARM CODE TO	FLASH TO REQUEST RESPONSE AND CISPLAY ALAPM CODE INDICAT— ING THAT INTEGRATION HAS OVERLAPPEC AVER—	#410
	INDICATE THAT STATE VECTOR IN- TEGRATION HAS OVER- LAPPED VERAGE G TURN ON	AGE G TURN ON TIME? Y N. .	#420
	TIME: 		
		•	P42/SUNDANCF

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	٠	•		•	•	P42/SUMDANCE	
		•		•	•	242/30mBANLE	
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		WATT FOR	•	KFY IN	•		
		KEYBOARD ENTRY		TERMIN-	•		
		10121	•	V34E	•		
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		TERMINATE		•	•		
	۰	FLASH UPCA		•	•		
	•			•		#440	
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	٥	. T		•	•	#450	
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		AUTCMATIC		AL AUT-	•		
		REQUEST		OMATIC			
• •		TERMINATE		REQUEST			
		RCUTINE		TERMIN-			
	6	(POO)		ATF	•	#//0	
	•			ROUTINE (ROO)	•	#460	
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• •	•			EXIT P42	•		
				747	•		
	•				•	#470	
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DISPLAY				MCNITOR			
ON CSKY				CPSERVE	DISPLAY CF		
VC6 N40				TEL AND			
DI-TEI						#480	
2 5-AC	•				•		
B3-CELT	Δ.	•			•		
ΛN	•	•			•		
	•	•			•	P42/SUNDANCE	
	۰	•			•	Z/ SUNDANI F	

108 (204)

109			-	
(205)				
				P42/SUNDANCE
		•	•	
		•		
	TFI-TIME .		•	
	FRCM APS .	•		
	IGNITION .	•	UPDATE EVENT TIMER	
	IN MIN, .	•	IF DESIRED. TIMER	
	SEC TO .	•	WILL NOT AGREE WITH	
	NEAREST .	•	DSKY RI IF IGNITION	#490
	SEC. MAX .	•	HAS BEEN SLIPPED	
	READING .	•	AS RI WILL DISPLAY	
	IS 59859 .	•	TFI TO NEW TIG	
	SIGN IS .	•		
	- BEFORE .	•	•	
	NEMINAL .	•	•	
	TIG, + .	•	•	
	THERE	•	•	
	AFTER	•	•	#500
	VG-MAG-	•	ARM APS	#50 0
	NITUDE .	•	ARM APS	
	OF THE .	•		
	VELCCITY .	•	•	
	TC BE .	•	•	
	GAINED .		•	
	BY THRUS		•	
	TING .		·	
	MANEUVER .			
	IN FPS .			#510
	TC NEAR			
	EST .1 .		 •	
	FPS .		•	
	•	•	•	
	DELTA VM	•	•	
	MEASUREC .	•	•	
	DELTA V .	•	•	
	MAGNITUCE.	•	•	
	IN FPS TO.	•	•	
	NEAREST .	•	•	#520
	.1 FPS	•	•	
	THIS DIS	•	•	
	PLAY WILL.	•	•	
	BE CCCCC .	•	•	
	UNTIL .	•	•	
	TIG-30 .	•	•	
	SEC AND .	•	•	
	THEN .	•	•	
	SHOULD . CHANGE .	•	•	#530
	ONLY DUE .	•	•	#930
	TC PIPA .		•	
	BIAS UN		•	
	TIL ULL- •	MEDIATELY	•	
	ACE IS .			
	STARTEE		•	
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		•	•	
			•	

P42/SUNDANCE

#540 #550

#570

#580

P42/SUNDANCE

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• •		•		CHECK STATES OF CALL
		•		CHECK STATUS OF C/W
				LAMPS
	9	•		
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	•	•		•
• •				•
AT T10 25	CCC	•	•	MENITOD DEKY
AT T1G-35	SEC	•		MCNITOR DSKY:
BLANK THE		•	•	AT TIG -35 SEC OB-
DSKY DISPL	AV			SEPVE DSKY DISPLAY
		•		
(V,N,R1,R2	7	•		TO GO BLANK FOR 5
AND R31 FC				SECONDS. (NOTF: IF
5 SECONDS.	•	•		STATE VECTOR INTEG-
				RATION HAS RUN INTO
		-		
		•		THE TIME PERIOD TIG
		•		-35 TO TIG-30 THE
	-	-		BEGINNING AND DURA-
	•	•		
		•		TION OF BLANKING
				CANNOT BE DEFINED.)
	•	•		CANNOT BE DET INLDS
	•	•		
		_		
	•	•		•
	•	•		•
AT TIC-20	CEC	DETIIDN		
AT T1G-30			•	
				MONITOR DSKY:
AT T1G-30 V06N40 DIS				
				AT TIG -30 SEC DB-
			•	AT TIG -30 SEC DB- SERVE RETURN OF
			•	AT TIG -30 SEC OB- SERVE RETURN OF VO6N4C DISPLAYS TO
				AT TIG -30 SEC DB- SERVE RETURN OF VO6N4C DISPLAYS TO INDICATE THAT AVER-
			•	AT TIG -30 SEC OB- SERVE RETURN OF VO6N4C DISPLAYS TO
			•	AT TIG -30 SEC DB- SERVE RETURN OF VO6N4C DISPLAYS TO INDICATE THAT AVER- AGE G INTEGRATION
			•	AT TIG -30 SEC DB- SERVE RETURN OF VO6N4C DISPLAYS TO INDICATE THAT AVER-
			•	AT TIG -30 SEC DB- SERVE RETURN OF VO6N4C DISPLAYS TO INDICATE THAT AVER- AGE G INTEGRATION
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			*	AT TIG -30 SEC DB- SERVE RETURN OF VO6N4C DISPLAYS TO INDICATE THAT AVER- AGE G INTEGRATION
V06N40 DIS	SPLAY	/S	•	AT TIG -30 SEC DB- SERVE RETURN OF VO6N4C DISPLAYS TO INDICATE THAT AVER- AGE G INTEGRATION
	SPLAY	/S	•	AT TIG -30 SEC DB- SERVE RETURN OF VO6N4C DISPLAYS TO INDICATE THAT AVER- AGE G INTEGRATION
CALL AVERA	SPLAY	/S 	•	AT TIG -30 SEC DB- SERVE RETURN OF VO6N4C DISPLAYS TO INDICATE THAT AVER- AGE G INTEGRATION
CALL AVERA	SPLAY	/S 	•	AT TIG -30 SEC DB- SERVE RETURN OF VO6N4C DISPLAYS TO INDICATE THAT AVER- AGE G INTEGRATION
CALL AVERA	SPLAY	/S 	•	AT TIG -30 SEC DB- SERVE RETURN OF VO6N4C DISPLAYS TO INDICATE THAT AVER- AGE G INTEGRATION
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CALL AVERA	SPLAY	/S 	•	AT TIG -30 SEC DB- SERVE RETURN OF VO6N4C DISPLAYS TO INDICATE THAT AVER- AGE G INTEGRATION
CALL AVERA	SPLAY	/S 	•	AT TIG -30 SEC DB- SERVE RETURN OF VO6N4C DISPLAYS TO INDICATE THAT AVER- AGE G INTEGRATION
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CALL AVERA	SPLAY	/S	•	AT TIG -30 SEC DB- SERVE RETURN OF VO6N4C DISPLAYS TO INDICATE THAT AVER- AGE G INTEGRATION
CALL AVERA	SPLAY	/S	•	AT TIG -30 SEC DB- SERVE RETURN OF VO6N4C DISPLAYS TO INDICATE THAT AVER- AGE G INTEGRATION
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CALL AVERA	SPLAY	/S		AT TIG -30 SEC DB- SERVE RETURN OF VO6N4C DISPLAYS TO INDICATE THAT AVER- AGE G INTEGRATION
CALL AVERA	SPLAY	/S		AT TIG -30 SEC DB- SERVE RETURN OF VO6N4C DISPLAYS TO INDICATE THAT AVER- AGE G INTEGRATION
CALL AVERA	SPLAY	/S		AT TIG -30 SEC DB- SERVE RETURN OF VO6N4C DISPLAYS TO INDICATE THAT AVER- AGE G INTEGRATION
CALL AVERA	SPLAY	/S		AT TIG -30 SEC DB- SERVE RETURN OF VO6N4C DISPLAYS TO INDICATE THAT AVER- AGE G INTEGRATION
CALL AVERA	SPLAY	/S		AT TIG -30 SEC DB- SERVE RETURN OF VO6N4C DISPLAYS TO INDICATE THAT AVER- AGE G INTEGRATION

110 (act)

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(407)	•		•	
(307)	•			
	•			P42/SUNDANCE
				101001101110
	-			
	•		•	
	•		•	
	•		MCMITTON DOWN-	****
	•		MCNITOR DSKY:	#590
	•		IN THE PERIOD FROM	
	•		TFT =-OOR30 UNTIL	×
	•		TFI =-00B15	
	•		DOES DELTA VM BECOME	
	•		GREATER THAN .5 FPS	
	•		INDICATING EXCESSIVE	
	•		PIPA BIAS ERRCR?	
	•			
	•		.N .Y	
			• • • • • • • • • • • • • • • • • • • •	#600
			•	4000
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	•		•	
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	•			
	•		 GO TO BACKUP 	
	•		 PROCEDURES 	
	•			
	•		•	
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	•			#610
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			Ĭ.	
	WAIT UNTIL TFI=			
	-5 SEC.		•	
	-5 350		•	
			•	
	•		•	****
	•		•	#620
	•		•	
		•••	• • • • •	
			• •	
			MONITOR DSKY:	
			OBSERVE VERB-NOUN	
	CHANGE VERB BUT RE-		FLASH TO REQUEST	
HOLD .	TAIN PRESENT NOUN		PLEASE PERFORM	#630
	AND CISPLAYS IN R1,		ENGINE ON FNABLE	
MON .	R2, P3, FLASH VERB-		CHOINE ON THEELS	
mon •	NCUN TO REQUEST	•		
			•	
	PLEASE PERFERM ENG-		•	
	INE ON ENABLE:		•	
	V99N40		•	
			•	*
	•		•	
	•		•	
	•		•	#640
	•		•	
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	•		•	
	•		•	P42/SUNDANCE

•				P42/SUNDANCE
	•	•		
•	•	•		
•	•	•		
•		IS THIS AN ATTEMPT	ED	
•	•	ENGINE RESTART?		
•	•			
•	•	N Y	•	
•	•		•	
	•		•	
WAIT FOR KEYBOARD	•	•	•	
ENTRY	•	•	•	#650
	•		•	
	•		•	
	•		•	
AT TFI = -3.5 SEC	•	AT TFI = -00BC3	•	
COMMAND 2 JET +X . TRANSLATION		. MCNITCR STAFT OF +X TRANSLATION.	•	
	•		•	
	•	•	•	
	•		•	#660
	•		•	
	•	. MONITOR START		
	•	. CF +X		
	•	. TRANSLATION.		
	•			
	•			
				#670
	•	MCNITCR DSKY:		
	•	 WAIT FOR INCREASE DELTA VM INDICATIN 		(6
	•	SUFFICIENT ULLAGE.		
	•	DECUITORE III ACE		
		DELTA V IS A		*
	•	FUNCTION OF VEHICL	E	
	•	WEIGHT.		
	•	•		#680
	•			
	•	SHALL I PERMIT		
		IGNITION OF REIGNI	-	
		TION?		
	•			
	•	N .Y		
	•			#690
		KEY IN PROCEED		
	• •			
	•			
				P42/SUNDANCE
	•			as after a management and many and many
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	•	• •		

++ +20 +ED IT ++

112			•	•	
113 (209)			•	•	
		•	•	•	P42/SUNDANCE
		•	•	•	P42/30NDANCE
			•	•	
			•	•	
		•		•	
			SHALL I ATTEMPT	•	
		•	TO COMPLETE	•	****
		•	THIS THRUSTING MANEUVER WITH	•	#700
			THE RCS?	•	
				•	
		•	.Y .N	•	<u> </u>
		•	•	•	
		• •		•	
		• •	VEV 11	•	
		****************	• KEY IN	•	
		• •	ENIER .	•	#710
				•	#115
				•	
				•	
				•	
		•	• • •	•	
		•	GO TO	•	
		•	пДп .	● =	
			BELOW .	•	
			•		#720
		•		•	
			•	•	
	TERMINATE FLASH UPON	• •		•	
	RECEIPT OF ENTER, PROCEED OR TERMI-	•••••••	• KEY IN TERMINATE	•	
	NATE.	••	V34E	•	
	NA 1 L 0		V 341.	•	
	•P •E •T				
	.R .N .E		•	•	· ·
g.	•O •T •R		•	•	#730
	•C •E •M	•	•	•	
	.E .R .I	•	•	•	
	.EN	•	•	•	·e
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	E				
			•	•	
	. TURN TURN	•	•	•	•
	• OFF OFF		•	•	
	 ULLAGE ULLAGE 	•	•		#740
		•	•	•	
		•	•.	•	
			•	•	
			•	•	
	. Gr Tr .		•	•	
	• "A" •	•	•	•	
	. BELCW .	•	•	•	
			•		

#750 P42/SUNDANCE

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			P42/SUNDANCE	F
•				
	•			
	•			
. DO FINAL AUTO-	• •	DO FINAL AUTO		
 MATIC REQUEST TERMINATE 	• • • • • • • • • • • • • • • • • • • •	MATIC REQUEST . TERMINATE .		
. ROUTINE (RCO)		ROUTINE (ROO) .		
•				
•		• •		#760
		• • •		
EXIT P42	•	EXIT P42 .		
• EATT F42		EXII F42 •		
•		•		
RESUME STATIC DIS-		MONITOR DSKY:		
PLAY CF VO6N40	•	CBSFRVE PETURN OF		****
		STATIC VERB-NOUN		#770
•	•	(VO6N40)		
•	: :			
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IS TEL NEGATIVE AND		MONITOR DSKY:		
GREATER THAN ZERC		IS RI DISPLAY OF TEI	,	
.Y .N	•	NEGATIVE AND GREATER THAN ZERO	× .	#780
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WAIT UNTIL .		STANDBY FOR .		
TFI= -C0800 .		THRUST ON .		#790
		WHEN TEI = -00800 .		
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		. STANCRY FOR	,	
		. THRUST ON		
		. IMMECIATELY		
	•			#800
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COMMAND ARC ON	•			
CCMMAND AFS ON		•		
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114 (210)

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115 (211)	•	•	•	•	•				
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	WAIT C.5 SEC	•	•	•	•				
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	TURN OFF LLLAGE		•	•	•				
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	•	•	•	•	•				#820
	TURN ON CAP TVC				•				.,520
	FUNCTIONS		•	•	•				
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	CHANGE TEI CISPLAY		. ,	MONITOR D	SKY:				
	TO TEC IN R1				HANGE OF				
MON .	V06 N40	•			AY TO TEC				#830
	R1 - TFC			IN R1					
	R2 - VG								
	R3 - CELTA VM		•	•					
	TFC - TIME FROM		•	•					
	ENGINE CUTOFF.		•	•					
	IN MIN AND SEC TO								
	NEAREST SEC. SIGN IS		•						
	- BEFORE + AFTER		•	•					
	CUTOFF.		•	•					#840
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	•			CHAMBER P					
	•		•	SHOULD IN	CICATE				
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P42/SUNDANCE

#860

#870

#880

#890

#900

P42/SUNDANCE

ESTABLISH DELTA V MCNITCR (REFER SFC-TION 5.3.3.4 OF R557). (NOTE: IF THE DELTA V POUTINE DCES NOT CETECT THRUST IN 8-10 SEC-ONDS FROM RECEIPT OF ENGINE ON COMMAND, IT IS CONSIDERED A THRUST FAIL. IF THE CELTA V MENITER DEES NOT DETECT THRUST FOR 2-4 SECCNES DURING NCRMAL THRUSTING. IT IS CONSIDERED A THRUST FAIL . IN THE EVENT A THRUST FAIL, THE PROGRAM WILL PETURN TO THE TIG-5 SEC. PCINT).

THRUST NC THRUST

• COMMAND ENGINE • OFF•

• TURN OFF DAP. TVC • FUNCTIONS

MAINTAIN VG CCM-PUTATION FOR POSSIBLE FURTHER THRUSTING

(312)

117/213)

CCMMAND + X
ULLAGE TRANSLATION (2 JET).

RESET TFC DISPLAY IN R1 TO 59 B 59

THROUGHOUT THE THRUSTING MANEUVER THE LGC WILL MCNITCR THE ANGLE BETWEEN THE DESIRED THRUST VECTOR AND THE MEAS-URED THRUST VECTOR. IF THIS ANGLE BECOMES GREATER THAN 45 DEGREES TURN ON PROGRAM ALARM BUT DC NCT CHANGE THE DSKY DISPLAY. STORE ALARM CODE (1407). (REFER SECTION 5.3.3.4 OF R557).

P42/SUNDANCE

#910

#920

#930

#940

#950

MONITOR APS
THRUSTING:
1. DSKY:
R1-TFC
SHCULD RF
DECREASING.

#960

P42/SUNDANCE

#970

#980

#990

#1000

#1010

R2-VG SHOULD BE DECREASING. R3-DELTA VM SHOULD INCREASE. 2. FDAI-ATT. FRROR SHOULD BE LESS THAN OR EQUAL TO DEGREE. ATT RATES SHOULD BE LESS THAN OR EQUAL TO DEGREF/SFC. 3. APS CHAMBER PRES-SUPE (PC) SHOULD BE NORMAL. (NOTE: A PROGRAM ALARM WILL OCCUR IF THE ANGLE BETWEEN THE DESIRED THRUST VECTOR AND THE MEA-SURED THRUST VECTOR BECOMES GREATER THAN 45 DEGREES. TO IDENTIFY THE ALARM KEY IN VOSNOSE. EXPECTED ALARM CODE IS 01407.) IDENTIFY EARLY, NORMAL, OR LATE EN-GINE CUTCEF FROM AS-SESSMENT OF DSKY DISPLAYS. . N .0 . A . 4 .R . T .E . C . C .U ·U · T . C .0

P42/SUNDANCE

118 (214)

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•			PUSH ENGINESTOP PUSH-		
•			BUTTON		#1020
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•			. GO TO BACK-		
•			. UP PROCE-		
•			• DURES		
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LGC COMMANDS ENGINE			•		
OFF WHEN INDICATED BY CUTOFF EQUATION			•	81	
51 601611 24041161			•		
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•			•		#1040
REMOVE CAP TVC	¥		•		
FUNCTIONS			•		
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TERMINATE DELTA V			•		
MCNITOR			•		#1050
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MATRITATAL VC			•		
MAINTAIN VG CCMPUTATIONS AFTER			•		
CUTOFF FOR POSSIBLE			•		
NULLING BY RCS			•		#1060
TRIMMING MANEUVER			•	8	
(NOTE: SEE ASSUMP- TION (2) ABCVE).			•		
1 10N (27 PBC VC7.			•		
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•		DISARM		,	
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P42/SUNDANCE

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	HOL D	•	• •				
				•	MCNITCR	DSKY:	
	MON		FLASH VERB-NOUN TO		DESERVE	VERB-NOUN	
			REQUEST PROCEED.			REQUEST	
			HOLD DISPLAY OF TEC			AND DISPLAY	
			AT ITS FINAL VALUE:				
						VG AND DELTA	
			V16 N40		V ₩		
			R1 - TFC				
			R2 - VG			•	#1090
			R3 - DEL TA VM				
						•	
			(NOTE: SEE ASSUMP-		30		
			TICN (2) ABCVE).			•	
			TICK (2) ADCVES			•	
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			•			THESE VALUES	
			•		AS DESIR	RED.	
			•				
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							#1100
				90			
			WAIT FOR KEYBOARD			•	
				•	KEN IN I	DOCCEED	
			ENTRY		KEY IN F	RUCEEU	
			TERMINATE FLASH UPON	•			
			RECEIPT OF PROCEED			•	
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			ZERO ATTITUDE ERROR				
			AND SET .3 DEGREES				
			DEADBAND IN PCS DAP				#1120
			DEADGARE IN PCS EMP			•	FILLU
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12	20 (16)		•			•	
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P42/SUNDANCE

#1130

#1140

#1150

#1160

#1170

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HOLD .	FLASH VERB-NOUN TO REQUEST RESPONSE AND DISPLAY COMPONENTS OF VG(LM): V16 N85 R1-VGX(LM)		MCNITCR DSKY: ORSERVE VERB-NOUN FLASH TO REQUEST RESPONSE AND DISPLAY OF VG(LM) COMPONENTS		
	R2-VGY(LM) R3-VGZ(LM)		•		
*	COMPONENTS OF THE VG		•		
	VECTOR RESOLVED ALONG THE PRESENT X, Y, AND Z AXES. THE VG VECTOR WILL BE UPCATED BY THE STEERING LOCPS DURING EACH COMPUTA- TION CYCLE. IN FPS TO NEAREST .1 FPS.		TO NULL CUT VG COMPONENTS COMMAND MANUAL TRANSLATIONS AND RCTATIONS. (NOTE: THIS MANEUVER IS AT THE CPTION OF THE CREW.)		
	(NOTE: SEE ASSUMP-				
	TION (2) ABOVE).		•		
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	•				
	•		THE ORBITAL PARAME-		
	•		TER DISPLAY ROUTINE		
	•		(R30) MAY BE SELECT-		
	•		ED AT THIS TIME		
	•		(V82E) TO MONITOR		
	•		CONTINOUSLY UPDATED		
	•		PER ALT, AND TEF.		
	•		PER ALI, AND IFF.		
	•				
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	WAIT FOR KEYBOARD ENTRY TERMINATE FLASH UPON		KEY IN PROCEED		
	RECEIPT OF PROCEED	•			
			•		

EXIT P42

#1200

#1180

#1190

CHANGE CCNTRCL NCTES:
LOGIC REV 18 PCN # MIT 49
LOGIC REV 19 PCR NASA 86,+ PCN-MIT-71,+ PCN-MIT-79,+ PCN MIT 92,
PCR-NASA-85
LOGIC REV 20 PCN MIT 401.2

EXIT P42

APOLLO COMPUTER LOGIC CHECKLIST INTERFACE

THRUST MONITOR PROGRAM (P47)

LOGIC REV 09 04/15/68

PURPOSE:

- (1) TO MONITOR VEHICLE ACCELERATION DURING A NON PENCS CONTROLLED THRUSTING MANEUVER.
- (2) TO DISPLAY THE DELTA V APPLIED TO THE VEHICLE BY THIS THRUSTING MANEUVER.

ASSUMPTIONS: (1) THE ISS MAY BE IN STANDBY OR OPERATE. THE IMU WOULD NORMALLY BE ON AND THE IMU DRIENTATION DETERMINATION PROGRAM (P51) COMPLETED BEFORE THE SELECTION OF THIS PROGRAM. THE ISS THUS MAY BF:

- (A) DEF (STANDBY).
- (B) ON, AND NOT ALIGNED SINCE TURN ON
- (C) ON AND AT AN INERTIAL DRIENTATION KNOWN DOLY INACCURATELY BY THE LGC, I.E. HAVING BEEN ALIGNED AT LEAST DACE SINCE TURN ON BUT NOT WITHIN THE LAST 3 HRS
- (D) ON AND AT AN INERTIAL ORIENTATION KNOWN ACCURATELY BY THE LGC, I.E. HAVING BEEN ALIGNED WITHIN THE LAST 3 HRS
- IF (A) IS TRUE A PROGRAM ALARM WILL BE MADE BY THIS PROGRAM.
- IF (B) IS TRUE A PROGRAM ALARM WILL BE MADE BY THIS PROGRAM.
- IF (C) IS TRUE THE LGC MAY OR MAY NOT HAVE A SATISFACTORY INERTIAL REFERENCE TO ACCURATELY COMPLETE THE MANEUVER. IF (D) IS TRUE THE LGC HAS A SATISFACTORY INERTIAL REFERENCE TO ACCURATELY COMPLETE THE MANEJVER. CASES (B), (C)
- AND (D) HOWEVER ARE FURTHER SUBJECT TO THE CONSTRAINT OF LARGE MIDDLE GIMBAL ANGLE, I.E. THE EXISTING INERTIAL ORIENTATION MAY CAUSE A MIDDLE GIMBAL ANGLE GREATER THAN 45 DEGREES AT THE THRUSTING DRIENTATION OF THE LM% WHICH IS UNSATISFACTORY.
- (2) THE LGC IDLING PROGRAM (POO), THE RENDEZVOUS NAVISATION PROGRAM (P20) AND THE RENDEZVOUS DISPLAY ROUTINE (R31) WILL AUTOMATICALLY UPDATE THE LM AND CSM STATE VECTORS. THIS PROGRAM ASSUMES THE LM AND CSM STATE VECTORS TO HAVE BEEN UPDATED TO WITHIN -- MINUTES OF THE PRESENT TIME.
- (3) THE RESPONSIBILITY OF AVOIDING SIMBAL LOCK DURING EXECUTION OF THIS PROGRAM IS JPON THE ASTRONAUT.
- (4) THIS PROGRAM IS NORMALLY USED DURING RENDEZVOUS FINAL PHASE. IF THE CREW DESIRED TO DO ANY FINAL PHASE THRUSTING MANEUVERS AUTOMATICALLY UNDER PROCS CONTROL THEY MUST BE ACCOMPLISHED VIA SELECTION OF TRANSFER PHASE INITIATION (TPI) PROGRAM (P34) AND THEN THE DPS THRUSTING PROGRAM (P40).
- (5) RANGE, RANGE RATE, AND THETA MAY BE DISPLAYED DURING THIS PROGRAM BY CALLING THE RENDEZVOUS PARAMETER DISPLAY POUTINE (P31).
- 2A MCC2 SA DETAMINENT DNA PRIVENAM BRITSURHT DEMNALD HET CE PEIPR TRUE NE DEMOKE BE GUICH? MAPBERS THE STATE OF THE PERMEMBERS POSSIBLE AFTER THE MANEUVER IN ORDER TO KEEP FRRORS ASSOCIATED WITH AVERAGE G INTEGRATION AT A MINIMUM.

			.DRFW .PPDGRAM .SELECTION			
	START THPUST MONITOR PROGRAM (P47). DISPLAY P47.		KEY IN THRUST MONITOR PROGRAM (P47) V37F47F			#10
		•	MONITOR DSKY: OBSERVE DISPLAY OF PROGRAM 47.			#20
	:		•			
	DO IMU STATUS CHECK ROUTINE (RO2)		DO IMU STATUS CHECK ROUTINE (RO2)			
+ ·09 ·+	•		•			#30
	BRING PERMANENT STATE VECTORS TO PRESENT TIME PLUS 60 SECONDS USING PRECISION INTEGRA- TION (REFER TO SEC- TION 5.2.2 OF R557).					#40
			•			****
	CALL FOR AVERAGE G ROUTINE AT PRESENT TIME PLUS 60 SECONDS. (REFER SECTION 5.3.2					
	OF R557).		•			#50
220	:				947/SUNDANCE	
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CHECKLIST

TIME

TOTAL TIME

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CPFY

P47/SUNDANCE

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	WAIT 60 SECONDS		WAIT 60 SECONDS					
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				-				
HOLD	FLASH VERS-NOUN TO		MONITOD DOZZE					
HULU			MONITOR OSKY:	•				
	REQUEST RESPONSE AND		OBSERVE FLASHING	•				
MON	DISPLAY DELTA V		VERB-NOUN TO REQUEST	•				
	(L4):		RESPONSE AND DISPLAY					
•	V16N83	•		•				
•			OF EACH COMPONENT OF	•				
•	RI-DFLTA VX(LM)		DELTA V(LM).	•				#70
	R2-DELTA VY(LM)			•				
	R3-DELTA VZ(LM)							
•	NO WELLIA VELETI		•	•				
•			•	•				
•	DELTA VX(LM - COM-			•				
	PONENT OF INTEGRATED							
	ACCELERATION ALONG							
•			•	•				
•	LM +X AXIS. IN FPS		•	•				
•	TO NEAREST .1 FPS.			•				
	DELTA VY(LM) - COM-		•					#80
•			•	•				#6U
	PONENT OF INTEGRATED			• •				
	ACCELERATION ALONG							
	LM +Y AXIS. IN FPS							
	TO NEAREST .1 FPS.							
•	TO NEAREST .1 FFS.			0 4				
			PERFORM THRUSTING .	0 4				
•	DFLTA VZ(LM) - COM-		MANEUVER(S) AS					
	PONENT OF INTEGRATED		DESIRED.					
	ACCELERATION ALONG		MUNITOR FOAT BALL					
•				• •				
•	LM +Z AXIS. IN FPS		TO AVOID SIMBAL .	• •				
	TO NEAREST .1 FPS.		LOCK					#90
•	NOTE: R1,2, AND 3							
•				• •				
•	-NI COCOO DABA LIIW		• •	• •				
•	ITIALLY AND WILL RE-			• •				
	MAIN SO EXCEPT FOR							
	124 BIAS ACCUMULAT-		THE DOSITAL DADAMET	•				
•			THE DRAITAL PARAMET-	• •				
•	IONS UNTIL A THRUST-		ER DISPLAY ROUTINE .	•				
•	ING MANEUVER IS		(R30) MAY BE SELECT					
2	STARTED. THEY WILL		FD AT THIS TIME .	. 1				
•	BE UPDATED EVERY			•				
•			(VSZE) TO MONITOR .	•		9		#100
•	2 SEC.		CONTINUOUSLY UPDATED .	•				
			VALUES OF APO ALT					
			PER ALT AND TEF					
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P47/SUNDANCE

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WALT FOR KEY3UA	ARD SHALL I TERMINATE	
FNTRY	THIS PROGRAM?	#110
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	. THE DISPLAY IN	
	. JERGE CT FROM CT FROM	
	· De availes · ·	
	· SAZKS · ·	#120
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	KFY IN RECY-	
	. C_E V32F	#130
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TERMINATE OR RE		
TERMINALE OF RE	ECYCLE.	#140
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•R •P •E •R •C •O •Y •C		#140
•R •P •E •R •C •O •Y •C		#140
.R .P .E .R .C .G .Y .C		#140
.R .P .R .C .C .C .E .E		#140
.R .P .E .R .C .G .Y .C		#140
.R .P .R .C .C .C .E .E .D		#140
.R .P .R .C .C .C .E .L .E .D ./		
.R .P .R .C .C .C .E .E .D		#140 #150
.R .P .R .C .C .C .E .L .E .D		
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. DO FINAL AUTOWATIC REQUEST TERMINATE ROUTINE (200)

#170

EXIT P47

EXIT P47 LOGIC REV 09 PCN # MIT 49

DO FINAL AUTOMATIC REQUEST TERMINATE ROUTINE (ROO)

RFINIT-IALIZE ACCELERO-METEP IN-TESPATION

APOLLO COMPUTER LOGIC CHECKLIST INTERFACE

IMU ORIENTATION DETERMINATION PROGRAM (P51)

LOGIC

REV 15 05/23/68

PURPOSE:

(1) TO DETERMINE THE INFRTIAL ORIENTATION OF THE IMU USING SIGHTINGS ON TWO CELESTIAL BODIES WITH THE ADT DR A BACKUP OPTICAL SYSTEM.

- ASSUMPTIONS: (1) THIS PROGRAM MAY ONLY BE PERFORMED WHILE THE LM IS IN FLIGHT.
 - (2) THE ISS MAY RE:

(A) TEF (STANDBY)

(B) ON, AND ALIGNED OR NOT ALIGNED SINCE TURN ON.

IF (A) IS TRUE, THE THU MUST BE TURNED ON BEFORE THIS PROGRAM CAN BE PERFORMED.

IF (B) IS TRUE THIS PROGRAM CAN BE COMPLETED.

- (3) THERE ARE NO RESTRAINTS JPON THE LM ATTITIDE CONTROL MODES UNTIL A PONCS CONTROLLED MANEUVER IS CALLED BY A PROGRAM OR THE CREW WISHES TO MANJALLY MANEJVER THE VEHICLE. THE AUTOPILOT CONTROL MAY BE POUCS OR AGS AND IF PGNCS, MAY BE AUTO OR ATTITUDE HOLD. PRIOR TO PGNCS CONTROLLED MANEUVERS THE LGC WILL REQUEST THE CORRECT MODE IF IT IS NOT IN EFFECT. FOR MANUALLY CONTROLLED MANEUVERS THE CREW MUST SELECT THE CORRECT MODES.
- (4) TIME AND RCS FUFL MAY BE SAVED, AND SUBSEQUENT IMJ ALIGNMENT DECISIONS GREATLY SIMPLIFIED IF THIS PROGRAM IS PERFORMED IN SUCH A WAY AS TO LEAVE THE INJ INERTIALLY STABILIZED AT AN ORIENTATION AS CLOSE AS POSSIBLE TO THE OPTIMUM DRIENTATION REQUIRED BY FUTURE LGC PROGRAMS.
- (5) THE PROGRAM IS SELECTED BY THE ASTRONAUT BY DSKY ENTRY.

PROG L GC GROUND CREW CHECKLIST TIME TOTAL CONT TIME

> .CREW PROG .SELECTION

KEY IN IMJ STAPT IMU DRIENTATION

DETERMINATION PPOGRAM (P51) DISPLAY PROGRAM 51 ORIENTATION DETERMI-NATION PROGRAM (P51) V37F 51F

051	SUNI	TARIF
1011	33 VI	JAING

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MONITAL SECTION 15 PROCESS 115 TOP 155 CUT 15 TOP 155 CUT 15 TOP 155 CUT 15 TOP 155 CUT 16 TOP 155 CUT 17 AUTHOR SECTION 18 ALEMA CODE ALLED ATTNS THAT 15 CUT 18 CUT 15 CUT 15 CUT 18 CUT 15 CUT 15 CUT 18 CUT 15 CUT 1				:							ř	*
15 THE 15S GV2				MONITOR DSKY: DBSFRVE DISPL PROGRAM 51	IC YA.	F						
# 15 THF ISS 097 # 15 THF ISS 097 # 1 THIST DEM PROTECTAM # ALASMY LIGHT AND DES PROSENA MALAZMY STORE ALASM CODE. # CHOTE: IF CALLED # AT THE THE THE THE THE THE THE THE THE TH												养2 0
1S THE ISS OV? Y N TURN ON PROGRAM ALAPM LIGHT AND STREE ALAPM CODE. LIGHT START HE FUL ARRANGE IF CALLED ATTING THAT THE FUL ARRANGE ALAPM WILL IS NOT OV? N TURN ON THAT THE FUL ARRANGE ALAPM NOT OVER THE FUL ARRANGE ALAPM NOT OVER THE FUL ARRANGE ARRANGE ATTING THAT THE FUL ARRANGE ALAPM NOT OVER THE FUL ARRANGE ATTING THAT THE FUL ARRANGE ARRANGE ATTING THAT THE FUL ARRANGE ATTING THAT THE FUL ARRANGE ARR	1 5	•		•							*	
TURN ON PROGRAM NOVITED DAYS TITLE ALGORITHM TURN ON PROGRAM NOVITED DAYS TURN DAYS TO FINAL ALTOMATIC PSI VIA 23D TURN DAYS TURN DAYS	IS T	HF ISS ON?		•			*					
TURN ON PRIGRAM ALARM LIGHT AND ALARM LIGHT AND ALARM CORRECT FOR ALLED ALARM	· Ý		N 9									
TINN ON PRIORAM MINITER DSKY: ALAPM LIGHT AND DESPRISAMM ALAPM STERE ALAPM CODE LIGHT COME DN INDIC- ALAPM CODE WILL AE DOZID.] TURN ON INJ AND RESCRECT PSI VIA 320 DO FINAL AJIOMATIC REQUEST TERMINATE AUTOMATIC REQUEST TERMINATE ROUTINE (930). EXIT PSI EXIT PSI FXIT PSI PSI PSI PSI PSI PSI PSI PS	:	•										#30
**************************************			•			М						
TURN DN INJ AND RESELECT PSI VIA ROD DO FINAL AUTOMATIC REQUEST TERMINATE ROUTINE (POO). REQUEST TERMINATE ROUTINE (ROD). HINATE RUD- TINE (ROD). EXIT PSI	. STI . (NI . AL	ORE ALARM CODE. OTE: IF CALLED ARM CODE WILL		LIGHT COME ON ATTHE BUTTA IS NOT DN?	GŅĪ MI H	J J						ik.
TURN ON IMJ AND RESELECT P51 VIA ROD DO FINAL AJTOMATIC REQUEST TERMINATE RUITINE (ROD). MINATE ROJ TINE (ROD). EXIT P51								•				*
TURN ON INJ AND RESELECT PSI VIA 230 DO FINAL AJIOMATIC REQUEST TERMINATE ROUTINE (R30). MINATE R30- TINE (R30). EXIT PSI PSI FXIT PSI PSI PSI PSI PSI/SUNDANCE		•		•								***
AND RESELECT P51 VIA 220 DD FINAL AJTOMATIC DD FIVAL REQUEST TERMINATE AUTOMATIC NINATE REJU- TINE (201). EXIT P51 FXIT P51 P51/SUNDANCE		•			•							#40
DO FINAL AJIOMATIC DO FINAL SEQUEST TERMINATE AUTOMATIC REQUEST TERMINATE ROUTINE (ROO). REQUEST TERMINATE ROUTINE (ROO). EXIT FXIT P51 P51/SUNDANCE	•	•										
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#220

P51/SUNDANCE						P51/SUNDANCE
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	MONITO OSKY: OBSERVE DISPLAY OF COARSE ALION VERR AND ICOU ANGLES (ALL DOGOC) FOR CARSE ALIGNMENT	,	. .	DBSERVE HYG ATT"		
		ICOU/SIM3 AL ANG- LES TO BE COARSE ALIGNED TO (OG, IG, MG, RESPEC- TIVELY).	COMMAND ISS TO COARSE ALIGN	TURN NC ATT"	CDAPSE ALIGN ISS CDAPSE ALIGN ISS TERMINATE CDAPSE ALIGN MODE IN ISS. PELJURE	VEHICLE

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#170

#190

#200

#210

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#230 DIT IDELISHT SISHTING			•	•	
#230 DIT IDELISHT SISHTING		•	•		
DO INFLIGHT SIGHTIME MARK ROUTINE (253) FOR CELESTIAL 200Y FIL			WAIT FOR "NO ATT" LIGHT OFF	•	
#240 #250 #250 #250 #250 #260 #260 #270				•	
DO INFLIGHT SIGHTING MARK ROUTINE (RES) FOR CELESTIAL RODY #1 #1 #1 #250 #250 #250 #250 #250 #250 #260 #27 #27 #27 #27 #28 #28 #29 #29 #29 #20 #20 #20 #20 #20	• •		•	•	#230
DO INFLIGHT SIGHTING MARK ROUTINE (RES) FOR CELESTIAL RODY #1 #1 #1 #250 #250 #250 #250 #250 #250 #260 #27 #27 #27 #27 #28 #28 #29 #29 #29 #20 #20 #20 #20 #20	• •	•	•		
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DO INFLIGHT SIGHTING MARK ROUTINE (RES) FOR CELESTIAL RODY #1 #1 #1 #250 #250 #250 #250 #250 #250 #260 #27 #27 #27 #27 #28 #28 #29 #29 #29 #20 #20 #20 #20 #20		•		• • •	
DO INFLIGHT SIGHTING MARK ROUTINE (RES) FOR CELESTIAL RODY #1 #1 #1 #250 #250 #250 #250 #250 #250 #260 #27 #27 #27 #27 #28 #28 #29 #29 #29 #20 #20 #20 #20 #20	•			•	
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DO INFLIGHT SIGHTING MARK ROUTINE (RES) FOR CELESTIAL RODY #1 #1 #1 #250 #250 #250 #250 #250 #250 #260 #27 #27 #27 #27 #28 #28 #29 #29 #29 #20 #20 #20 #20 #20		•	•	•	#2/0
MARK ROUTINF (253) FOR CELESTIAL 300Y #1 #1 #1 #250 DO INFLIGHT SISHTING MARK ROUTINE (853) FOR CELESTIAL 800Y #2 #2 #2 #2 #2 #2 #250 #250 #250 #250 #26 #27 #27 #27 #27 #27 #27 #27	DO INFLIGHT SIGHTING		DO INFLIGHT SIGHTING	•	#240
#1 #1 #250 OC INFLIGHT SIGHTING DD INFLIGHT SIGHTING MARK ROUTINE (R59) FOR CELESTIAL BODY #2 #250 OD SIGHTING DATA DO SIGHTING DATA DISPLAY ROUTINE (R59) FOR CELESTIAL ROUY #2 #250 #250 #270 F	MARK ROUTINE (353)		MARK ROUTINE (RES)		
DO INFLIGHT SIGHTING MARK ROUTINE (R53) FOR CELESTIAL BODY FOR CELESTIAL BODY #2 DO SIGHTING DATA DISPLAY ROUTINE (R54) FOR CELESTIAL BODY #2 #2 DO SIGHTING DATA DISPLAY ROUTINE (R 54) FOR CELESTIAL BODY #2 #250 #27		•		•	
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DO INFLIGHT SISHTING MARK ROUTINE (253) FOR CELESTIAL RODY #2 DO SIGHTING DATA DISPLAY ROUTINE (P 54) F	•			•	#250
MARK ROUTINE (253) FOR CELESTIAL BODY #2 #2 #250 #2	•	•		•	
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FOR CELESTIAL BODY #2 #2 #250 #2 #2 #2 #2 #250 DO SIGHTING DATA DISPLAY ROUTINE (P 54)				•	
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CHANGE CONTROL MITES

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PRESENT PLATFORM
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EXIT P51

DO FINAL AUTOMATIC
REQUEST TERMINATE
ROUTINE (200).

DD FINAL AUTOMATIC REQUEST TERMINATE ROUTINE (ROO).

SET PFFSMFLAS

FXIT >51

APOLLO COMPUTER LOGIC CHECKLIST INTERFACE

IMU REALIGN PROGRAM (P52)

LCGIC REV 19 01/17/69

PUR POSE:

- (1) TO ALIGN THE INC FROM A "KNOWN" (SEE ASSUMPTION 5) ORIENTATION TO ONE OF THREE ORIENTATIONS SELECTED BY THE ASTRONAUT USING SIGHTINGS ON TWO CELESTIAL BODIES WITH THE ACT OR A BACKUP OPTICAL SYSTEM.
 - (A) PREFERRED ORIENTATION

AN OPTIMUM ORIENTATION FOR A PREVIOUSLY CALCULATED MANEUVER. THIS ORIENTATION MUST BE CALCULATED AND STORED BY A PREVIOUSLY SELECTED PROGRAM.

(B) NOMINAL CRIENTATION

X = UNIT(R)-SM Y = UNIT(V X R)-SM Z = UNIT(X X Y)-SM -SM -SM

WHERE:

R = THE GEOCENTRIC (EARTH ORBIT) OR SELENOCENTRIC (LUNAR ORBIT) RADIUS VECTOR AT TIME T(ALIGN) SELECTEC BY THE ASTRONAUT.

V = THE INERTIAL VELOCITY VECTOR AT TIME T(ALIGN) SELECTED BY THE ASTRONAUT.

(C) REFSMMAT

SEE ASSUMPTION (5)

- ASSUMPTIONS: (1) THIS PROGRAM MAY ONLY BE PERFORMED WHILE THE LM IS IN FLIGHT.
 - (2) THE DOCKED CONFIGURATION MAY BE LM/CSM OR LM ALONE. THE PRESENT CONFIGURATION SHOULD HAVE BEEN ENTERED INTO THE LGC BY COMPLETION OF THE CAP DATA LCAD ROUTINE (RO3).
 - (3) THERE ARE NO RESTRAINTS UPON THE LM ATTITUDE CONTPOL MODES UNTIL A PGNCS CONTROLLED MANEUVER IS CALLED BY A PRO-GRAM OR THE CREW WISHES TO MANUALLY MANEUVER THE VEHICLE. THE GUIDANCE CONTROL SWITCH MAY BE PGNCS OR AGS AND IF PGNCS THE MODE MAY BE AUTO OR ATTITUDE HOLD. PRIOR TO PGNCS CONTROLLED MANEUVERS THE LGC WILL REQUEST THE CORRECT MODE IF IT IS NOT IN FFFECT. FOR MANUALLY CONTROLLED MANEUVERS THE CREW MUST SFLECT THE CORRECT MODES.
 - (4) THIS PROGRAM MAKES NO PROVISION FOR AN ATTITUDE MANEUVER TO RETURN THE VEHICLE TO A SPECIFIC ATTITUDE. SUCH A MAN-EUVER, IF DESIREC, MUST BE CONE MANUALLY. AN OPTION IS PROVIDED HOWEVER TO ALLOW POINTING OF THE ACT AT ASTRONAUT OR LGC SELECTED STARS EITHER MANUALLY BY THE CREW OR AUTOMATICALLY BY AN LGC CONTROLLED ATTITUDE MANEUVER.
 - (5) THE ISS IS ON AND HAS BEEN ALIGNED TO A ""KNOWN" ORIENTATION WHICH IS STORED IN THE LGC (REFSMMAT). THE PRESENT IMU ORIENTATION DIFFERS FROM THAT TO WHICH IT WAS LAST ALIGNED ONLY DUE TO GYRO DRIFT (I.E. NEITHER GIMBAL LOCK NOR IMU POWER INTERRUPTION HAS CCCURRED SINCE THE LAST ALIGNMENT).

++ +19 +603 +19	(6) IF THE DAP IS ON AND THE CONTPOL MODE IS RATE COMMAND/ATTITUDE HOLD (V77E) WHEN THE ASTRONAUT KEYS IN "PROCEED" TO FLVO6N93, THE DAP MAY FIRE RCS JETS WHEN THE STABLE MEMBER IS RECRIENTED BY MEANS OF GYRD TORQUING. THESE JET FIRINGS CAN BE SUPPRESSED BY TURNING OFF THE DAP (GUIDE CONTROL SWITCH TO AGS OR THE MODE CONTROL SWITCH TO OFF), OR BY KEYING IN V76E (MINIMUM IMPULSE CONTROL MODE).											
++	(7) THE PROGRAM	IS SELECTED BY THE AS	TRONAUT BY DSKY ENTRY.									
PROG CONT	LGC	GR CUND	CREW		CHECKLIST	TIME	TOTAL TIME					
	ar .		•CREW PROG •SELECTION									
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	START IMU REALIGN PROGRAM (P52) DISPLAY P52	•	KEY IN IMU REALIGN PROGRAM (P52) V37E 52E				#10					
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			MCNITCR DSKY: OBSERVE DISPLAY OF PROGRAM 52									
	•		•				#20					
	DO IMU STATUS CHECK ROUTINE (RO2)	•	DO IMU STATUS CHECK ROUTINE (RC2)									
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	IS THE PREFERRED ORIENTATION FLAG SET?	-	•				#30					
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HOLD .	FLASH VERB-NOUN TO		. MCNITOR D	cvv.			
	REQUEST RESPONSE AND		• OBSERVE	VERB-NOUN .			#60
SNAP .	DISPLAY CPTION CODE		FLASH TO	REQUEST .			Van Ober ann
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CCD 	STORED ORIENT E 00002? 	ATIC		TATION SE	.N	 #230
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CCD •Y • • • • • • • • • • • • •	STORED ORIENT E 00002? .N (NCM) .(RE GC TO BELOW RE COOCO, OC, 00000 FOR PLAY AS	ATIC FSM)		· Y (NOM)	N (REFS	#230 #240
CCD •Y • • • • • • • • • • • • •	STORED ORIENT E 00002? .N (NCM) .(RE GC TO BELOW RE COOCO, OC, 00000 FOR PLAY AS	ATIC FSM)		· Y (NOM)	N (REFS	#230 #240
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CCD -Y	STORED ORIENT E 00002? .N (NCM) .(RE GC TO BELOW RE COOCO, OC, 00000 FOR PLAY AS	ATIC FSM)		· Y (NOM)	N (REFS	#230 #240
CCD -Y	STORED ORIENT E 00002? .N (NCM) .(RE GC TO BELOW RE COOCO, OC, 00000 FOR PLAY AS	ATIC FSM)		· Y (NOM)	N (REFS	#230 #240

128 (238)

129 (239)	•		•		
(23)					
					P52/SUNDANCE
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HOLD .	EL ACU MEDO MOUN TO	•	MCMITCO DO		
CAIAD	FLASH VERE-NOUN TO REQUEST RESPONSE AND		MONITOR DS		
SNAP .	DISPLAY T(ALIGN);	•	FLASH TO F	VERB-NOUN	
	V06N34	•		ND DISPLAY	
	R1- T(ALIGN)-HRS		OF TIALIGN		
	R2- T(ALIGN)-MINS	•			
	R3- T(ALIGN)-SECS				#260
		•			
	T(ALIGN)- TIME(GET)	•			•
	AT WHICH LM PCSITICN	•	•		•
	VECTOR AND LM VEL-	•			
	DCITY VECTOR OR CSM	•	•		
	ANGULAR MCMENTUM	•	•		
	VECTOR ARE TO BE	•	•		
	DEFINED FOR A NOMI-	•	•		
	NAL IMU ORIENTATION.	•	•		4070
	IN HRS, MINS, SEC,	•	•		#270
	TC NEAREST .01 SEC.	•	•		
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WAIT FOR KEYBOARD ENTRY TERMINATE FLASH UPCN RECEIPT OF PROCEED KEY IN V25E AND OR NEW DATA . LOAD THE DESIRED . T(ALIGN) IN R1, #310 . PROCEED . NEW . R2, AND R3. . DATA STORE DATA #320 IS T(ALIGN) DEFINED TO BE = 0? #330 DEFINE T(ALIGN) = T PRESENT COMPUTE NCMINAL #340 ORIENTATION FOR THE PREVIOUSLY DEFINED T(ALIGN). SELECT THIS ORIENTATION FOR GIMBAL ANGLES COM-PUTATION. (NOTE: AT THIS TIME ANY PRE-FERRED ORIENTATION STORED IN THE LGC IS LCST). #350 P52/SUNDANCE

130 (240)

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13	(241)	•		•					
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		FLASH VERE-NOUN TO	•		OP DSKY		•		
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132 (24.2)

WAIT FOR KEYBOARD ENTRY

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	DC COARSE ALIG	GN	• • • • • • • • • • • • • • • • • • • •		COARSE ALIGN TINE (R50)				
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P52/SUNDANCE

STORE THE PRESENT IMU ORIENTATION IN REFSMMAT AND SET REFSM FLAG		
RESET PREFERRED ORIENTATION FLAG		"B" FPOV ABOVE
DO FINE ALIGN RCUTINE (R51)	•	DO FINE ALIGN RCUTINE (R51)
DC FINAL AUTOMATIC REQUEST TERMINATE ROUTINE (ROO)		DO FINAL AUTOMATIC REQUEST TERMINATE ROUTINE (ROO)
EXIT P52		EXIT P52

CHANGE CENTROL NOTES

LOGIC REV 18 PCN-MIT-136 LOGIC REV 19 PCN 603.1

(244)

#520

#530

#540

#550

#560

APOLLO COMPUTER LOGIC CHECKLIST INTERFACE

FINAL AUTOMATIC REQUEST TERMINATE ROUTINE (ROO)

LCGIC

REV 05 01/17/69

PUR PCSE:

+05 +EDIT

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- (1) TO PROVIDE A STANDARD EXIT FOR PROGRAMS, AND AN OPTION TO SELECT ANY PROGRAM DESIRED.
- (2) TO PROVIDE A GENERAL DESCRIPTION OF THE COMPUTER ACTIVITY FOLLOWING ANY V37EXXE.

- ASSUMPTIONS: (1) THE CALLING PROGRAM HAS SUCCESSFULLY COMPLETED ALL ITS FUNCTIONS OR THE OPERATOR HAS PREMATURELY TERMINATED THE PREGRAM.
 - (2) THE COMPUTER CHECKS ON THE RENDEZVOUS OR LUNAR SURFACE NAVIGATION PROCESS FOLLOWING ANY V37EXXE IN THE FOLLOWING
 - (A) IF P20, OR P25 IS THE NEW PROGRAM KEYED IN AND IT IS NOT PRESENTLY RUNNING AND WAS NOT RUNNING IN THE BACKROUND IT WILL BE STARTED AS A NEW PROGRAM.
 - (B) IF P2C, OR P25 IS THE NEW PROGRAM KEYED IN AND IT IS THE ONLY PROGRAM PRESENTLY RUNNING (I.E. 20 OR 25 DISPLAYED IN THE PROG LIGHTS) IT WILL BE STARTED AS A NEW PROGRAM (I.E. RE-INITIALIZED).
 - (C) IF P20 OR P25 IS THE NEW PROGRAM KEYEC IN BUT A PROGRAM OTHER THAN P20 OR P25 IS DISPLAYED IN THE PROG LIGHTS THE PROG LIGHTS WILL BE CHANGED TO 20 OR 25 AND P20 OR P25 WILL EITHER BE STARTED AS A NEW PREGRAM (IF IT WAS NOT RUNNING AT ALL) OR MERELY CONTINUED (IF IT WAS ALREADY RUNNING).

- (D) IF PCC IS SELECTED, THE RENDEZVOUS FLAG AND P25 FLAGS ARE RESET (SHUTS OFF P20 OR P25) AND P00 IS STARTEC.
- (E) IF A PROGRAM CTHER THAN P20, OR P25 OR P00 IS KEYED IN, THE NEW PROGRAM WILL BE STARTED AND THE PROG LIGHTS WILL DISPLAY THE NEW PROGRAM. IF P20, OR P25 WAS RUNNING IT WILL CONTINUE IN THE BACKGROUND.
- (3) THIS ROUTINE RESTORES THE CEADBAND SPECIFIED IN RO3 BY THE ASTRONAUT.
- (4) FLAGS USEC BY THIS ROUTINE:

NODO V37 FLAG - INFIBITS PROGRAM SELECTION OTHER THAN LGC IDLING PROGRAM POO. SET BY R47 STATE VECTOR INTEGRATION, AND PO6. RESET BY R47, STATE VECTOR INTEGRATION, AND RECOVERY FROM STAND BY.

PROG	LCC	GROUND		CREW			CHECKLIST	TIME	TOTAL TIME
	• LGC • RCUTINE • SELECTION			• CREW • PROGRAM • SELECTION					*
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+05	•			•	•	•			
+512	• • •			•	•	•			#10
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+	•			•	•	•		ROO/SUNDANCE	

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1 0 0	•		•	•
HOLD				•
	FLASH VERB 37 TO		. MCNITOR DSKY:	•
SNAP .	REQUEST PLEASE PER-		. OBSERVE VERB	
+	FERM CHANGE OF			
*			. 37 FLASH TO RE-	
+	PROGRAM:		. QUEST PLEASE	•
+	V37 N BLANK		. PERFORM CHANGE	•
4	R1-BLANK		. CF PRCGRAM.	
			. CI PREGRAPA	<u>*</u>
+	R2-BLANK			•
+	R3-ELANK		•	#20
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	ENTRY		. PROGRAM:	-
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+	TERMINATE FLASH ON			
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+	 RECEIVE V37EXXE 		KEY IN DESIRED .	•
+	. TO REQUEST NEW	•	PROGRAM .	
	. PRCGRAM.	•	V37EXXE .	#40
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	. TURN	ON		MONITOR DSKY:		•	•
	. PROGP		•	DOES PROGRAM		•	
		LIGHT		ALARM LIGHT COME		•	· • #80
	. AND S		•	ON INDICATING		•	***************************************
		CODE		ABNORMALITY?			
	. 01520						•
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	•	EXIT			•		. #90
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•	•			TO DISPLAY	•	•	•
•	•			ALARM CODE. EX-	•	•	•
•	•			PECTED ALARM AT	•	•	•
•	•			THIS TIME IS	•	•	•
•	•			01520	•	•	•
•	•			INDICATING:	•	•	•
•	•			(1) THE IMU IS	•	•	•
•	•			BEING IN-	•	•	•
•	•			ITIALIZED	•	•	• #100
•	•			(2) A PROGRAM	•	•	•
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	•		•				ROO/SUNDANCE	
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(249)

ROO/SUNDANCE

#180

#190

#200

#210

#220

ROO/SUNDANCE

IS NEW PREGRAM PEC? RESET RACMOCES BITS 10 & 15 RESET NCCCV37, RENDEZVCUS, P25, . AND IMUSE FLAGS. . IS NEW PROGRAM . P20 OR P25? . RESET IMUSE . FLAG TURN CFF ULLAGE TURN OFF ENGINE DC STOPRATE

#230

#240

#250

#260

#270

ROO/SUNDANCE RESET THE TRACK FLAG RESET THE UPDATE FLAG. RESTORE ASTRONAUT SPECIFIEC DEADBAND. ------IS NEW PROGRAM POO? RESET THE REN-DEZVOUS AND P25 FLAGS. +05 IS NEW PREGRAM P20 CR P25? IS THE CURPENT PRCGRAM P20 OR P25? ROO/SUNPANCE

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			OBSERVE DISPLAY OF NEW PROGRAM.		
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	•				ROO/SUNDANCE
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ROO/SUNDANCE

ROO/SUNDANCE

RELEASE CISPLAY
SYSTEM.

GO TO PROGRAM
SFLECTED

EXIT ROO

EXIT

R00/P--

#340

CHANGE CENTREL NOTES

REV C4 PCN NC. 86 + PCR-NASA-88 + PCN-MIT-15 + PCN-MIT-106.
REV C5 PCN-512

APOLLO COMPUTER LOGIC CHECKLIST INTERFACE

IMU STATUS CHECK ROUTINE (RO2)

LOGIC

REV 05 05/23/68

PURPOSE:

(1) TO CHECK WHETHER INU IS ON AND IF ON THE LECTOR IT SELTEN AN ORIGINATION KNOWN BY THE LECTOR

(2) TO ESTABLISH A PROGRAM ALARM AND STORE AN ALARM CODE IF THE IMU IS DEF OR NOT ALIGNED TO AN ORIENTATION KNOWN BY THE LGC.

ASSUMPTIONS: (1) THE ROUTINE IS AUTOMATICALLY SELECTED BY THE PROGRAM IN PROCESS.

PRJG LGC GROUND CREN CHECKLIST TIME TOTAL CONT TIME

> .LGC .RJUTINE . SELECTION

START IMU STATUS CHECK ROUTINE (RO2)

IS THE ISS DRIENTA-TION KNOWN FLAG SET? (CHECK REFSM=LAG)

IS THE ISS ON?

#10

#20

APOLLO COMPUTER LOGIC CHECKLIST INTERFACE

PAP DATA LOAD ROUTINE (RO3)

LOGIC

REV 13 04/16/68

PURPOSE:

(1) TO LOAD AND VERIFY LGC DIGITAL AUTOPILOT (DAP) DATA, AND DPS ENGINE SIMBAL TRIM ANGLES.

(2) TO PROVIDE THE CREW A MEANS FOR SELECTING THE DESIRED DAP RESPONSE.

(3) TO PERFORM ENGINE GIMBAL TRIM.

**SULTY NAME OF THE STATE OF TH

PROG CONT	LGC	GROUND	CREW	CHECKLIST	TIME	TOTAL TIME
			CREW ROUTINE SELECTION			
	START DAP DATA LOAD ROUTINE (RO3)	•	• KEY IN V48E			#10
	:		:			
HOLD .	FLASH VERR-NOUM TO PEQUEST PESPONSE AND DISPLAY DAP CONFIG- URATION/PESPONSE DATA CODE:		DBSERVE VER3-NOUN FLASH TO REQUEST RESPONSE AND DISPLAY OF DAP DATA CODE			#20
	VOL N46 R1-ARCDE R2-BLANK R3-BLANK P1 DATA CODE:		AN I CATISTICO MITU		*	,
	A=0 LM ONLY A=1 LM AND CSM B=0 2 JET TPANS- LATION (PCS		AM I SATISFIED WITH THE STORED DAP CON- FIGURATION AND PES- PONSE DATA?		×	#30
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P=2 4 JFT TRAVS-						•					770
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SYSTEM A AND						•					
3).						•					
C=O FINE SCALING					•	•					
ACA. C=1 NOPMAL SCALING					•	•					
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DEO ATT DEADRAND,						•					
.3 DEGREES						•					#50
D=1-ATT DEADRAND,		9			•	•					
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RECEIPT OF PROCEED											
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.PROCEED .NEW DATA											#80
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R03/SUNDANCE

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- F R D W	EQUE ISPL EIGH EIGH VO	AY STORI T AND C'	ONSE AND ED LM SM		• • • • • • • • •		DBSERVE FLASH 1 SPONSE	VERB- TO REQU TO DVA	POUN JEST RE- ISPLAY					
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- F R D W	EQUE ISPL EIGH EIGH VO R1	AY STOR AY STOR HT AND C' HT; C6 N47 L- THIS (LM)	DNSE AND ED LM SM VEHICLE WEIGHT	• •			DBSERVE FLASH 1 SPONSE	VERB- TO REQU TO DVA	POUN JEST RE- ISPLAY					
- F R D W	EQUE ISPL EIGH EIGH VO R1	AY STORI AY STORI HT AND CO HT; 26 N47 L- THIS (LM)	ONSE AND ED LM SM VEHICLE WEIGHT VEHICLE		• • • • • • • • • •		DBSERVE FLASH 1 SPONSE	VERB- TO REQU TO DVA	POUN JEST RE- ISPLAY					
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- F R D W	EQUE ISPL EIGH VO R1	AY STORI AY STORI HT AND CO HT; 26 N47 L- THIS (LM) 2- OTHER (CSM)	DNSE AND ED LM SM VEHICLE WEIGHT VEHICLE WEIGHT		• • • • • • • • •		DBSERVE FLASH 1 SPONSE	VERB- TO REQU TO DVA	POUN JEST RE- ISPLAY		*			#190
- F R D W	EQUE ISPL EIGH VO R1	AY STORI AY STORI HT AND CO HT; 26 N47 L- THIS (LM) 2- OTHER (CSM)	DNSE AND ED LM SM VEHICLE WEIGHT VEHICLE WEIGHT				DBSERVE FLASH 1 SPONSE	VERB- TO REQU TO DVA	POUN JEST RE- ISPLAY				RO3/SUNDANC	#190
- F R D W	EQUE ISPL EIGH VO R1	AY STORI AY STORI HT AND CO HT; 26 N47 L- THIS (LM) 2- OTHER (CSM)	DNSE AND ED LM SM VEHICLE WEIGHT VEHICLE WEIGHT		• • • • • • • • • •		DBSERVE FLASH 1 SPONSE	VERB- TO REQU TO DVA	POUN JEST RE- ISPLAY					#190
- F R D W	EQUE ISPL EIGH VO R1	AY STORI AY STORI HT AND CO HT; 26 N47 L- THIS (LM) 2- OTHER (CSM)	DNSE AND ED LM SM VEHICLE WEIGHT VEHICLE WEIGHT		••••••		DBSERVE FLASH 1 SPONSE	VERB- TO REQU TO DVA	POUN JEST RE- ISPLAY		*			#190
- F R D W	EQUE ISPL EIGH VO R1	AY STORI AY STORI HT AND CO HT; 26 N47 L- THIS (LM) 2- OTHER (CSM)	DNSE AND ED LM SM VEHICLE WEIGHT VEHICLE WEIGHT		•••••		DBSERVE FLASH 1 SPONSE	VERB- TO REQU TO DVA	POUN JEST RE- ISPLAY					#190
- F R D W	EQUE ISPL EIGH VO R1	AY STORI AY STORI HT AND CO HT; 26 N47 L- THIS (LM) 2- OTHER (CSM)	DNSE AND ED LM SM VEHICLE WEIGHT VEHICLE WEIGHT		• • • • • • • • • •		DBSERVE FLASH 1 SPONSE	VERB- TO REQU TO DVA	POUN JEST RE- ISPLAY				R03/SUNDANC	#190
- F R D W	EQUE ISPL EIGH VO R1	AY STORI AY STORI HT AND CO HT; 26 N47 L- THIS (LM) 2- OTHER (CSM)	DNSE AND ED LM SM VEHICLE WEIGHT VEHICLE WEIGHT				DBSERVE FLASH 1 SPONSE	VERB- TO REQU TO DVA	POUN JEST RE- ISPLAY					#190
- F R D W	EQUE ISPL EIGH VO R1	AY STORI AY STORI HT AND CO HT; 26 N47 L- THIS (LM) 2- OTHER (CSM)	DNSE AND ED LM SM VEHICLE WEIGHT VEHICLE WEIGHT				DBSERVE FLASH 1 SPONSE	VERB- TO REQU TO DVA	POUN JEST RE- ISPLAY				R03/SUNDANC	#190

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RO3/SUNDANCE

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LOGIC REV 12 PCN NO. MIT 60 LOGIC REV 13 PCN MIT 85 + PCN-MIT-96.

266

#510

APCLLC COMPUTER LOGIC CHECKLIST INTERFACE

	RR/LR SELF TES	ST RCUTINE (RO4)	LCGTC	RFV 12 01/17/69	
PUR PO SE:		DE SUITABLE CSKY DISPLAT D) CP THE LANDING RADAR	/S AND LGC CCWNLINK INFCRMAT	ION TO SUPPORT THE SELF T	ESTS OF THE RENDEZVOUS
++ +12 +592			RATAR CATA CURING PROGRAMS	CTHER THAN POO, PARTICULA	PLY DURING P47 IN TERMINAL
ASSUMPTIONS:			ED BY THE ASTRONAUT BY DSKY CONSOLE (RADAR TEST SWITCH		MANUAL SELECTION OF THE
++ +12 +592	(2) THE POUTI		THE LGC ICLING PROGRAM (PC	00) AND ANY CTHER PROGRAM/	ROUTINE WHEN P20 IS NOT
+ +	(3) THE POUTI	THE MAY ALSO BE CALLED I	DURING THOSE EXTENDED VERBS	WHICH DO NOT RESTRICT OTH	ER EXTENDED VERB ACTIVITY.
+ +12 ++	(4) THE RR HE	TATERS HAVE BEEN IN THE	CPERATE POSITION AT LEAST	HOUP.	
PRCG CONT	LGC	GROUND	CREW	CHECKI IST	TIME TOTAL TIME
			• CREW • RCUTINE • SELECTION •		#10
TES	RT FR/LR SELF T RCUTINE (RO4)		KEY IN V62E		*10
	•	·	•		
+592 FLA + P20	THE RENDEZVOUS G SET? (IS RUNNING?)	·			#20
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PO4/SUNDANCE

+ + + + + + + + + + + + + +		-	MCNITOR DSKY: DOES OPERATOR ERROR LIGHT COME ON INDICATING THAT THIS ROUTINE CANNOT BE SELECTED AT THIS TIME?	RO4/SUNDANCE #30
	EXIT RC4		KEY IN V37E00E . THEN RESELECT THIS ROUTINE BY KEYING IN V62E.	#5 O
••	PLD		MCNITOR DSKY: OBSERVE VERB-NOUN FLASH TO REQUEST RESPONSE AND CISPLAY OF OPTION CODE FOR RADAR	#60 #70
144(26)	5)			RO4/SUNDANCF

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RADAR		•	ASSUMPTION CORP	RECT? .			
	-200	•					
R2 IS THE L		•	. Y	.N .			#8
ASSUMED RAD	AR	•	•	• •			
OPTION:		•	•				
00001-RR		•	•				
00002-LR		•	•				
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HALT FOR KE		• •	VEN THE DOOCEST	• •			#6
WAIT FOR KE	ARNAKD .		KEY IN PROCEED				#9
ENTRY		• •					
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		•	· VEN IN NO	•			
TERMINATE E	1.461	•	. KEY IN V2				
TERMINATE F UPCN RECEIP		• •	. LOAD THE				
PROCEED OR			. IN R2	CUDE .			
	TEW CODE		• 114 1/2				#10
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LR?			•				
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	2					RO4/SUNDANCE	

RO4/SUNDANCE

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	•	•	•	AUTC MOCE:	•	• H60 E	 		•		*110
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				BCARD ENTRY.					•		
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46(270)	•	•	•		•	•	•	•	•		
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		•	•	. TERMINATE	•			•	•	
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		•		NGLES EVERY			•		•	#210
		•		ECCND, AND RANGE			•		•	#210
				ND RANGE RATE			•		•	
				N ALTERNATE			•		•	
				ECCNDS. TRANSMIT					•	
				HESE QUANTITIES						
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	HOLD .	• •	• F	LASH VERB-NCUN	•	MONITOR			•	
				O REQUEST RES-	• • • • • • • • • • • • • • • • • • •		E VERB-NO	UN .	• •	
	MON .		• P	CNSE AND MONITOR	•	FLASH IL	REQUEST			***
		•		R CDU ANGLES:		KESPUNSE	AND MONI	TUR •		#230
		•	•	V16 N72			U ANGLES.		•	y ·
		•	•	R1-TRUNNION R2-SHAFT					•	
		•	•	R3-BLANK			•		•	
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#240

#250

#260

#270

#280

. TRUNNICH-360 . MINUS RR TRUNNICH . CDU VALUE. . IN DEGREES TO . NEAREST .01 DEG-. REE. . (PLUS IS DEFINED . AS A NEGATIVE . ROTATION ABOUT . LM M AXIS.) . SHAFT-RP SHAFT . ANGLE. IN DEGREES . TO NEAREST .01 . DEGREE. DO I WISH TO MONITOR . . RANGE AND RANGE RATE? DO I WISH TO TERMINATE THIS ROUTINE? WAIT FOR KEYBOARD KEY IN . . ENTRY. PROCEED . KEY IN TERMINATE (V34E) R04/SUNDANCE

148 (272)

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49 (273)	•	•		•	•		•			
(475)		•					•			
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HOLD .		. FLASH VERB-NOUN		MONITOR	DSKY:	_	_			#310
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		. TO REQUEST RES-			VE VERB-NOU	JN .	•			
MON .		 PONSE AND MONITOR 			O REQUEST	•	•			
	•	. RR PANGE AND	•	RESPONS	E AND MONI	TOR .	•			
		. RANGE RATE:		OF RR R	ANGE AND		•	•		
		 V16 N78 		RANGE R		-	-			
	•	. R1-RANCE			WHENEVER A	•	•			
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	•	. R2-RANGE RATE			R RANGE RAT		•			
		. R3-ELANK		MEASURE	MENT IS OB-		•			
		•		TAINED	FRCM THE RE	R .				
		. RANGE- RANGE			DATA GCOD		•			#320
	-	. (SIMULATED) TO			E IS ALSO		•			17520
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	•	 EST .01 NM. 		TRACKER	FAIL ALARI	м .				
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	-	. PANGE RATE-	4				-			
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	•	. RANGE RATE			•	•	•			
	•	. (SIMULATED)			•	•	•			
	•	. BETWEEN LM AND			•	•	•			
		. CSM. IN FPS TC					•			#330
		. NEAREST FPS.			SH TO TERM-					
	•	• MCMUEST 1750					-			
	•				ADAR SELF	•	•			
	•	. (NCTE: WHENEVER A		TESTING	3	•	•			
	•	. RANGE OR RANGE					•			
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	WAIT FOR KEYBOARD	•	KEY IN	DO I	WISH			
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150 (274)

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	• K	EAD LR PARA	AMETERS		•		•	
	. (RANGE, V(X)), V(Y),				•	
		ND V(Z)) EA			•	•	•	
		ND AND TRAP	N2WII CV		•	•	•	
	• 0	CWNLINK			•		•	#430
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HOLD	FLASH VERB-NOUN TO REQUEST RESPONSE AND MONITOR THE LR RANGE AND ANTENNA POSITION: V16 N66 R1-RANGE R2-POSITION R3-BLANK	•	FLASH TO RESPONSE THE LR RAI ANTENNA PONCTE: POSKER FAIL DATA GOOD	VERB-NOUN REQUEST AND MONITOR NGE AND CSITION: SIBLE TRAC- IF ALTITUDE DISCRETE	• •			# 450
•	RANGE- SIMULATED SLANT RANGE. IN FEET TO NEAREST FCCT		IS MISSING	J.	• •			
•	POSITION-PRESENT LANCING RADAR ANTENNA POSITION (00001 OR 00002)			TO MONITOR) AND V(Z)? .N		¥		#460
•	•	,	•	•	• • • • • • • • • • • • • • • • • • • •			
•	WAIT FOR KEYBOARD ENTRY.	•	PROCEED	DO I WISH TO TERM- INATE THIS ROU- TINE?	• •			#470
			•	.Y .N			*	
•	TERMINATE FLASH UPON RECEIPT OF PROCEED OR TERM- INATE	•	. TE	Y IN RMINATE 34E)	•			#480
	.P .T .R .E .O .R .C .M		•	•	•			
:	• E • I • E • N • C • A • T • E		•	FXIT RO4	•			#490
:			•		•		RO4/SUNDANCE	
152 (276)			•		•			

53(277)			•						
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	• EXIT		•		•				
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HOLD	FLASH VERB-NCUN TO		MONITOR DS		• •				
00000000	REQUEST RESPONSE AND			VERB-NOUN					
MON	MONITOR LR		FLASH TC P		• •	*			
•	V(X), V(Y), AND V(Z): V16 N67	•		ND MONITOR , V(Y) AND					
•	R1-V(X)		V(Z)		• •				#510
•	R2-V(Y) R3-V(Z)		(NOTE: WHE		• •				
			IS OBTAINE	C FRCM THE	• •		*		
	V(X), V(Y) AND V(Z)- SIMULATED VELOCIT-		LR THE ASS		• •				
	IES. IN FPS TO NEAR-		IS ALSO CH	ECKED. IF					
	EST FPS		IT IS MISS						
	(NCTE: WHEN EACH		IS ACTUATE						
•	VELOCITY COMPONENT IS OBTAINED FROM THE				• •				#520
	LR THE VELOCITY		•		• •				
•	DATA GCCD DISCRETE		•		• •				
•	IS ALSO CHECKED. IF IT IS MISSING THE				• •				
	TRACKER FAIL ALARM		DO I WISH						
•	IS ACTUATED)		INATE RADA	R SELF	• •			¥	100
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•	HATT FOR MEMBUARD		VEV IN	DO I WICH	• •				
•	WAIT FOR KEYBOARD ENTRY		KEY IN TERMINATE	DO I WISH TO PER-	• •			ψ.	
		•	(V34E)	FORM RR	• •				
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TERMINATE FLASH	!						•		
UPON RECEIPT OF			KEY IN				•		
RECYCLE, PROCEE	CCR	•	PRCCEE	D			•		
TERMINATE							•		
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EXIT		EXI							#600
R 04		R 04							

154 (278)

CHANGE CENTREL NETES

LOGIC REV 10 PCN MIT - 58,65 LOGIC REV 11 PCN - MIT - 52. + PCR - 55.1 LOGIC REV 12 PCR 592

APOLLO COMPUTER LOGIC CHECKLIST INTERFACE

	RR I	DESIGNATE ROUTIN	BE (R21)		LOSTC	RFV 15	05/28/68	4	
PURPOSE:	(1)		ENDEZVOUS RADAR (ACQUISITI	ON OF THE CSM IS 4	YS DEFELLING	THE
:SUCITORUZZA	(1)	THIS ROUTINE I		ALLED BY THE REND	EZVOJS NAVIGA	FION PROGR	AM (P20) AND THE L	UNAR SURFACE NAV	VIGA-
	(2)		MAY BE COMMANDED EVED BY THE RR.	BY THE LGC AFTER	THE LGC ISSUE	S THE TRAC	K ENABLE DISCRETE	UNTIL RANGE RATE	E
PROG		I GC	GROUND	CREW			CHECKLIST	TIME	TOTAL TIME
		.LGC .PROGRAM .SELECTION							
DE:	ART RE SIGNAT 21)	E ROUTINE						×	#10
+16 + +		•							
+	•	•							#20
	SCRETE	TRACK ENABLE TO THE PR.							
+ . + . + .		•							
		(SET K = 60)						4	#30

R21/SUNDANCE

WAIT FOR SSY TO

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年130

R21/SUNDANCE

#200 '

#210

#220

#230

#240

#250

R21/SUNDANCE

• SEND AUTO • TRACK ENABLE • TO THE RR.

IS DATA GOOD
DISCRETE RECEIVED
FROM THE RR?

.N .Y

EXIT R21

ISSUE RATE COMMANDS TO THE RR
PROPORTIONAL TO
THE ANGULAR DIFFERENCE BETWEEN
RR LOS AND THE
LOS TO THE CSM
ONE SECOND FROM
NOW.

WAIT .5 SECONDS.

TERMINATE PERIODIC LOS DETERMINATION CALCULATION. #250

#270

#280

#290

#300

R21/SUNDANCE

284

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285		•	•							
	•	•	•		•				R21/SUNDANCE	, - :
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		REMOVE RR TRACK EN- ABLE DISCRETE	•		•					
			•							421.0
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+16		• FROM	•							
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+16		• •	•							
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PRIO HOLD			•						*	#320
• • • •		FLASH VERB NOUN TO		MONITOR DSKY:						
SNAP	• •	REQUEST RESPONSE AND	••	DOES ALARM CODE			*			
	•	DISPLAY ALARM CODE: V05N09	•••	PLAY INDICATE T						
		R1-00503	•	ROUTINE (R21) 1	IS UN-					
	•	R 2-XXXX	•	ABLE TO ACQUIRE	THE					
	•	R3-XXXXX	•							
		•	•	. Y	• N					#330
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	•	•	•	PUSH ALARM					_	
	•	•	•	PROGRAM ALARM.	•					
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	•	•	•	•	EXIT	3				#340
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	•	•	•	INITIATE AN AUTOMATIC SEARC	• u ɔ					
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	•	WAIT FOR KEY3DARD							* 10	
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GO TO RE SEARCH . #350 ROUTINE (R24) . FXIT R21 #370 DO I WISH TO ATTEMPT TO DESIGNATE THE RR . AGAIN? KEY IN RECYCLE #380 V32F TERMINATE FLASH UPON . KEY IN TERMINATE RECEIPT OF PROCEED #390 V34E TERMINATE, OR RECYCLE .P .R .R . E . F . C .0 .R . Y . C .E #400 GO TO RR SEARCH ROUTINE (R24) #410 R21/SUNDANCE

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	,	•		R21/SUNDANCE	
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EXIT P21 .		•			
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IS ANOTHER PROGRAM		IS ANOTHER PROGR			
OTHER THAN P20/P22		OTHER THAN P20/P	222		
IN PROCESS?		IN PROCESS?			#420
• Y			N.		#42U
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EXIT R21		EXIT R21			
AND P20/P22		AND P23/P22			
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DO FINAL AUTOMATIC		TAMETUA JAMIN OD	IC		4
REQUEST TERMINATE		REQUEST TERMINAT			
ROUTINE (ROO)		ROUTINE (ROD)			#440
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EXIT R21		EXIT R21			

CHANGE CONTROL NOTES

LOGIC REV 16 PCN-MIT-143

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	TRACK FLAG EE P20/P22)			SURFACE							
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IS RR A	UTO MODE	•	IS RR	MODE SI	HITCH						
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•	IN P20/P22		•	IN P2	1/22	•	•				
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291 R22/SUNDANCE ARE COUS BEING ZEROED? #100 WAIT 15 SECONDS . #110 . STORE RR . PANGE SCALE #120 . . IS RR DATA . GOOD PRESENT? .N #130 . READ RANGE RATE . . IS PR CDU FAIL ON? #140 +16 R22/SUNDANCE

#160

#150 .

#170

#180

#190

R22/SUNDANCE

. IS RE DATA GOOD . PPESENT? . FEAD 5 COUS . (ISS-3 AND RR-2) . AND TIME (TM) . IS RP DATA . GOOD PRESENT? READ RANGE . IS RR CDU FAIL ON? ______ IS THE RR RANGE SCALE THE SAME AS BEFORE? .N

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R2-	XXXXX			CALL PROGRA	м .			
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AND TUP	RN ON THE			RECALL PREV	TOUS .	•		
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9 9	•			PRESS ALARM		•		
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. TERMINATE FLASH		KEY IN	•			(6)	
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· PROCEED OR	,	V32F					
. RECYCLE.			•				
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IS THE SURFACE						*	
NAVIGATION FLAG							
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IS THE TRACK .							
FLAG SET? .							
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IS RR LOS WITHIN .		•	• •				
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+15 ++ R22/SUNDANCE

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R22/SUNDANCE

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•	. TER	IIMS	NATE FLASH		• . •				
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	•	•	EXIT R22						
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R22/SUNDANCE

#640

CHANGE CONTROL NOTES

IS SURFACE NAVIGA-TION FLAG SET?

WAIT 30

SEC

LOGIC REV 15 PCN MIT - 65 LOGIC REV 16 PCN-MIT-125

WAIT 45

SFC

R22/SUNDANCE

#610

#620

#630

APOLLO COMPUTER LOGIC CHECKLIST INTERFACE

	EB W	ANUAL ACQUISI	TICN RCUTINE (R23)		r ce ic	PFV 17 01	1/17/69		
PUR POSE:	(1)	TC ACCUIDE T	HE CSM BY MANUAL CP	EDATION DE THE	DENDETVOLS DADA	D/DD1 HUTLE T	THE IM TO THE	EL TOUT	
ASSUMPTIONS	: (1)		A MANUAL ACQUISITIO		CEZVUUS NAVIGAT	IUN PRUGRAM (P20) IN RESPU	ONSE TO AN ASTRONAUT	
PRCG		LGC	GRCUND	CREW			CHECKLIST	TIME	TOTAL
		• LGC • RCUTINE • SELECTION							
		•							
_		•							
Α		MANUAL ICN ROUTINE							#10
-									
		•							
		IN. DEACBAND	*						
		•							91
		•							#20
F	LAG FOR	NGLE MONITOR LSE BY RR ROUTINE							
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	•								#30
	•	•			INITIAL				
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R23/SUNDANCE

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•	DO PREFERRED .	• • • •	DO PREFERRED .	•	#40
•	TRACKING .		TRACKING ATTIT-	•	
•	ATTITUDE .		UDE ROUTINE	•	
	RCUTINE (R61) .		(R61)	_	
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	SEND AUTO TRACK				
•	ENABLE TO RENDEZVOUS				#70
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•	RADAR	•	•	•	
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	FLASH VERB-NOUN TO	• •	MONITOR DSKY:		
	REQUEST PLEASE		OBSERVE VERB-N	CUN	
HOLD.	PERFORM MANUAL		FLASH TO REQUEST		
HOLD		• •			
	. ACQUISITION OF CSM.	•	PLEASE PERFORM		#80
SNAP	V50N25	•	MANUAL ACGUISITI	ON	
	R1-00205		OF THE CSM.		
-	R2-BLANK				
•		•			
	R3-ELANK	•	•		
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•	•	•	PUT RR CONTROL		
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•	•	•	SWITCH FREM LGC	10	
		•	SLEW		#90
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158 (304)

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59(305)	•	• ,	•	•				
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	•	•	•	SEARCH FOR C	SM			#100
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	•	•		HAS THE CSM	BEEN			
	•	•	•	ACQUIRED?				
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	•						R23/SUNDANCE	

R23	1511	MITA	NIC
7/2	130	INLE	1.16

		#150
		#160
	*	#170
		#180
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		#200

DO I WISH TO HAVE LM MANE—UVER AGAIN TO THE PREFERRED TRACKING ATT—ITUDE AND CONTINUE MANUAL ACCUI—SITION ATTEMPTS?

KEY IN ENTER

KEY IN

TERMINATE

(V34E)

GC TC

88 V 88

BELCW

R23/SUNDANCE

160 (304)

TERMINATE FLASH UPCN

PROCEED OR TERMINATE

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88 V 88

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RECEIPT OF ENTER,

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61(307)	•	•	•				
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+	•		•		•		#210
+	•	ARE THE RR GIMBAL			•		
+	•	ANGLES WITHIN PRE-	•				
+	•	SENT MCDE LIMITS?	•		•		
*	. •	(REFER FIGURE 5.2.4-	•		•		
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		FLASH VERB-NOUN TO	•••••	MCNITOR D	SKY:		
SNAP	• •	REQUEST RESPONSE AND	• •		ERB-NCUN		
	•	DISPLAY ALARM CODE:	•	FLASH AND			
	•	V05NC9 R1-00501	•	CATE THAT	CCDE INDI-		
	•	R2-XXXXX	•	PRESENTLY	CUTSIDE		
		R3-XXXXX			LIMITS OF		
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EXIT R23

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DO I WISH TO MANEUVER AGAIN TO THE PREFERRED TRACKING ATTITUDE? (THE CSM AND/OR LM STATE VECTORS PROB-ABLY ARE INCORRECT IN THE LGC BECAUSE THE PREFERRED ATTITUDE ROUTINE (R61) IS NCT POINT-ING THE LM +Z AXIS NEAR THE (SM)

80 A 80

ABOVE

FROM

WAIT FOR KEYBOARD KEY IN RECYCLE ENTRY (V32E)

TERMINATE FLASH UPON KEY IN TERMINATE RECEIPT OF RECYCLE OR TERMINATE (V34E)

.RECYCLE .TERMINATE

86 V 86 FRCM ABOVE

R23/SUNDANCE

#260

#270

#280

#290

#300

163 (309)			<u>:</u> :		R23/SUNDANCE
*		•	: :		
	• •		PUT RR CONTROL SWITCH TO PGNCS.	· ·	#310
	RESET THE NC ANGLE		•		
	e e		•		#320
	DO FINAL AUTOMATIC REQUEST TERMINATE ROUTINE (ROC).		DO FINAL AUTOMATIC REQUEST TERMINATE ROUTINE (ROO).		
	•			*	#330
	EXIT R23 AND P20		EXIT R23 AND P20		

CHANGE CONTROL NOTES

LOGIC REV 15 PCR #86 & PCN MIT - 65 LOGIC REV 16 PCN - MIT - 1C4 LOGIC REV 17 ECITCRIAL CORRECTIONS

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165

APOLLO COMPUTER LOGIC CHECKLIST INTERFACE

	RR SEARCH ROUTINE	F (R24)		LCGIC	RFV 13 01/17	/59		
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	SEARCH ACQUISITIO	EN•						
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				•			. ' '	
	T SEARCH FLAG			•				#20
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•	TRACKING ATTITUDE RCUTINF (R61)		TRACKING ATTI- TUDE ROUTINE (R61)	•				#30
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R24/SUNDANCE

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	. OTHER RR ANTENNA .	• • WITHIN T	RANTENNA
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•	. MODE?		LGC WILL #160
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		• •	· #170
	 SET REMODE FLAG 	• •	•
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168 (314)

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•	. RESET REMODE FLAG.	• •	•	•
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•	PERFCRM RR SEARCH		•	•
•	SCAN WHICH IS A 5.6	•	•	•
•	DEGREE HEXAGEN ARCU-	• •	•	• #200
•	ND COMPUTED LOS. (SEE	•	•	•
•	SECTION 5.2.4.1.3 CF R557).	• •	•	•
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•	START CALCULATION OF		•	• #210
•	THE ANGLE BETWEEN	• •	•	•
•	THE RR LOS AND THE		•	•
•	LM +Z AXIS (OMEGA). DISPLAY THIS ANGLE		•	•
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•	DISCRETE PRESENT?		•	#240
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169 (315)

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170 (316)

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+	SECOND DESIGN IS SURFACE	- -	•	•		#370
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	P20/P22 .		• 721	0/P22		
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	IS ANCTHER PROGRAM OTHER THAN P20/22 IN PROCESS?		IS ANCTHER PROCESS?	/22 IN		#400
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	EXIT R24			EXIT R24	•
	AND P20/22		,	AND P20/22	•
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	DO FINAL AUTOM	ATIC		DO FINAL AUTO	DMATIC
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	ROUTINE (ROO)			ROUTINE (ROO)
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	EXIT R2	4		EXIT R2	4

AND P20/22

CHANGE CENTREL NOTES

LOGIC REV 11 PCN MIT 44 LOGIC REV 12 PCN - MIT - 138, PCN - MIT - 104 LOGIC REV 13 PCN 500

AND P20/22

R24/SUNDANCE

#410

#420

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APCLLC COMPUTER LOGIC CHECKLIST INTERFACE

R R MCNITOR ROUTINE (R25)

LCGIC

REV 14 01/17/69

PUR POSE:

(1) TO MONITOR THE RR STATUS WITH RESPECT TO MODE CHANGES, RR COU FAILURE, AND RR GIMBAL POSITIONS.

+14 +EDIT (2) TO COMMAND THE RR GIMBALS TO ONE OF TWO PEFERENCE POSITIONS (DEPENDENT UPON RR ANTENNA MODE) IF THE PR GIMBAL

ANGLES EXCEED PREDEFINED LIMITS (AS DESCRIBED IN FIG 2.4-3 OF SECTION 5 OF R-557).

+14 ++

(3) TO ZERO THE RR COUS WHEN THE RR IS FIRST PUT IN AUTO MODE.

ASSUMPTIONS: (1) THE PREDEFINED LIMITS OF PURPOSE (2) ABOVE ALLOW THE ANGLE BETWEEN THE LM +Z AXIS AND THE RR LOS TO BE GREATER THAN 30 DEGREES CURING NORMAL BY TRACKING UNDER CONTROL OF THE RENDEZVOUS MAVIGATION PROGRAM (P20) OF THE LUNAR SURFACE NAVIGATION PROGRAM (P22).

> WHILE IN FLIGHT, THE 30 DEGREE LIMIT DEFINED IN THE RR DATA READ ROUTINE (R22) WILL ACT TO KEEP THE RR LOS WITHIN THIS LIMIT WOROTO THE LM +7 AXISO THIS WILL BE ACCOMPLISHED BY LM ATTITUDE MANEUVERS UNDER THE CONTROL OF THE PREFERRED TRACKING ATTITUDE ROUTINE (R61). THEREFORE, IN FLIGHT, WHEN THE TRACK FLAG (SEE P20) IS SET, THE LIMITS CEFINED BY THIS ROUTINE SHOULD NEVER BE EXCEEDED AND IT SHOULD ONLY BE NECESSARY FOR THIS ROUTINE TO CONTROL THE RR GIMBALS WHEN THE TRACK FLAG IS RESET (AS DURING MANEUVERS FOR THRUSTING, ETC).

WHILE ON THE LUNAR SURFACE RR DESIGNATION IS INHIBITED IF THE LOS TO THE CSM IS NOT WITHIN THE ALLOWABLE

RR GIMBAL LIMITS OF MODE # 2.

(2) THIS ROUTINE IS AUTOMATICALLY CALLED EVERY C.48 SECONDS WHENEVER THE LGC IS ON.

PROG CONT LGC

GRCUND

CREW

CHECKLIST

TIME

TOTAL TIME

. LGC

. RCUTINE

· SFLECTION

START RR MONITOR

ROUTINE (R25)

#10

++ +14 +ED IT HAS THE RR AUTO MCDE DISCRETE CHANGED STATUS? #20 . UPDATE RR AUTO . MODE FLAG #30 . RESET CONTINUOUS . DESIGNATE FLAG, . REMCDE FLAG, RE-. POSITION FLAG. . CDU ZERO FLAG, . AND TURN ON FLAG #40 . IS THE RR AUTO . MCDE DISCRETE . PRESENT? #50 . REMOVE RR . ERRCR . COUNTER . ENABLE #60 R25/SUNDANCE

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+	. SET RR CDU				
+	ZERC FLAG AND				
+	TURN ON FLAG				#70
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+	ZERC RR CDUS				
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*	WAIT 10				
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+	RESET RR CDU				
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Ĭ	. EXAMINE RR	-			
+	TRUNNICN				#100
+	. ANGLE TO				*100
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÷ +	 SET OR RESET RR ANTENNA 				#110
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+	2; RESET =				
+	MCDE 1)				
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R25/SUNDANCE

#120 IS A CSKY LAMP TEST IN PROGRESS? N. ARE RR CCUS . BEING #130 . ZERCED? HAVE ANY CDUS #140 #150 CRETE #160 R25/SUNDANCE

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179 + (325)+ + + +				•		ì	R25/SUNDANCE	
+ + + +	•	TURN ON TRACKER FAIL LIGHT	 DOES TRACKER FA LIGHT INDICATE ABNORMALITY?	IL	•		`	#170
+ + + + + + + + + + + + + + + + + + + +		TURN OFF . TRACKER . FAIL . LIGHT .						#180
* * * * * * * * * * * * * * * * * * *		WAIT 1 SECOND	CONSULT BACKUP	N				#190
+ + + + + + +		RESET TURN ON						#200
* * * * * * *		EXIT R25						#210
+ + + + + + + +	DISC	THE RR CCU FAIL RETE CHANGEC E? Y.						#220
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•	IS THE RR AUTC		•	•
	MCDE DISCRETE			•
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•	UPDATE RR CCU		•	*240
•	FAIL FLAG		•	•
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•	IS RR CCU FAIL		•	•
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•	TURN ON	•	MCNITOR DSKY:	•
•	 PRCGRAM ALARM LIGHT 		DOES PROGRAM ALARM LIGHT INDICATE	•
	BUT DO NOT	•	ARNORMALITY?	•
	CHANGE PRE-			
•	SENT DIS-		. Y . N	•
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•	ALARM CODE 00515.		•	• #270
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			ALARM DISPLAY	•
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182 (-8)

R 25

R25/SUNDANCE

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R25/SUNDANCE

IS THE RR AUTO MODE DISCRETE PRESENT? #440 EXIT R25 #450 ARE THE RR GIMBAL ANGLES WITHIN PRESENT MCDE LIMITS (REFER FIGURE 2.4-3 OF SECTION 5 OF R-557)? #460 EXIT 225 REMOVE RR TRACK ENABLE CISCRETE TO THE RR AND RESET THE #470 RR ERRCR COUNTER. SET REPOSITION FLAG #480 CCMMAND RR GIMEALS TO REFERENCE POSI-TICK FOR THE PRESENT RR ANTENNA MCDE. #490 R25/SUNDANCF

184

R25/SUNDANCE

#500

185 + (326-E)+

CHANGE CONTROL NOTES

LOGIC REV 13 PCR 97,410 LOGIC REV 14 EDITORIAL COPRECTIONS

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APOLLO COMPUTER LOGIC CHECKLIST INTERFACE

	ORBIT PARAMETER	CISPLAY ROUTINE (R 30)	LCC	SIC REV 11	01/17/69		
PUR POSE:	(1) TC PROVIDE PROVIDED HIM BY		INENT CRBITA	AL PARAMETERS COM	PUTED BY THE L	LGC TO SUPPLEMENT OR	BITAL INFORMATIO	AC
ASSUMPTIONS	(1) THE COMPUT		THIS ROUT IN	E ARE UPDATED A	BOUT EVERY TWO	SECONDS ONLY IF THE	AVERAGE G ROUTI	INE IS ON
	(2) THE VALUE (CF TFF CR TF PER W	ILL BE MADE	TO COUNT DOWN IF	THE AVERAGE	G ROUTINE IS NOT ON	WHEN THIS ROUTIN	NE IS
++ +11 +518 ++		WILL SET TFF EQUAL				ORBIT OR GREATER TH T IN N32. THE ASTRON		
**	(4) THIS ROUTIN	F MAY BE SELECTED	WHILE THE L!	IS EITHER IN EA	ARTH OR LUNAR 1	ORBIT.		
	(5) THIS ROUTIN	E IS MANUALLY SELE	CTED BY THE	ASTRONAUT BY DSH	CY ENTRY.			
PROG CONT	rec .	GROUND	CRE	EW		CHECKLIST	TIME	TOTAL TIME
				• CREW				
				• RCUTINE • SELECTION				,
				• SELECTION				
				• • •				
_				•				
	TART ORBIT PARAMET		KEY IN					
0	ISPLAY ROUTINE (R3	0) •						#10
	•			•				,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,
	•			•				
_		-						
מ	S AVERAGE G ROUTIN N?		ON?	PAGE G ROUTINE				
	• Y • N		• Y	• N				
	• •		•	•				#20
	• •		•	•				#20
			•	•				
•	•		•	•				
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R30/SUNDANCE

	•		•	•				R30/SUNDANCE	
	:								
	•		•	•					
	. SET LGC ASSUMED			•					
	• OFTICN TO 00001.		•	•					
				•					
			•	•					#20
		****	•						#30
		•							
HOLD .		•	•			•		ē u	
	. FLASH VERB-NCUN TO	•		NITOR DSKY:					
	. REQUEST RESPONSE AND	• •		SERVE VERB-NOL		•			
	 DISPLAY OPTION CODE FOR ASSUMED VEHICLE; 			ASH TO REQUEST SPONSE AND CIT					
	. VO4 NO6		. OF	OPTION CODE	FOR	•			
	R1-000C2	•		SSUMED VEHICLE (CSM)	(LM	•			#40
	. R3-BLANK	•							
	. R1 IS THE CPTION	•	•	•		•			
	. CODE FOR ASSUMED	•		•			*		
	. VEHICLE.	•	•	•		•			
	. R2 IS THE LGC ASSUM-	•	•	•	•	•			
	. ED CPTION:		•	•					
	. JOOO1-THIS VEHICLE (LM)	•	•	•		•			#50
	. DOOOZ-OTHER VEHICLE	•		•		•			
	. (CSM)	•	•	•		•			
			•	•		•			
		•	•	•					
	•	•	•	IS THE VEHICL	E (IM	•			
		•		OR CSM) ASSUM					
	•	•	•	CORRECT?		•			#60
	•	•		. Y	. N				
	•	•	•		•	•			
	•	•	•	•	•	•		*	
	. WAIT FOR KEYBOARD			KEY IN PRO-					
	. ENTRY		• • • •	CFED	•	•			
	•	• •		•					
	•	•	•	•	•	•			#70
	•	•	•	•	•	•			
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	•	•	•		•			R30/SUNDANCE	
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189 (329)	•		•							
(324)	•		•	•	•					
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			•		•					
	. TERMINATE									
	. RECEIPT OF					KEY IN .				
	. OR NEW CAT	Δ	• •	•		V22E .				
	p	• NEW	•	•		AND LOAD . THE .				
	R	• CODE				DESIRED .				
	· . C	. DATA	•	•	•	VEHICLE .				
	• • C	•	•	•		(LM DR .				400000
	• • E	•	•	•		CSM) . CCDE IN				#80
	_		•	•		TC R2				
		RE CODE								
	· · CAT	Δ	•	•	•					
			•	•	•	• .				
	•	•	•	•	•					
				•		• •				
				•						
				•	•					#90
	• •			•	•					
	. EXTRAPOLAT	E SELECTED		•	•					
	. VEHICLE ST	ATE VECTOR								
	. TC PRESENT			•	•					
	. USING PREC			•	•					3
	. INTEGRATIO	IN.		•	•					
	•	•		•						#100
	•	•		•	•					
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	•	•		•						*
		•								
		•								
		•								
	. CCMPUTE AP	O ALT. PER								
	. ALT AND TE									#110
									*	
	•	•								
	•	•								
	. IS TFF COM						*			
	. (I.E. IS P									
	. LESS THAN									
	. 35,000 FT									#120
	. ORBIT)?									
	. · · · · · · · · · · · · · · · · · · ·	• N								
		•						it.		
		•							R30/SUNDANCE	

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¥	•		• •		
	. SET TF SET TE		• •		
	 PER EQUAL EQUAL TO ZERO -59B59 		• •		
	. AND COM- AND CO		• •		#13
++	. PUTE TFF. UTE TE				#13
	• PER.		• •	*	
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	• • •				
POSS					
HOLD .	. FLASH VERB-NCUN 1		MONITOR DSKY:		
e e e e e e e	. REQUEST RESPONSE		DESERVE VERB-NOUN		
	 DISPLAY ORBIT PAR METERS: 	< A-	FLASH TO REQUEST		#14
	• V16 N44		 RESPONSE AND DIS- PLAYS OF APO 		
	. RI-APC ALT		. ALT, PER ALT		
	. R2-PER ALT		. AND TFF		
	R3-TFF			•	
	. APC ALT-ALTITUDE		•		
	OF APCGEE ABOVE		•		
	. THE LAUNCH PAD				
	. RADIUS (EARTH O		. IS AVERAGE G ROUTINE		#15
	BIT) CR ALTITUE	DE	• ON?		
	 OF THE APCLUNE ABOVE THE LUNAR 	2	. Al V		
	. RADIUS AT THE N		N .Y		
	. RECENTLY DEFINE				
	. LANDING SITE (
	. AR ORBIT). IN A	NAU-			
	 TICAL MILES TO NEAREST .1 NM. 		• • •		
	. NEAKESI .I NM.		• • •		#16
	. PER ALT-ALTITUDE				#10
	. OF PERIGEE ABOV	/ E	• •		
	. THE LAUNCH PAC	70			
	 RACIUS (FARTH 0 BIT) CR ALTITUE 		• • • • • • •		
	. OF THE PERILUNE		DO I WISH TO		
	. ABOVE THE LUNAR		. HAVE THE CAL		
	. RADIUS AT THE M	MOST	. CULATION RF		
	. RECENTLY DEFINE		. PEATED? (SEE .		
	 LANDING SITE (1 NAR CREIT). IN 		. ASSUMPTION 1) .		#17
	. NAUTICAL MILES		Y N.		
	. NEAREST .1 NM.				
	•		• • •		
	•		• • •		
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5 4 L' 1	•				

191 (331)	•	-	-				
(331)		•	•	• •			
		•	•			R30/SUNDANCE	
	•	:				KJD7 JONDANCE	
	•						
	•	•	•		.*		
	. TFF-TIME OF FREE	•	•				
,	• FALL TO 3CO,000 FT	•	•				
,	FOR EARTH ORBIT	•	•				
•		•	•	• •			
•		•	•	• •			
	ADOME THE LANGE	•	•	• •			#180
	PAE RADIUS (EARTH	•	•	• •			
	CODITA AND ADDIT	•	•				
	THE LUNIAR RARTIC						
	AT THE MOST RECEN-		•				
	TLY DEFINED LAND-	•					
:	the state of the s	•	•				
		•	•				
		•	•				
++ +11	NEAREST SEC. MAX READING IS -59859.	•	•	• •			#190
+518	(IF PER ALT IS	•	•	• •			
+	GREATER THAN	•	•				
+	300,000/35,000	-					
+	FT THE TEF DISPLAY	•					
+11	WILL READ -59859.)	•	•				
++		•					
1		•	•				
	•	•	•				
	•	•	•	• •			#200
	WAIT FOR KEYBOARD	•	KEY IN				
•	ENTRY		RECYCLE	• •			
	LIVINI		V32E				
		•					
	•	•	•				
	•		•				
	•	• •					
	•			• •			#210
	•						
	•		NOTE: REFE	P TC	_		
			ASSUMPTION				
			DEFINITION				
	•		ADDITIONAL	DISPLAYS			
	•		AVAILABLE	IN THIS	*		
	. TERMINATE FLASH UPCN	•	ROUTINE.				
	RECEIPT OF PROCEED	• • • • • • • • • • • • • • • • • • • •	WHEN FINIS				
	OR RECYCLE	•	THIS ROUTI				#220
•	DECACLE BACCEL		KEY IN PRO	CEEU	_		
	• RECYCLE • PRCCEEC • CR AVE G •				_		
	. AUTEMATIC .		•				
,	.RECYCLE .						
	•		•				
	•		•				

R30/SUNDANCE

#230

EXIT R30 FXIT R3C

CHANGE CENTROL NOTES

LOGIC REV 09 PCN # MIT 47 .
LOGIC REV 10 REVISION NUMBER INCREMENTED IN ERROR
LOGIC REV 11 PCN #518

192 (332)

APOLLO COMPUTER LOGIC CHECKLIST INTERFACE

	RENDEZVOJS PARAM	TER DISPLAY ROUTING	F (R31)	LOSIC	3EA 08 0	5/23/68		i,
PURPOSE:	(1) TO DISPLAY	T ASTRONAUT REQUES	T LGC CALCULATED RF	NPEZVOUS PAR	AMETERS (RAN	GE, RANGE RAT	re, THETA)	
ASSUMPTIONS:	REQUIRE THAT THE IS DESIRED. THE R	ISS BE DN. THE ISS	ATED BY THE LGC ON MUST BE ON AND ALI: ETA DISPLAY IS NOT BE OPERATING.	GNED TO A "K	THEISC "NECK	ATION I = A C	RRECT DISPLAY D	F THETA
	(2) THE ROUTINE	IS SFLECTED BY THE	ASTRONAUT BY DSKY	ENTRY.				
++ +08 +	VECTOR WILL NOT B	E EXHIBITED IN THE	FTER THIS ROUTINE IS DISPLAY OF RANSE AS STRONAUT MUST TERMI	ND RANGE RAT	E. TO SEE TH	E EFFECT OF 1	THE NAVIGATION M	
+ +08 ++			IN COASTING FLIGHT : E EHT FOR SUCITALICANS			INFORMATION	IN N54 WILL BEG	IN TO
PROG CONT	LGC	GROUND	CREW			CHECKLIST	TIME	TOTAL TIME
	* * * * * * * * * * * * * * * * * * * *					*	æ	
			.CREW .ROUTINE .SELECTI					
			• • •					
		•						
РД	ART RENDEZVOUS RAMETER DISPLAY UTINE (R31)		KEY IN V33E					#10
*	•		:					*
CS ++ PR +08 C1 + (D + TO + ST + SU	TRAPOLATE LM AND M STATE VECTORS TO ESENT TIME BY PRE- SION INTEGRATION ESCRIBED IN SECT- N 5.6.7.1 DE R557) ESTABLISH A BASE ATE VECTOR FOR THE BSEQUENT CONIC EPLER SUBROUTINE)		•		•			#20

R31/SUNDANCE

```
EXTRAPOLATIONS.
                                                                                                                              #30
          IS AVERAGE G ON?
                                                                                                                               #40
           . EXTRAPOLATE CSM
           . STATE VECTOR TO
           . AVERAGE G TIME
           . USING PRECISION
+08
           . INTEGRATION. (SEE
+
           . SECTION 5.6.7.1
+08
           . OF R557)
++
                                                                                                                              #50
         EXTRAPOLATE CSM
         AND LM STATE
         VECTORS TO PRE- .
          SENT TIME USING
         KEPLER SUB-
          ROUTINE.
                                                                                                                              #60
          CALCULATE RANGE,
          RANGE RATE AND THETA
                                                                                                                              #70
         FLASH VERB-NOUN TO
                                                    MONITOR DSKY:
HOLD ..
          REQUEST RESPONSE AND
                                             ..... OBSERVE VERB-NJUN
          DISPLAY RENDEZVOUS
MON
                                                    FLASH TO REQUEST
          PARAMETERS:
                                                    RESPONSE AND DISPLAY
           V06 N54
                                                    OF RENDEZVOUS
           R1-RANGE
                                                    PARAMETERS.
            R2-RANGE RATE
                                                    (NOTE: THESE PARA-
            R3-THETA
                                                    METERS ARE JPDATED
                                                                                                                            #80
                                                    EVERY .5 SECOND).
                                                                                                               R31/SUNDANCE
```

++

+07 ++ R31/SUNDANCE

PANGE-CALCULATED PANGE TO CSM. IN MAUTICAL MILES TO NEAREST .OI VM. PANGE RATE-CALCULATED RANGE FATE BETWEEN LM AND CSM. NEGATIVE SIGN #90 INDICATES CLOSING. IN FPS TO MEAREST .1 FPS. THETA-ANGLE BETWEEN LM +Z AXIS AND THE LOCAL HORIZONTAL PLANE AT THE PRESENT . TIME REFERENCED TO THE DIRECTION OF #100 . FLIGHT. (SEE SECTION 5.6.7.1 OF R557 FOR DETAILED DESCRIPT-ION). IN DEGREES TO MEAREST .01 DEGREE #110 WALT FOR KEYBOARD #120 ENTRY TO TERMINATE THIS TERMINATE FLASH UPON DISPLAY, KEY IN PROCEED #130

R31/SUNDANCE

CHANGE CONTROL NOTES

PCN MIT - 65 PCN-MIT-129 LOGIC REV 07 LOGIC REV 08

APOLLO COMPUTER LOGIS CHECKLIST INTERFACE

		APOLLU	COMPOTER LUGIS CHECKLI	31 INTERFACE		· ·	
	TARGET DELTA V	ROUTINE (R32)		LOGIC REV 05	03/06/68		£
	*						,
PURPOSE:	(1) TO PROVIDE		ING THE LGC THAT THE C	SM HAS CHANGED ITS O	RBITAL PARAMETERS 8	Y THE EXECUTION	OF A
	(2) TO PROVIDE	E TO THE LGC THE DE	LTA V APPLIED TO THE C	SM TO ENABLE AN UPDA	TING OF THE CSM STA	TE VECTOR.	
ASSUMPTIONS:	DISPLAYED PRIOR	R TO TIG BY THE THR SPLAY THE RESULTS O	TO BE APPLIED TO THE C USTING PROGRAMS (P40 A F THE MANEUVER IN A FO TIS IS NOT AS ORIGINA	ND P41 IN THE CMC). RM USABLE BY THIS RD	NO PROVISION IS MAD NO PROVISION IS MAD NO PROVISION OF THE BURN	E IN THESE THRE	ISTING
+06	(2) IF THE RE	NDEZVOUS NAVIGATION E SELECTED PRIOR TO	PROGRAM (P20) OR THE THE CSM THRUSTING MAN	LUNAR SURFACE NAVIGA	TION PROGRAM (P22)	IS IN PROCESS	
++ +04 +04 ++			TATE VECTOR UPDATING B Y MANUAL V80E (JPDATE				
	(4) THE ROUTIN	E IS SELECTED BY TH	E ASTRONAUT BY DSKY EN	TRY.	* * *		
	*	*		***			\$
PROG CONT	L GC	GROUND	CREW		CHECKLIST	TIME	TOTAL TIME
			• CREW				u v
			• SELECTID	N		* *	
DI	TART TARGET ELTA V OUTINE (R32)	 	KEY IN V84E	×			#10
++	•				8 7 V		
+04 ++	•		•				
	• • • •						
		•					
	• •	•	• •	•			
		•		•			
		•		•			
	• •	•		•			

R32/SUNDANCE

	when were MATE and made anyou make insure mate were independent array areas come come about these states are anyou	•		
HOLD .	FLASH VERB-NOUN		MONITOR DSKY	. #20
.1620		•		
	TO REQUEST RESPONSE		OBSERVE VERB-NOUN	•
SNAP .	AND DISPLAY THREE		FLASH TO REQUEST	
	STORED COMPONENTS OF		RESPONSE AND DISPLAY	
		•		•
	DELTA V(OV).		OF THREE STORED	•
	V06N84	•	COMPONENTS OF DELTA	
	RI-DELTA VX(OV)		V APPLIED TO THE	
				· v
	R2-DELTA VY(OV)	•	OTHER VEHICLE (OV)	•
	R 3-DELTA VZ (DV)		ALONG LOCAL VERTICAL	•
		2	AXES AT TIG(DV).	
	DEL TA MY LOWA	•	AXES AT 110(30).	
	DELTA VX(OV)-	•		• #30 \
	COMPONENT OF DELTA V		•	•
	APPLIED TO THE OTHER			
				•
	VEHICLE AT TIG(DV)	•	•	•
	ALONG (RXV)XR. IN	5		•
	FPS TO NEAREST .1		WAIT UNTIL THE CSM	
		•		• ,
	FPS.	•	CREW HAS TRANSMITTED	•
			THE VALUES OF THE	•
	DELTA VY(OV)-		DELTA V TO BE AP-	
		•		• .
	COMPONENT OF DELTA V	•	PLIED AND THE TIME	•
	APPLIED TO THE OTHER	•	OF IGNITION AND	#40
	VEHICLE AT TIG(OV)		THE THRUSTING MAN-	
		•		•
	ALONG VXR. IN FPS TO	•	EUVER HAS BEEN	•
	NEAREST .1 FPS.		SUCCESSFULLY COM-	
			PLETED.	
	551 Ft 11710111	•	FELILIO.	•
	DELTA VZ (OV)-	•		•
	COMPONENT OF DELTA V			•
	APPLIED TO THE OTHER			
		•	•	• * ** ** ** ** ** ** ** ** ** ** ** **
	VEHICLE AT TIG(OV)	•	•	•
	ALONG -R. IN FPS TO			
	NEAREST .1 FPS.	-		· #50
	MEAKEST .1 FFS.	•		**DU
		•	•	•
	WHERE R IS GEOCEN-	2		
		•	•	•
	TRIC (EARTH ORBIT)	•	•	•
	OR SELENDCENTRIC	(c)	• "	•
	(LUNAR-ORBIT) RADIUS			• A Company of the Co
		•	•	· Note that the second
	VECTOR AND V IS THE	•	•	•
	CSM INERTIAL VEL-	•	•	
	DCITY VECTOR AT	_		
		•	•	
	TIG(OV).	•	•	•
		•	•	#50
		_		
	•	•	•	
SMI	•	•	•	
	•		•	•
4		_		
	HALF FOR VEYPOARD	•	ADE THE MANIES	
	WAIT FOR KEYBOARD	•	ARE THE VALUES	•
	ENTRY	•	DISPLAYED THE	•
		-	CORRECT DNES	
		•		•
		•	EXECUTED BY THE SSM?	•
			. Y	. #70
		•	• 1	***************************************
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		•	•	• R32/SUNDANCE
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339			: :		R32/SUNDANCE
			· · · · · · · · · · · · · · · · · · ·		*
			DCEED		2 2
•	TERMINATE FLASH UPON . PECEIPT OF PROCEED		KEY IN V25E . AND LDAD THE . CORRECT DELTA .		#30
	PROCEED .NEW .DATA		· · · · · · · · · · · · · · · · · · ·		
	STORE DATA			,	#90
			: :		#100
HOLD .	FLASH VERB-NDUN TO REQUEST RESPONSE AND DISPLAY STORED TIG(OV):		NITOR DSKY . DBSERVE VERB-NDUN . ASH TD REQUEST . SPONSE AND DISPLAY .		
*06 **	V06N33 R1-TIG(DV)-HRS R2-TIG(DV)-MINS R3-TIG(DV)-SECS		STORED TIS(DV).		#110
*	TIG(OV)-TIME OF IGNITION (GET) FOR DELTA V(OV). IN HRS, MINS, SEC TO NEAREST .01 SEC.				
		•			#120
	•	•			

R32/SUNDANCE

	•	•		•						
	•	•			•					
			IS THE						,	
	FOR KEY3UARD		DISPLAY		•					
FMTRY	•		CORRECT	TIME AT	•					
			WHICH T	HE CSM EXF	CU					
				MANEJVER						
			. Y		. N .					
		•	• '		• • •					#130
		•	•							7230
		•	•		• •			*		
		• •			• •					
			KFY IN	PROCEED	• •					
		• •			• •					
			•							
			•							
TERMI	NATE FLASH UPON									
	PT OF PROCEED		. <fy< td=""><td>IN V25E</td><td></td><td></td><td></td><td></td><td></td><td></td></fy<>	IN V25E						
	W DATA		AND	SHT DACL						
	, DAIA			REST TIGO	V 1					#140
0	NE G	• •		NEST 11313	V / 0 0					*140
• P	. NEW	•			•					
• R	. DATA	•	•	•	•					
.0		•		•	•					
• C	STORE DATA	•	•							
• E		•	•							
• E			•							
.0	•									
			•						4	#150
•			•							#130
•			•							
			•				(4.7)			
	O UPDATE FLAG		•							
	ASSUMPTION (4)		•							
ABOVE) .		•							
			•							
	2									
		-	•							#150
HDDAT	E CCM CTATE		•							#13U
	E CSM STATE		•							
	R TO REFLECT		•							
THE D	ELTA V ADDED.		•							
			•							
	•		•							
7E20	RR TRACKING		•	9						
	COUNTER		•							#170
MAKK			•							#IIU
			•							
	•		•							
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332/SUNDANCE

EXIT 832

CHANGE CONTROL NOTES LOGIC REV O6 PCN MIT - 65

FXIT 832

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APOLLO COMPUTER LOGIC CHECKLIST INTERFACE

	LGC	CMC CLCCK S	YNCHRENIZATION ROUTIN	(F33)	LCGIC	REV 08	01/17/69		
++			¥-						
+EDIT PURPOSE: ++	(1)	TO DETERMI	NE THE TIME CIFFERENT	TIAL BETWEEN THE	LGC CLOCK AN	D THE CMC CI	LOCK.		
	: (1)		ATION REQUIRES THE VA DINATED READING OF TH						
	(2)	THE LGC IS	CN. THE CMC MUST CNU	Y BE ON UNTIL SA	TISFACTORY C	OMPARATIVE	READINGS HAVE BEEN	MADE BY THE CREW	ŨВ
++ +08	(3)	CCRRECTION	CF THE LGC CLOCK MAY	BE MADE VIA V55	AFTER THE T	IME DIFFERE	NTIAL HAS BEEN DET	FRMINED.	
+EDIT	(4)	THIS ROUTI	NE IS SELECTED BY THE	ASTRONAUT BY DS	KY ENTRY.				
PROG		rec	GRCUND	CREW			CHECKLIST	TIME	TOTA
			* ,	•					
				DO I HAVE A PR VALUE FOR THE FERENCE BETWEF CMC AND LGC CL SUPPLIFD FRCM	DIF- N THE OCKS	,			
				GRCUND?					#10
				• N	• Y				
				•	•				
++ +08 +513				•	•				
+ED IT	AIT 500			VEV IN VOCALE	•				#20
	NTRY	R KEYBCARD		KEY IN VOENES	•				
+				•	•				
+				•	•				
+				•	•				
+				•	•			P33/SUNDANCE	

		CONFIRM SELE-					
		CTICN OF THIS	•				
			•				#30
		ROUTINE (R33)	•				帯のび
		IN THE CTHER	•				
		VEHICLE.	•				
			•				
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		• • • •	•				
	•		•				
	•		•				#40
	•	PERFORM COUNT-	•				
	•		•				
	•	DOWN WITH CREW	•				
	•	MEMBER IN	•				
	•	OTHER VEHICLE	•				
	•	TO INSURE	•				
		SIMULTANECUS			*		
	•	DEPRESSION OF					
	•		•				
	•	BCTH ENTER	•				***
	•	KEYS.	•				#50
	•		•				
	•	•	•				
		-					
CONTINUE UPON			•				
	•	MEN IN ENTER	•				
RECEIPT OF ENTER		KEY IN ENTER	•				
	• •		•				
		•	•				
			•				
_		_					#60
		•					
DECEDE CONTENTS OF	•	•	•				
RECCRC CONTENTS OF	•	•	•				
LGC CLCCK AT TIME	•	•	•				
OF ENTER	•	•	•				
		_					
• .	•	•	•				
	•	•	•				
•	•	•	•				
			•				
DISPLAY LGC CLOCK		MONITOR DSKY:	•				#70
TIME ON DSKY:		OBSERVE DIS-	• .	*			
V06 N65		PLAY OF LGC					
R1-FRS		CLOCK AT TIME					
R2-MINS	•	OF ENTER.	•				
	•	OF ENIER	•				
R3-SECS	•		•				
	•	•	•				
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	•	•	•		833	/SUNPANCE	
	•	•	•				
	•		•				

R33/SUNDANCE

#80

#90

#100

#110

#120

R33/SUNDANCF

#140

DC I WISH TO MAKE THIS CORRECTION TO THE LGC CLOCK?

EXIT

CHANGE CENTREL NOTES

PCN - 513.2, EDITORIAL CCRRECTICNS

REV C8

196 (346)

APOLLO COMPUTER LOGIC CHECKLIST INTERFACE

*REMDEZVOUS DUT-DE-PLANE DISPLAY ROJTINE (R36) LOGIC * REV 07 05/23/68

PURPOSE:

(1) TO DISPLAY AT ASTRONAUT REQUEST LGC CALCULATED RENDEZVOUS OUT-JF-PLANE PARAMETERS (Y, Y DOT, PSI)

ASSUMPTIONS: (1) THESE PARAMETERS ARE CALCULATED BY THE LGS ON THE BASIS OF THE STORED LM AND CSM STATE VECTORS AND DO NOT REQUIRE THAT THE ISS BE ON.

(2) THE ROUTINE IS SELECTED BY THE ASTRONAUT BY OSKY ENTRY.

PROG CONT	CMC	GROUND	CREW	CHECKLIST	TIME	TOTAL
	START RENDEZVOUS OUT-OF-PLANE ROUTINE		.CREW .ROUTINE .SELECTION			
	(R36)					#10
	SET T(EVENT) TO ZERO		: : :			
: :	:					#20
		······································	MONITOR DSKY: OBSERVE VERB NOUN FLASH TO REQUEST RESPONSE AND DISPLAY OF TIME AT WHICH OUT-DF-PLANE PARA- METERS ARE DESIRED.			#30
					?36/SUNJANZE	

•	T(EVENT): TIME (G.E.T.) FOR WHICH OUT-OF-PLANE PARA- METERS ARE DESIPED. IN HRS, MINS AND SECS TO NEAREST .01 SECONDS. A SPECIAL CASE IS ALL ZEROFS INDICA- TING PRESENT TIME		PARAMETERS FOR THE PRESENT TIME? .Y N.	£40
•	•		ARE ALL THREF REGISTERS ZERO?	.50
•	•		AM I SAT	
۰	•		· ISFIFO ·	
۰			WITH THE DISPLAYED .	60
•			. TIME?	
	•			
۰	•		v . y .	
	•			
	WAIT FOR KEY30ARD ENTRY:	•		70
٠				
	TERMINATE FLASH UPON RECEIPT OF PROCEED OR NEW DATA.		KEY IN PROCEED	180
	.NEW .P .DATA .R .0			
	DATA .E		• •	
				100
,			R36/SUNDANCE	190
			•	
			•	
•				

HOLD .

SNAP .

```
IS T(EVENT) ZERO?
                                                                                                                    #100
   . EXTRAPOLATE LM
   . AND CSM STATE
   . VECTORS TO THE
   . PRESENT TIME
   . USING PRECISION
   . INTEGRATION.
                                                                                                                   #110
EXTRAPOLATE LM
AND CSM STATE
VECTORS TO THE
TIME DEFINED BY .
T(EVENT) USING
PRECISION INTE-
GRATION.
                                                                                                                   #120
CALCULATE DUT-7F-
PLANE PARAMETERS:
     Y DOT
    PSI
                                                                                                                   #130
FLASH VERB NOUN TO
                                          MONITOR DSKY:
REQUEST RESPONSE AND ....
                                            OBSERVE VERB NOUN
DISPLAY RENDEZVOUS
                                          FLASH TO REQUEST
DUT-OF-PLANE PARA-
                                          RESPONSE AND DISPLAY
METERS:
                                          OF RENDEZVOUS OUT-OF
   V06N90
                                          -PLANE PARAMETERS
   21-Y
   R2-Y DOT
                                                                                                                 #140
   R3-PSI
```

R36/SUNDANCE

	•		•	•			A contract to the second	
	•		•	•				
	•			•				
	•							
	. (NOTE: FOR DEF-							
	. INITIONS REFER TO		DO I WISH TO	RECEIVE .				
	• SECTION 5.6.7.3		ANOTHER DATA					
	OF R557).		FOR A DIFFER	ENI .				
	•		TIME?					
++	 Y-IN NAUTICAL 							
+07	 MILES TO VEAREST 		. N	٧ .				
+07	01 NM.							#150
	• • (17 1/2.1 •			•	-			#170
++	•			•				
	. Y DOT-IN =PS TO			•				
	. TO NEAREST .1 FPS			•				
	•							
	 PSI-IN DEGREES 		- 1					*
	• TO NEAREST •01			· ·				
				•				
	. DEGREE.		• •	. •				
		*			**			
								#150
	•			•				,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,
	•			•				
				. •				(4)
	. WAIT FOR KEYBOARD	•						
	. FNTRY:		KEY IN	RECYCLE .				4.
		•	 V32F 				V V	
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	•							
	and the second s							#170
	<u> </u>							,,
	•		•			**		
	***************************************		•					
	. TERMINATE FLASH UPON							
	. RECEIPT OF PROCEED		KEY IN PROCE	ED				
	OR RECYCLE	•						
								3
	R .P							
			•				*	
	• • E • P		•					
	C .J		•					
	Y .C		•					#180
	C .F							
	L .E		•					
	. E .D		EXIT			p.		-
	• • • • • • • • • • • • • • • • • • • •							
			₹35					
	. EXIT							
	. R36						- * *	
	• 1000							
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								#190
			i k					

CHANGE CONTROL NOTES

LOGIC REV 07 PCN-MII-94.

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APULLO COMPUTER LOGIS CHECKLIST INTERFACE

	AGS INITIALIZATIO	" POUTINE (R47)		LOGIC : REV 13	05/23/68		
PURPOSE:			ONICS ASSEMBLY (AEA) E LGC DIGITAL DJWNLIV		STATE VECTORS (P	OSITION, VELOCIT	Y, TIME)
			SIMBAL ANGLE COUNTERS). ANGLES WHICH DEFINE				REFERENCE
	(3) TO ESTABLISH	THE GROUND ELAPSED	TIME OF AEA CLOCK ZE	PO IF THE AFA CLOCK	IS ZEROED DURING	THIS ROUTINE.	
ASSUMPTIONS:	(1) THE LGC DOWN	LINK DATA FORMAT AN	O SCALING ARE DEFINED	IN SECTION 2 OF 35	57.		e 9
			PROGRAM (V37EE DTH ABILITY REQUIRES COMP			the second of the second of the second	TINE.
* *			ASTRUNAUT BY DSKY EN Y BE CALLED AT AVY TI				ВҮ
++ +13	(4) ZERDING OF TOUT P20).	HE ICDU, LGC, AND A	EA GIMBAL ANGLE COUNT	FRS OCCURS ONLY WHE	TOP SI UMI SHT M	BEING USED (POO,	P3X AITH-
+13	(5) THE DAP IS T	URNED DEE PURING CO	J ZFRO.				
		011011110	and the second of				
PP OG CUNT	f ec	ekunab	CRE∦		CHECKLIST	TIME	TOTAL TIME
	r ec	(KIII)AI)	CRE#		CHECKLIST	TIME	
	ŕ ec	e (Prinyl)	CREW CREW PPOGRAM SELECTION		CHECKLIST	TIME	
	r ec	e (SKIIIAI)	•CRF# •PPCGRAM		CHECKLIST	TIME	
	ŕ ec	(SKIII)AII)	•CRF# •PPCGRAM		CHECKLIST	TIME.	
CUMT	ART AGS INITIALI-	(SKIII)AI)	•CRF# •PPCGRAM	-	CHECKLIST	TIME	
CUMT		· ·	.CRFW .PFOGRAM .SFLFCTION	_	CHECKLIST	TIME	TIME
CUMT	ART AGS INITIALI-	· ·	.CRFW .PFOGRAM .SFLFCTION	_	CHECKLIST	TIME	TIME
CUMT	ART AGS INITIALI-	(PKIII)AI)	.CRFW .PFOGRAM .SFLFCTION	-	CHECKLIST	TIME	TIME
CUNT STA 2A1	ART AGS INITIALI-	GRIHAD	CREW PPOGRAM SELECTION KEY IN V47E	-	CHECKLIST	TIME	TIME
CUNT \$17 2 A1 ++ +13 + +13	ART AGS INITIALI-	GRIIIAI)	CREW PPOGRAM SELECTION KEY IN V47E	-	CHECKLIST	TIME	#10
CUNT STA ZAI	ART AGS INITIALI-	GRUIND	CREW PPOGRAM SELECTION KEY IN V47E	-	CHECKLIST	TIME	TIME

347/SUNDANCE

										•					4						
FLAG S	REFSMAT																	6			
. Y		N																			
•										•											#30
	•												-								#30
. ALA . CHA	RN ON PROGRAM ARM BUT DO NO ANGE CURRENT SPLAY (PROGRA ARM IF CALLED	M				• • • • •	• •	LIGH THE ALIG	IMU SNED	SICN	ALA MI		_	*							. (
. WIL	L BE							. Y				N.									
	/ 05 N09 R1-00220				4			•				•									
	R2-XXXXX																				#40
	R3-XXXXX										E MAY										
. TH	TE: WHEN CALL IS DISPLAY WI SPEND THE								D I	AN	DRMEC - LA										*
. CUF	RRENT DISPLAY									•											
	TURN ON THE											•									
										•											
•	•								E	XIT	247	•									#50
	•											•									
	EXIT R47											٠									
•												•									
			•																		#60
	RECORD G.E.T. DE ENTER KEY																				
. [DEPRESSION AN	ID	•									•									
•	STORE AS K.																				
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++ +13

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355	+	: ::		:: : :	:		
	+				•	3/	47/SUNDANCE
	+				•		×
	+		• •		•		
	HOLD .			:			
		• FLASH VFF3-V7HV TO		. YOULTOR PSKY:			
	SNAP .	FEQUEST PESSONSH AND			•		
	+	CISPLAY STORED G.F.T. UF AEA CLOCK		. FLASH TO REQUEST . RESPONSE AND DISPLAY	•		
	+	7530 (K):		. OF G.E.T. OF AFA			
	+	V06 N16		. CLOCK ZERO (<).			
(a)	+	PI-K-HRS			•		#80
	+	R2-K-MIN R3-K-SEC	• •		•	*	#80
	+			•	•		
	+	K- G.F.T. OF AFA			•		ų V
	+ +	CLOCK ZERO IN HPS., MIN., SEC. TO NEAR- FST .01 SEC.		. DO I WISH TO PERFORM . AEA CLOCK ZERD?	•		
	+	F 51 • 01 SEC •		Y	•		*
	+	•					
-	+	•			•		
	+	WAIT FOR KEY30ARD	• •		•		#90
	+	FNTRY	• •				
	+				•		
	+		• • •		•		
	+			. KEY IN V32	•		
	+13						
	++				•		
			• •		•		#120
			• •	. KEY IN ENTR .			#100
			**************	. SIMULTANEDUSLY .	•		
			• • •	. ON DSKY AND DEDA .	•		
			• •		•		
					•		
				• • • •	•		
			• **•	•	•		#110
			: :		•		#119
				DO I HAVE A MCPE	•		
			• •		•		
				TRANSMITTED FROM	•		
				ISON OF AFA AND LCC			
*				- DOWNLINK DATA FOL-	•		
				LOWING THE LAST AFA	•		
			• •		•		#120
				V	•		#120
			• •	•	•		
			: :	•	•		
			• •		30. 100		
					•		
						2.0	47/SUNDANCE

IS THE DISPLAYED .. VALUE OF K THE CORRECT G.E.T. OF LAST AEA #130 CLOCK ZFRO? .Y .N . REFER TO K RE- . . CORDED DURING . . LAST EXECUTION . . JF R47 #140 . REFER TO K . OBTAINED FROM . GROUND #150 KEY IN V25E AND . LOAD NEW VALJE OF. K. #150 RECORD K TERMINATE FLASH UPON RECEIPT OF PROCEED, KEY IN PROCEED #170 . NEW . DATA VEW DATA . . R47/SUNDANCE

++ +13

V32 OR NEW DATA

. 3

. 2

. E

. P

· R

.0

. C

. E

R47/SUNDANCE

#180

#190

#200

#210

#220

#230

R47/SUNDANCE

PLACE EACH COMPONENT
(OR COMPONENT/4)
OF CSM AND LM POSITION AND VELOCITY
AND CSM AND LM STATE
VECTOR TIMES (EACH
REDUCED BY K) ON THE
AGS INITIALIZATION
DOWNLINK LIST.
TRANSMIT THIS LIST
TEN TIMES. FORMAT
FOR STATE VECTORS IS
TWOS COMPLEMENT,
ROUNDED OFF. (SEE
SECTION 2 OF R557.)

IS IMU PRESENTLY BEING USED BY ANY LGC PROGRAM?

ZERO ICDU COJNTERS (IN LGC)
AND TRANSMIT CDU
ZERO DISCRETES
TO THE AEA AND
THE ICDUS. HOLD
DISCRETES FOR
.32 SEC. (NOTE:
DURING CDU ZERO
THE DAP IS TURNED OFF.)

WAIT APPROXIMATE- . LY 12 SECONDS TO . ACCUMULATE TOTAL . GIMBAL ANGLES . #240

#250

#260

#270

#280

R47/SUNDANCE

358

++ +13

+13

++

+13

+13

++

9				20 20 E
++ +13	: :			•
+ · · · · · · · · · · · · · · · · · · ·	FLASH V50N16 TO RE- QUEST RESPONSE AND TO INDICATE COMPLE- TION OF DOWN LINK TRANSMISSIONS	•	FLASH TO RESPONSE TION OF	E VERB-NOUN
+ + +	:		MISSIONS	•
+ + + +	:			• H TO CONTIN- TERRUPTED
+ + +	WAIT FOR KEYBOARD ENTRY		Y .	٧.
+ + + + + + + + + + + + + + + + + + + +	TERMINATE FLASH UPON		KEY IN PROCEED	•
+ + + +	OR TERMINATE .P .T .R .E		•	KEY IN TER-
+ + +	.0 .9 .C .9 .E .1 .E .N		EXIT R47	**************************************
+ + +	.D .A .T .E			•
+ + +13 ++	• • • • • • • • • • • • • • • • • • •			FXIT R47

CHANGE CONTROL NOTES

LOGIC REV 13 PON-MIT-85, PON MIT - 102

R47/SUNDANCE

#290

#300

#310

#320

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APOLLO COMPUTER LOGIC CHECKLIST INTERFACE

PS- A		

LOGIC REV 05 03/07/68

PURPOSE:

(1) TO CHAPSE ALIGN THE IMU TO A DESIPED INERTIAL DRIENTATION.

- ASSUMPTIONS: (1) THE DESIRED INDITINENTIAL DRIENTATION HAS BEEN SPECIFIED BY THE CALLING PROGRAM.
 - (2) THE ROUTINE IS AUTOMATICALLY SELECTED BY THE IMU REALIGN PROGRAM (P52).

PPOG CCNT	L GC	GROUND -	CREW	CHECKLIST	TIME	TOTAL TIME
·	.F3C .SELECTION					
	START COARSE ALIGN FOUTINE (R50)					#10
	:					*10
	PFAD PRESENT IMU - ORIENTATION W.R.T. THE VEHICLE. (GIMBAL ANGLES)					
						#20
,	SELECT PRESENT IMU INERTIAL ORIENTATION FROM STORAGE					
	:					*30
	CALCULATE THE IMERTIAL DESENTATION OF THE VEHICLE					
	•				(R)	

R50/SUNDANCE

	•					
	SELECT DESIRED IMU					#40
	INERTIAL ORIENTATION					#40
	FROM STORAGE (PRO-					
	VIDED BY CALLING					
	PROGRAM).					
	•					
	•		*			
	•					
	CALCULATE REQUIRED					#50
	FINAL GIMBAL ANGLES		-			
	TO GIVE DESIRED IMU					
	INERTIAL ORIENTATION					
	•.					
	•					
. ++						
+06	IS ANY REQUIRED GIM-					
+	BAL ANGLE CHANGE					#60
+	GREATER THAN 1	(4)				
+	DEGRFE?					
+						
+	. Y . N.					
+						
+06	• EXIT					1 1
++	• R50					
	•					#70
	•					
	SWITCH ISS TO COARSE	_	OBSERVE NO ATT LIGHT			
	ALIGN MODE. TERMINATE		TO INDICATE THAT IMU			
	ATTITUDE HOLD DE		IS IN COARSE ALIGN			
	VEHICLE		MODF.			
	•		•			
			•			#80
			:			#50
	COARSE ALIGN THE IMU		•			
					90	
	•		•			
	•		•			
	•		•			
	TERMINATE COARSE		DBSERVE TERMINATION			
	ALIGN MODE IN ISS.		OF NO ATT LIGHT TO			
	RESUME ATTITUDE HOLD		INDICATE THAT IMU IS			#90
(8)	OF VEHICLE		NOW INERTIAL.	Opt		
				-#O		
30	•		•		R50/SUNDANCE	
	•		•		120, JUNDANGE	
	•					
362	•		•			
100						

250/SUNDANCE

CHAVGE CONTROL WITES LOGIC REV OF PON MIT - 65

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36/2

APOLLO COMPUTER LOGIC CHECKLIST INTERFACE

INFLIGHT FINE ALIGN FOUTINE (R51)

LOGIC REV 09 11/21/67 CHECKLIST REV 06 01/19/68

PURPOSE:

(1) 10 DETAIN THE NECESSARY STAR, PLANET OR SUN SIGHTINGS AND THEN TO FINE ALIGN THE IMU TO A DESIRED INERTIAL DRIENTATION WHILE THE LM IS IN FLIGHT.

ASSUMPTIONS: (1) THE DESIRED IMU INERTIAL ORIENTATION HAS BEEN SPECIFIED BY THE CALLING PROGRAM.

(2) THE ROUTINE IS NORMALLY AUTOMATICALLY SELECTED BY THE IMU REALIGN PROGRAM (P52), AND THE BRAKING PHASE PROGRAM (P63).

PROG LGC GROUND CREW CHECKLIST TIME TOTAL CONT

.LGC ROUTING · SELFCTION . . . START INFLIGHT FINE ALIGN ROUTINE (R51) FLASH VERB-NOUN TO : YXXC SCTIVON REQUEST PLEASE PER-DBSERVE VERE-NOUN FRUM CELESTIAL BODY FLASH TO REQUEST ACQUISITION: PLEASE PERFORM CELESTIAL BODY AC-V50 N25 R1-00015 VCITIZIUO R2-BLANK R3-BLANK

#10

#20

R51/SUNDANCE

DO I WISH LGC ASSIS-TANCE IN SELECTING 2 STARS SUITABLE FOR ALIGNMENT? NOTE: IF ANY LOS OTHER THAN THE ACT CENTER DETENT IS TO BE USED THE STAR SELECTION POUTINE MAY POSSIBLY BE JSED BY THE CREW TO ASSIST IN SPATIAL ORIENTATION OF THE VEHICLE ATTITUDE. HOWEVER IT MUST BE REMEMBERED THAT THE ROUTINE ONLY CONSID-ERS STARS WITHIN THE AOT CENTER DETENT FIFLD OF VIEW. ALLOWANCE MUST BE MADE BY THE CREW FOR ANY DIFFERENT DETENT OF THE ADT OR THE BACKUP OPTICAL SYSTEM. IF JSF OF THIS ROUTINE IS CON-SIDERED IMPRACTICAL IT MAY BE EASILY BY-PASSED (SEE BELOW)). .N WAIT FOR KEYBOARD MANEUVER VEHICLE UNTIL 2 SUITABLE STARS MAY BE AC-SCTINCE CERIUS FDAT BALL TO AVOID GIMBAL LOCK. (NOTE: ASTRONAUT MAY

CHOICE J? MAY

#50 #60

#30

#40

#70

#80

USE OPTIOS TO ASSIST ATTITIDE

R51/SUNDANCE

366

FNTRY

06#

001#

#130

	1	r		• 1	C	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		• •				•			•	•			• •	 	•		•	9 6							V V V V	SPLAY	MI IVII		anne L	 ٠, ١. ا			
	. ,					:	•	•	ERMINATE	ECEIPT OF FV	PAUCEED		• •	•	•	L.	•	•		 STAP SELEC	F F F R S	TION 5.6.4 0	. ()	CML.	STARS .	AVAII . NOT	•		 	A VERA	-	_	0:	4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4		 * * * * * * * * * * * * * * * * * * *	× 1		

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	•	•						
SHALL I BY-	•	•						
PASS STAR		•						#140
SELECTION								
ROUTINE, SE-								
LECT MY DWN		•						
CELESTIAL	•	•						
	•	•						
BODIES, AND	•	•					2	
MANUALLY AC-	•	•						
QUIRE THEM?	•	•						4_
	•	•						
.N Y.	•	•						
	•	•						#150
		•						
	•	•						
. MANEUVER								
· VEHICLE								
. UNTIL A		_						
. SUITABLE		•						
. CELESTIAL		•						· ·
	•	•						
. BODY IS	•	•						
. ACQJIRED	•	•						
	•	•						#160
	•	•						
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	•				×			
		•						
KEY IN .		•						
RECYCLE .								
V32E .				: 61				
								8
	•	•						#170
	•	•						W110
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	•	•						
KEY IN	•	•						
PROCEED	•	•						
	•	•						#180
		•						
			•					9.11
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•	•	•						
•	•	•						#190
	•	•						*:
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	•	•				351/SU	NDANCE	
	•							

WAIT FOR KEY-BOARD ENTRY

. TERMINATE

. P

.R .D .C .E

. D

• FLASH JPON RE-• CFIPT OF PRO-• CEED OR PE-• CYCLE

> .C .C .L

251	/SUNDAN	CC
371	/ SUNUAN	IL. E

#200

#210

#220

#230

#240

R51/SUNDANCE

	•		
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	14		
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	•	•	
		18	
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	•	•	
. SELECT STAR #1 .		•	
	•	•	• • •
. FOR USE BY .	•	•	
. AUTO OPTICS .	•	•	
. (LM) POSITIO	•		
. NING POUTINE .		_	
· (P52)	•		
• 15021	•	•	
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DO AUTO OPTICS (LM)	*		DO AUTO DETICS (LM)
	• •		
POSTITIONING ROUTINE			POSITIONING ROUTINE
(R52) FOR CELESTIAL	• •		(R52) FOR CELESTIAL
BODY #1			30DY #1
		-	
	•	•	
•	•	•	•
•	•	•	•
		•	•
DO INFLIGHT SIGHTING	-	•	DO INFLIGHT SIGHTING
	• •	• •	
MARK ROUTINE (353)			MARK ROUTINE (R53)
FOR CELESTIAL BODY			FOR CELESTIAL BODY
# 1			#1
	_		
	•	•	
•	•	•	•
•	•	•	•
	•	•	•
	•		
SELECT STAR #2 FOR			-
	•	•	•
(MA) SOLTEC DIUM	•	•	•
POSITIONING ROUTINE	•	•	•
(R52) IF STAR SELFC-			•
TION DOUTTHE HAS			

TION ROUTINE HAS

	DO AUTO OPTICS (LM) POSITIONING ROUTINE (R52) FOR CELESTIAL BODY #2	:. ::	DO AUTO OPTICS (LM) POSITIONING ROUTINE (R52) FOR CELESTIAL BODY #2		
		•			# N S S
	:	:	•		
				x	#250
	DO INFLIGHT SIGHTING MARK ROUTINE (253) FOR CELESTIAL BODY #2		DO INFLIGHT SIGHTING MARK ROJTINE (353) FOR CELESTIAL BODY #2		
			•		
					9.230
	•		•		
	•	•	•		#260
		1. 1.			
++ +0° ++	DO SIGHTING DATA MINISTRUCTION OF THE CONTROL OF TH		DO SIGHTING DATA DISPLAY ROUTINE (R54)		
	•E •E	: :	•E F •		
	. X		. X . X .		6434
	• I		• I .		
	•T		•T •		#270
	иви иди	. • •			
	· uBu		пДп изи.		
	• • • • • • • • • • • • • • • • • • • •	1.4			
		• • • • • • • • • • • • • • • • • • • •			
	. DO GYRO TORQUING . ROUTINE (355)	**************	DO GYRO TORQUING . ROUTINE (R55) .		% of f
	. KOUTTHE (KSS)	•	KUUTINE (355) .		#280
					#200
		•	•		
		•	<u> </u>		
	FLASH VERB-NOUN TO	1 1.	MONITOR DSKY:		
	REQUEST PLEASE		DBSERVE VERB-NOUN		
HOLD .	PERFORM FINE ALIGN:		FLASH TO REQUEST		# 3 1 位
	V50 N25	•	PLEASE PERFORM FINE		
	R1-00014 R2-BLANK	•	ALIGN		#290
	R3-BLANK				
*					e e
	•				
			•	,	
*	•	•	•		R51/SUNDANCE
	•		•		NOT / SUNDANCE
	800	100 PT	(F)		

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•	•				
	•				R51/SUNDANCE
	•				
•	•				*
•	•	•			
•	•			× "	
•	•	. DO I WANT			
.•1	•	• ALIGNMENT			
•	•	 CHECK THE ALIGNMENT? 			#200
•	•	· ALIGNMENT?			#300
•	•		N.		
1			14.		
	• •				
WAIT FOR KEYBOARD .		KEY IV	ENTER		
ENTRY	• •				
*					
	•		•		#310
TERMINATE FLASH UPON	• •			*	
RECEIPT OF ENTER .		KEY IN PRO	CEED .	*	
OR PROCEED	• •	•			
	•	•			
.E .P	•	•	•		
.N .R .T .O	•	•	•		
.E .C	•	•	•		
.R .E	•				
E		•	•		#320
D					#320
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•					
•			•		
• • •					
•			•		#330
FXIT R51			EXIT P51		

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APOLLO COMPUTER LOGIS CHECKLIST INTERFACE

AUTOMATIC	PPTICS(LM)	POSITIONING	ROUTINE (R52)
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LOGIC REV 13 02/12/68

PURPOSE:

(1) TO POINT THE LOS OF ANY ADT DETENT OR THE LOS OF A BACKUP OPTICAL SYSTEM AT A SPECIFIED CELESTIAL BODY BY. MANEUVERING THE LM.

ASSUMPTION: (1) THE ROUTINE IS AUTOMATICALLY SELECTED BY THE INFLIGHT FINE ALIGN ROUTINE (R51).

						9
PROG CONT	r ec	GROUND	CREW	CHECKLIS	T TIME	TOTAL TIME
	.LGC .RDUTINE .SELECTION			*		2
	START AUTO OPTICS(LM) POSITIONING ROUTINE(R52)					#10
	:					
HOLD .	FLASH VERB-NOUN TO REQUEST RESPONSE AND DISPLAY AOT DETENT AND STAR CODE: V91N70	:	MONITOR DSKY: OBSERVE FLASHING VERB-NOUN TO REQUEST RESPONSE AND DISPLAY OF ADT DETENT AND STAR CODE.			#20
	P1-ABC DE R2-BLANK F3-BLANK P1 IS AOT DETENT CODE AND STAR CODE: A, B-BLANK C-AOT DETENT				* *	#30
	D, E-STAR CODE WHERE:	:			₹52/SUNDANCE	

ACT DETENT THE ACT	•	•	•	9		
ACT DETENT- THE ACT DETENT POSITION USED	•	•	•			
FOR SIGHTING; 1			•			
(LEFT), 2 (CENTER),	. ARE	THE ADT DETENT				#40
3 (RIGHT), OR 4 (ANY	. AND	STAR CODE	•			
OF THE THREE REAR		PLAYS CORRECT FOR	•			
DETENTS); 5 IF A		DESIRED SIGHT-	•			
BACKUP OPTICAL SYS- STEM IS USED.	· ING	5?	•			
31Em 13 0310.		Y .N	•			
STAR CODE-THE			•			
DESIGNATION OF THE		•	•			
CELESTIAL RODY TO BE			•			#50
USED. ALL DESIGNA- TIONS IN DCTAL.		•	•			#50
110.03 10 30142.		•	•			
00-PLANET			•	#	W.	
		•	•			
01/45-STAR (FROM		•	•			2200
STAR CODE LIST)		•	•			
46-SUN	•	•	•			
			•		(4)	
47-EARTH			•			#50
		•	•			
50-MOON	•	•	•			
		•	•			
•		•	•			
			•			
WAIT FOR KEYBOARD .	KEY	IN PROCEED .	•			
ENTRI						#70
		•	•			
		•	•			
		VEV 14 4215	•			
	••	KEY IN V21E	• *			
TERMINATE FLASH UPON		STAR AND DETENT	•			
PROCEED OR NEW DATA		CODES IN R1.	•			
			•			
.PROCEED .NEW		•	•			#00
· DATA		•	•			#80
			•			
			•			
. STORE DATA						
	• .					
•						
		*				
			*			#90
•					352 ICHMDANCC	
•	•				R52/SUNDANCE	
•						
	100					

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+	-	•										
+												
4				Table 1	_				v v			
	_											
		CACT	DETENT 22224		* C	THE 3	3 F C F N T					
*			DETENT 22004				RESENT					
+	· L	R 0000	2.3				N USE D	NE DE				
+	-				THE	THRE	E REAR					*
+	<u> </u>	. V	. Y		DET	ENTS?						
+	-	2										
		•	•			V		٧.				
		•	•		•	Y		4 .				****
+		•	•					•				#100
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+		-					CAL SYS					
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7		•	•		•	•		•				****
+		•		• •		•						#110
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	DSS	•	• •	•	•	•	•					
												(8)
1	HOLD .		H VER3-YOUN				DSKY:					
		. TO R	EQUEST RESPO-		0	BSERV	E VERB-					
5	NAP .	. NSE	AND DISPLAY		NOU	N FLA	SH TO					
4		PRES	ENT ADT DET-				RESPON-					
			OR BACKUP	•			ISPLAY					
*				•								
+			CAL SYSTEM	•			NT ADT					#120
+	+	· LUS	DEFINITION:	•	DET	ENT D	R BACK-					
+	4	. V06	N 87		UP	OPTIC	AL SYS-					
4			OPT AZ				DEFINI-					
			OPT EL	•	TIO		251141					
7				•	110							
+		• F3-	BLANK	•								
+	+			•			•				v	
+	+	. OPT	AZ-THE									
4			IUTH OF THE				-					
			ENT DETENT	•			•					
7	n			•			•					
+	•		IPTICAL SYS-	•								#130
4	+	. STFM	IN USE. THE	•	ARE	THE	CALI-					
+	+	. ANGL	E IN THE LM		BRA	TIONS	PRES-					
4	-	. Y/7	PLANE MEAS-		ENT	IY DI	SPLAYED					
			FROM THE LY			RECT?						
,				•	CUIN	KLU1:						
7			XIS TO THE	•								
4	r .		IECTION OF THE	•		Y	1 .					*
4	+	LOS	ON THE Y/Z		•			0 0	*			
. 4	F	. PLAN	IE . POLARITY									
,	L		FOR NEGATIVE									*
				•	•		•					****
1			TION ABOUT	•	•		•					#140
4	+		LM +X AXIS.	•	•		•					
4	F	. IN D	EGREES TO	•								
- 4	F	. NEAR	REST .D1	•								
		. DEGR		-			-					
		- INLUM	m 1 *		•		•					
1	r	•		•	•							
- 1	•	•		•			•					
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4	-											

		•		· NJZ/JONDANGE
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	OPT FL-THE ELF-	•		•
	VATION OF THE LOS			
	OF THE PRESENT			
	DETENT OR OPTICAL			
		•		*150
	SYSTEM IN USE.	•		*150
	THE ANGLE FROM	•		•
	THE LOS TO LM Y/Z	•		•
	PLANE. POLARITY	•		•
•	IS + FOR A LOS	•		•
	IN THE SAME HEMI-	•		•
	SPHERE AS THE LM			
	+X AXIS. IN DE-			
	GREE TO NEAREST			
•	.01 DFGREE.		• • •	•
•	·UI DEGREE.	•		*
•		•		*160
•	•	•		· ·
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		•		•
	WAIT FOR KEYBOARD	KF	Y IN	
-	ENTRY		DCEED	
•	LIVENT	• •	30000	•
•				•
•		•		•
•		•		•
•		•		#170
				•
	TERMINATE FLASH			
	UPON RECEIPT OF		. KEY IN V24E .	
-	PROCEED OR NEW			· ·
•				
	DATA			
		•	. CALIBRA	•
•	•P	•	. TIDNS .	•
	•R •	•		•
	•0	•		•
	.C NEW DATA			#180
	.F			
•	•: •E	•		•
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	.D	•	• • •	•
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1 0	STAR CODE 00?			#190
1.5	STAR COME OUT	T C	THE TARGET A	F170
			THE TARGET A	
. N	. Y	PL	AVET?	
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			. Y	• N
			•	•
TS	THE STAR CODE .			
46	,47 DR 50? .	×	_	
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			9	*200
	• •		•	R52/SUNDANCE
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POSITION

VECTOR OF THE

R52/SUNDANCE

#210

#220

#230

#240

#250

• •		•	•	•	
		•	•	•	
	PLANET AT GET.	• VECTOR COM-	•	• .	
	IN REFERENCE	. PONENTS COR-		•	
	COORDINATES. TO	. RECT?			
• •	THE FIFTH PLACE			•	
		•		•	
	(.XXXXX).	Y .!	V .	•	*24.0
	V 100		•	•	#260
	Y PL - SAME		•	•	
	AS X FOR Y			•	
	COMPONENT.				
			-	.51	
• •	Z PL - SAME			•	
			•	•	
	AS X FOR Z		•	•	
	COMPONENT.				
				-	
				•	#270
	•		•	•	#2:0
	•			•	
		••	•	•	
	WAIT FOR KEY-	KEY IN .	•	•	
	BOARD ENTRY	PROCEED			
				-	
			•	•	
			•	•	
• •			•	•	
			•	•	
	TERMINATE FLASH				
	UPON RESEIPT OF	KEY IV			#280
	PROCEED OR NEW	V25E		-	#255
• •				•	
• •	DATA.	. AND LOAD	•	•	
		• CORRECT	•	•	
	.P .NEW	. POSITION			
	.R .DATA	. VECTOR			
	5)	. COMPO-	-	-	
			•	•	
• •	. C	. NENTS.	•	•	
	.E LOAD DATA		- •	•	
	·E		•	•	
	.D .				#290
				_	
	•			-	
		• •		•	
	•	•		•	
	•	•		•	
		•		•	
DFF	INF THE SPECIFIED				
	WITH RESPECT TO				
		•		•	
	LM TO BE ALONG	0		•	
	LOS TO THE CELE-			•	
STI	AL BODY SELECTED	•		•	#300
FOR	USE BY THE ATTI-				
	E MANEUVER ROU-	•			
	E (R60). THE			(.5)	
		•		•	
	AL VEHICLE ATTI-	0		•	
	E WILL BE COM-			•	
PUT	FD DURING	•		•	
R60	(VECPOINT).	Ð			
	OPDER TO SONSERVE				·
		-		-	
		•		•	352 (6)1904.955
		•		•	R52/SUNDANCE
		•		•	

79+			•	•			
// ;			•	•		R52/SUNDANCE	
+							
+			•	•		*	
+			•				
+	ECS FUEL THE NON		•	•	*		
+	CRITICAL ATTITUDE		•	•			#310
+	ABOUT THE SPECIFIED		•	•			
+	LOS WILL NOT BE		•	•			
+	CONSTRAINED.		•	• .			,
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+	•		•	•			
*	•		•	•			
Ť	•		•	•			¥II
	RESET 3 AXIS FLAG		•	•			
·	FOR USE BY ATTITUDE		•	•			#320
	MANEUVER POUTINE		•	•			#J20
+	(860)		•	•			
+			•				
+						*	
+							
+							
+							
+	DO ATTITUDE MANEUVER		DO ATTITUDE	MANEJVER			
+	ROUTINE (R60)		ROUTINE (360))			
+							#330
+	•	*,	• ,				
+	•	**					
+	•						
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+	•		•				
+13	EXIT R52		EXIT	352			
++							

#340

CHANGE CONTROL NOTES LOGIC REV 13 PCN MIT - 65 THIS PAGE INTENTIONALLY LEFT BLANK

APOLLO COMPUTER LOGIC CHECKLIST INTERFACE

	INF	IGHT SIGHTING MA	ARK ROUTINE (R53)		LOGIC	REV 19 02/13/68	* ;	
PURPOSE:	(1)		REQUIRED DPTICAL LIGNMENT PROGRAMS			SIGHTING MARKS ON	CELESTIAL BODIES FOR USE	ВУ
ASSUMPTION	NS: (1)	THE ROUTINE IS	DNLY USED DURING	FLIGHT.		* .		
*	(2)	THE ROUTINE IS		LLED BY THE IMJ	ORIENTATION DET	ERMINATION PROGRAM	(P51) OR THE INFLIGHT F	INE
	(3)	MULTIPLE PAIRS CELESTIAL RODY.		TO A MAXIMJM DF	FIVE MAY BE USE	D TO DETERMINE THE	AVERAGE LOS VECTOR TO TO	HE .
PROG CONT		L GC	GROUND	CREW		CHECKL	IST TIME	TOTAL Time
		•LGC •ROUTINE						
		.SELECTION						
		•						
	START III SIGHTING POUTINE	MARK	i					#10
		•						w. **
		•	• • • • • •					i.e.
		• •	•				*	
9		MARK, AND Y AGS; ZERO	•					#20
	COUNTER MARK DA	AND CLEAR TA STORAGE.	•			er .		
		•						
		•	•					
								#30
			•				R53/SUNDANCE	

HOLD .					
	FLASH VERB-NOUN TO	• • •		• •	
CNAD			MONITOR DSKY:		
SNAP .	REQUEST RESPONSE	• • •	DBSERVE FLASHING		
	AND DISPLAY ANT		VERB-NOUN TO REQUEST		
	DETENT AND STAR		RESPONSE AND DISPLAY	• •	
	CODE:		OF AOT DETENT AND	• •	
	V01N71		STAR CODE.		
	R1-ABCDE				
	R2-BLANK				#40
	R3-BL ANK				
	ing pearly	•	•		
	R1 IS ANT DETENT	•	•	• •	:
	CODE AND STAR	•	•	• •	
	CODE:	• •	•	• •	
			•	• •	
	A, B - BLANK	• •	•	• •	
	C AOT DETENT			* *.	
	D, F - STAR CODE		•	• •	
			•		
	WHERE:		•		#50
	ADT DETENT- THE ADT		•		¥
	DETENT POSITION USED				
	FOR SIGHTING; 1				
	(LEFT), 2 (CENTER),		ARE THE ADT DETENT		
	3 (RIGHT), OR 4 (ANY		AND STAR CODE		
	OF THE THREE REAR	•	DISPLAYS CORRECT FOR	• •	
				• •	
	DETENTS); 5 IF A		THE PRESENT SIGHT-	• •	
	BACKUP OPTICAL SYS-		INGS?	* *	
	STEM IS USED.			• •	#50
			. Y . N	• •	
	STAR CODE-THE			• •	
	DESIGNATION OF THE	•		• •	
	CELESTIAL BODY TO BE	• '		• •	
9.	USED. ALL DESIGN-		•		
	ATIONS IN OCTAL.				
	00-PLANET			• •	
	01/45-STAR (FROM				#70
	STAR CODE LIST)				,,,,
	STAR CODE EIST	•	•	• •	
	46-SUN	•	•	• •	
	40-3014	•	•	• •	
	/7 FARTH		•		
	47-EARTH	•	•	• •	
				• •	
	50-MOON		•	• •	
			•		
	•				
	•				#80
	•			• •	
				• •	
	WAIT FOR KEYBOARD		KEY IN PROCEED .	• •	
	ENTRY				
			•		
				R53/SUNDANCE	
				• • KOO/SUNUANCE	
		•	•		

*			**				
						* .	
	383						*
	307		: :		• •	353/SU	INDANCE
			:				
						*	
×		TERMINATE ELACH HROM	•• •	. KEY IN V21E			#90
		PROCEED OR NEW DATA	•••••	STAR AND DETENT		*	*
		.PROCEED .NEW	: :				*
			: :		• •		
		STORE DATA		•			#100
		:			•	. *	#100
				•	•		
			• •	•	•		*
	++ +16	:	•	•	•		
	+	IS ACT DETENT 004XX OR 005XX?		S THE PRESENT DETENT IN USE ONE OF	•		#110
	++	.N .Y	• 1	THE THREE REAR DETENTS?	•	e	
				.Y N.	•		
					•		
			:	• IS THE BACKUP • OPTICAL SYSTEM		*	#120
		•	•	BEING USED?	•		
		:	:	Y N.	•		
		•	. :				
	1				•		
			• • • • •		•	, *	#130
	POSS HOLD .			OBSERVE VERB OBSERVE VERB	•	* *	
	SNAP .	• PRESENT AGT DET- • ENT OF BACKUP		REQUEST RESPONSE	•		,
		OPTICAL SYSTEMLOS DEFINITION:		RESENT ADT DETENT OR BACKUP	•		
		• V06N87 • R1-OPT AZ		OS DEFINITION	•		#140
		:			•	R53/SU	NDANCE
		:			•		*
		•		• •	•		

R53/SUNDANCE	
*	

-	R2-OPT EL	2			-	0.0		-			
•	R3-BLANK	•	•					•			
•	K3-DLANK	•	•	•		• •	•	•			
		•	•	•			•	•			
		•	•				•	•			
	OPT AZ-THE	•	•	•			•	•			
	AZIMUTH OF THE		•	•				•			
	PRESENT DETENT										
	OR OPTICAL SYS-				-						
	STEM IN USE. THE		•	ARE THE CALIBRA	_			•			
		•	•				•	•			#150
	ANGLE IN THE LM	•	•	TIONS PRESENTLY			,	•			#150
	Y/Z PLANE MEAS-	•	•	DISPLAYED				•			
•	URED FROM THE LM	•		CORRECT?				•			194
	+7 AXIS TO THE		•		-						
	PROJECTION OF THE			. Y			,				
	LOS ON THE Y/Z								*		
	PLANE. POLARITY							-			
	IS + FOR NEGATIVE	-	•	•							
		•	•	•			•	•			
	ROTATION ABOUT		•	•				•			
	THE LM +X AXIS.	•	•	•	•		•	•			
•	IN DEGREES TO						•				#150
	NFAREST .01										
	DEGREE.										
•	3	-									
•	ODT II THE II	•	•	•	۰						
	OPT EL-THE ELE-	•	•	•	•		•	•			
	VATION OF THE LOS	•	•	•							
•	OF THE PRESENT		•	•	•		•				
	DETENT OR OPTICAL			•							
	SYSTEM IN USE.										×
	THE ANGLE FROM	-									
	THE LOS TO LM Y/Z		•	-	-						#170
		•	•	•	•		,	•			7210
	PLANE. POLARITY		•					•			
	IS + FOR A LOS	•	•	• 1			•	•			
•	IN THE SAME HEMI-	•	•	•	•						
	SPHERE AS THE LM			•				•			
	+X AXIS. IN DE-										
	GREE TO NEAREST										
	.01 DEGREE.		•	•				-			
	OI DEGREE.	•	•	•	•		•	•			
		•	•	•			•	•			
		•	•	•	•		•	•			
	•	•	•	•	•			•			#180
			•	•							
_											
-	WAIT FOR KEYBOARD			KEY IN PROCEED	_			•			
•	ENTRY			VET TV T V35E. 0				•			
	ENIKT	• •	•		•		•	•			
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			•	•				۰			
•				•			•	•		R53/SUNDANCE	
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-							6				
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25/	•			•		
385	•					
	•	•		•		R53/SUNDANCE
	•	•		•		
	•	•		•		
	. TERMINATE FLASH			•		#190
	. UPON RECEIPT OF		KEY IN V24E			
	. PROCEED OR NEW	• •	. AND LOAD THE			
	· DATA		. CORRECT CAL	•		
			. IBRATIONS	, •		
	· • P			•		
	· .R			•		
		•		•		
	C NEW DATA		•	. •		
x **	F	•	• • • • • • • • • • • • • • • • • • • •	•		#200
		: :				#200
		•	•	•		
		. •				*
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	•	•	•	•		
++	• •		• • • • • • • • • • • • • • • • • • • •	• • •		#210
+16 +	• •	• •	• • • • • • • • • • • • • • • • • • • •	• •		#210
+	• • • • • • • • • • • • • • • • • • • •	• •		• •		
HOLD .	FLASH VERB-NOUN TO		MONITOR DSKY:			
	REQUEST MARK X OP MARK Y RETISLE		DBSERVE VERB-NOUN FLASH TO REQUEST	• •		
	LINE/STAR INTER-	• • •	MARK X OR MARK Y RE-	• •		
	SECTION; V54 N71		TICLE LINE/STAR			*
+			INTERSECTION;			
+			V54 N71			
+	•					#220
+			è			
+						
+	•		•	• •		
+						
+				• •		
+	• •			• •		*
*	WAIT FOR KEYBOARD	• • •	COMPLETE SIGHTING .			*0*
+16	ENTRY	• • • •	MARK PROCEDURE .	• •		
++	CHIA		ADHERING TO THE .			#230
+19			FOLLOWING PRINCI			,, 230
++	MCQU HEALT STANINAT		PLFS; .			
+16	RECEIPT OF MARK X,					
. +:	MARK Y, MARK REJECT,		. TCA TZLLOA (1)	• •	*	
+	ENTEP, PROCEED OR		RETICLE TO ZERT .			
+	TERMINATE		BEFORE PERFORMING .			w
	M M M D T E					
+	.M .M .M .P .T .E	• • •		• •		
+	.R .R .R .O .R .T					#3/0
+	.K .K .C .M .E		V 04736			#240
+	F . I . P					
+	.X .Y .R .F .N .		121 250 151125 25			
+						
+						R53/SUNDANCE
+						

•	•									
	. 5	.D .A .		MARKS IN EACH						
		T		PAIR(X, OR Y,X)					•	
	. 5	F		IS IRRELEVANT.						
	- (
•	7		• •	(4) MARK REJECTS			Tr.			
•		• •	• •							
			• •	MAY BE MADE TO						****
	•	• •	• •	THE DEPTH OF ONE						#250
				PAIR OR PARTIAL						
•	•	• •		PAIR.			5			
						*				
		. 00		(5) THE LGC CAN						
		· =INAL		PROCESS UP TO AND						
		· AUTD-		INCLUDING 5 MARK						
•	•		• •	PAIRS FOR EACH						
•	•	. MATIC	• •							
•	•	• REQUEST	• •	STAR. THE LGC						
•		. TERMIN-		WILL AVERAGE ALL						
•	•	. ATE ROU-		OF THE LOSS TO						#250
•	•	. TIVE		DEFINE A FINAL						
•		. (ROO)		LOS.						
-				(6) AFTER EACH						
		•		PAIR THE CREW						
•	•	•								
•			• •	MAY TERMINATE THE						
		•		MARKING (KEY IN					(A)	*
٠	•		• •	"PROCEED");						
•	•	•		CONTINUE MARKING						
		EXIT		ON THE SAME STAR						#270
		. R53		(IF LESS THAN 5						
-	-			PAIRS ARE ALREADY						
•		•	• •	STORED IN THE			0.0			
•	•	•	• •							
•	•	T. 100 1 1 1 1 1 1 1 1	• •	LGC) (JSE APPROP-						
		THROW AWAY		RIATE MARK BUT-						
•	•	ANY JNPAIRED	• •	TONS); OR THROW				18.		
	•	X DR Y MARK		AWAY ALL DATA ON						
•	•	DATA AND DE-		PRESENT STAR,						15
	•	CREMENT MARK		SELECT A NEW STAR				•		
•		PAIR COUNTER		AND CONTINUE MAR-						#280
				KING (KEY IN						
•				"ENTER", DEFINE						
•	•	•	• •	•						
•	•	•	• •	NEW STAR AND CON-	• • •					
•	•	•	• •	TINUE MARKING).						
•	•	•		3.4						
	•			(7) THIS ROUTINE						
		HAVE AT		AND THE PRESENT						
		LEAST ONE		ALIGNMENT PROGRAM						
		PAIR OF X		MAY BE TERMINATED		*				
		AND Y MARKS		AT ANY TIME BY						#290
-	۰	BEEN MADE		KEYING IN TERMIN-						17270
•										
•	•	TO DEFINE	• •	ATE (V34E).						
•	•	THE STAR								
	•	VECTOR?	• •	A PRIGRAM ALARM						
•				WILL DOOUR IN THE						
•		.Y .N		FOLLOWING CASES						
•				(TO IDENTIFY						
				as we see the second distribution of		* *				
-	•							*	353/SUNDANCE	
•	•	•	• •						. J.J. J. GORDANGE	
•	•	•								

0	-0	١.
~2	A. 1	
0	0 1	

R53/SUNDANCE

VO5NO9E AND
OBSERVE ALARM
TJPN ON CODES IN R1, R2,
PROGRAM AND AND R3).
ALARM AND
STORE
CODE

(1) A MARK IS
MADE WHEN 5 PAIR:

ALARM KEY IN

(3) A "MARK X", ... OR "MARK REJECT" ... WHEN NO MARKS ARE ... BEING REQUESTED ... BY THE LGC. I.E. ... NO FLASHING V52, ... V53 OR V54. (CODE ... O0112)

(4) A "MARK X"
WHEN THE LGC IS
REQUESTING A
"MARK Y" DR VICE
VERSA (CODE
00114).

(5) A "MARK REJECT" WHEN A PAIR

DR PARTIAL PAIR

HAS ALREADY BEEN

REJECTED DR WHEN

NO UNREJECTED

MARKS ARE STORED

IN THE LGC. (CODE

00115).

#300

#310

#320

#330

#340

#350

R53/SUNDANCE

CALCJLATE
LOS VECTOR
TO STAR USING MOST RECENT PAIR OF
X AND Y MARK
DATA, AND
AVEPAGE WITH
PREVIOUSLY
COMPJIED LOS
VECTOR TO
STAR.

(00111)

IS MARK PAIR
COUNTER =

.

DECREMENT
MARK PAIR
COUNTER

#360

#370

#380

#390

#400

. 17 A 12 .BELOW ARE MARKS BE-ING REQUESTED BY LGC? V52, 53 OR 54 N. TURN ON PROGRAM ALARM AND STORE CODE (00112) -----ARE X MARK OR Y MARK OR BOTH X AND Y MARK FLAGS SFT? N. TURN ON PROGRAM ALARM AND STORE CODE (20115) R53/SUNDANCE

R53/SUNDANCE

#410

#420

#430

#440

#450

#460 R53/SUNDANCE

SET MARK RE-JECT FLAG -RESET MK PAIR FLAG WAS THE MARK REJECT FLAG SFT BEFORE? . RESET X . MARK AND Y . MARK FLAGS . . RESET THE MARK . FLAG CORRESPON-. . DING TO X MARK . OR Y MARK IDEN-. . TIFICATION IN . . MAPK ID REGIS-. . TER AND REDIS-. . PLAY THE APPRO-. . PRIATE MARK RF-. QUEST VERS (V52, V53, V54). . ARE MARKS BEING . REQUESTED BY LGC? · 152, 53, 54

TURN ON PROGRAM ALARM AND STORE SODE (00112) . SET MARK ID REGIS-. TER TO Y MARK . IS MARK PAIR FLAG SET? . IS MARK PAIR • COUNTER = 4?. TURN ON PRO-. GRAM ALARM . AND STORE . CODE (00107) . INCREMENT MARK . PAIR COUNTER

#470

#480

#490

#500

#510

R53/SUNDANCE

392

....

R53/SUNDANCE

#520

#530

#540

#550

#560

R53/SUNDANCE

DISP_AY V52 . SET MARK . PAIR FLAG _____ ARE MARKS BEING RE-QUESTED BY LGC? V52, 53, 54 .Y N. TURN ON PROGRAM ALARM AND STORE CODE (00112) SET MARK ID REGISTER TO X MARK. ______ IS MARK PAIR FLAG SFT? IS MARK PAIR COUNTER = 4?

#570 ,

#580

#590

#600

#610

#620

R53/SUNDANCE

			XII	*		
102 t						
393+						
+						R53/SUNDANCE
+						
+						
*						*
*	TURN ON PRO-					
	. GPAM ALARM			• • •		,
	. AND STORE					
+	CODE (20107))	•			
+						
++						
+17						
+			*			#630
+						
+						
+17	• •					
++	. INCREMENT MARK					*
	• PAIR COUNTER					×
	• FAIR COUNTRY			• • •		
+						
+						
+						#640
+						
+	. RESET X AND Y					
+	. MAPK FLAG AND					
+	. MARK PAIR FLAG.					
+				• • •		
*	•					
+		• •		• • •		
Ţ		-				
	IS X MARK FLAG SET?					#650
+					*	#050
+	. N . Y					
. +						
+						
+			*			
+	. TURN ON PROGRAM					
+	. ALARM AND STORE	• •				
+	. CODE (00114). . (NOTE: ALL X		•			8
+	. MARKS AFTER FIRST	т		• • •		#44.0
+	. ONE ARE ISNURED.					#650
+						
+						
+						
+						
. + -					in A	
+	STORE 3 ISS ANG					
+	LES AND TIME					× ×
+		• •				
+	• •	• •		•		#670
T	•	• •	• •			
4		• •			*	
+			:			
+						
			•			

353/SUNDANCE

RESET MARK REJECT . FLAG. #680 SET X MARK FLAG . #690 IS X AND Y MARK . FLAG SET? DISPLAY V53 #700 SET MARK PAIR FLAG #710 18 A 19 FROM ABOVE #720 IS THE TARGET A IS STAR CODE 00? PLANET R53/SUNDANCE

+18

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10¢								•		•					
395+														R53/SUNDANCE	
+		•						•							
+								•			*				
+			THE S	TAP COD	 E .			•							
+		46,		02 50?				USING GET							#730
+		. N			Υ			OF LAUNCH EPHEMERIS	TIME						
+		•			• . •			OF MARK. 3 ON BOARD T		•					
+								TO DETERMI	NE					*	
+			AIN S		• •			PLANET POS VECTOR AT							
+				PHEMERI	S			PRESENT TI							
+															#740
+		•						•		•				*	
+		•			:										
+				HATE CE BODY V						•					
+			TOR F	OR THE											
+				DEFINED TAR SOO						•		*			
÷		•						•		•					#750
+			•					•							#150
+		•	•		•					•					
+														4	
+		•	•	•											
+															
+ POS	SS		•	•											
HOI	LD .	•		ACH VER		•		MONITOR DS							#760
SN		•	. NO	ASH VER	E-		 	DBSERVE							
+		•		EST RES		•	•	VERB-VOJV FLASH IN							
+			. LG	C-ASSUV	IFD	•		REQUEST RF							
+		•		ANET PO ON VECT				AND DISPLA							
+		•		V06 V88	,	•		PLANET POS VECTOR.					*		
+				R1-X PL				VEG10X.							#770
+		•	•	R3-Z PL		•									
+				Pl Th							*				
+		•		IMPUNENT LE LGC	DE			ARE THE						*	
+		•	. 45	SUMED	INIT	•		POSITION V							
+			. VF	SITION CTOR AT				COMPONENTS CORRECT?							
+		•		REFERE		•		. Y	٧.						#780
+				THE FI				•						*	#150
+								•						R53/SUNDANCE	
+		•						•							

#790

#800

#810

#820

#830

	• •		
	• •		
	· PLACE		ž.
	(. xx x x x) .		
	. Y PL - SAME AS		
	X PL FOR Y		
	COMPONENT.		
	• •		
	Z PL - SAME AS		
	X PL FOR Z		
	COMPONENT.		<u> 6</u>
	WAIT FOR KEY-	KEY IN	
	BOARD ENTRY.	· · PROCEED · · ·	
	• •		
		1	
× *		· · · KFY IV · ·	
	TERMINATE		
	FLASH JPON	· · DACI CAA	
	RECEIPT OF	. CORRECT	
	PROCEED, OR	. POSITION	
	NEW DATA.	. VECTOR	
	1 1	. COMPONENTS	
	P NEW		
	R . DATA		
	C		
	E	: :::::::::::::::::::::::::::::::::::::	
	E STORE		
	D DATA	EXIT	
	• • • • • • • • • • • • • • • • • • •	. R53	
	• •	• • • • • • • • • • • • • • • • • • • •	
		EXIT	
		353	
	CVIT	. 123	
	EXIT	•••	
18	R53 FX11		
	400		
+			
141:05 60:	TOOL MOTES		
	NTROL NOTES 'S 16, 17, 18 PC	R #7	

APULLO COMPUTER LOGIC CHECKLIST INTERFACE

	SIGHTING DATA DISPL	AY ROUTINE (R54)		LOGIS REV	07 02/12/68		
PURPOSE:	(1) TO DISPLAY THE STATE (1) THE ROUTING IS ALIBNA ROUTING (NORMALLY AUTOMATI			ON DETERMINATION PROGRAM	1 (P51) DR THE	FINE
PROG CONT	L GC	GROUND	CREW		CHECKLIST	TIME	TOTAL TIME
*+ +07	• LGC • ROUTINE • SELECTION • • • • • • • • • • • • • • • • • • •					,	
+07	DISPLAY ROUTINE (R54)						#10
	CALCULATE ANGLE BE- TWEEN TWO CELESTIAL BODIES USING FROM STORED EPHEMERIS DATA (ACTUAL)						#20
	CALCULATE ANGLE BE-					•	#20
	TWEEN TWO CELESTIAL BODIES USING VECTORS DERIVED FROM MARK ANGLES (INDICATED)						#30

HOLD . FLASH VERR-NOUN TO FROMEST RESPONSE AND SNAP . DISPLAY SIGHTING ANGLE DIFF: VO6 NO5 R1-SIGHTING ANGLE DIFF R2-BLANK	 MONITOR DSKY: NUCK-EFF SVFRRR PALACID CKA HEALT PALACID SLOW CHITHELE .		#40
R3-BLANK SIGHTING ANGLE DIFF- DIFFERENCE BETWEEN ACTUAL AND INDICATED ANGLES BETWEEN CELE- STIAL BODY VECTOR #1 AND CELESTIAL BODY VECTOR #2. IN DEGREES TO NEAREST .01 DEGREES.			#50
	DOFS THE SIGHTING ANGLE DIFFERENCE EXCEPT THE ACCEPT-ABLE TOLERANCE?		#60
	SHALL I PROCEED WITH OUT OF TOLERANCE DATA?		#7 0
WAIT FOR KEYBOARD FNTRY	 CEEU XEA IN 532-		#8 0
98		•	R 54/SUNDANCE

R54/SUNDANCE #90 #100

CHANGE CONTROL NUTES -LOGIC REV 07 PCN MIT - 65

TERMINATE FLASH UPON .

. P . E

. C

EXIT "B"

CONTINUE

ROUTINE

FROM

R54.

AS DEFINED AS DEFINED

IN CALLING IN CALLING

PROGRAM/ PROGRAM/

OR RECYCLE

P. 0.

C .

EXIT "A"

CONTINUE

ROUTINE

FROM

R54.

PECEIPT OF PROCEED

#110

. KEY IN RECYCLE

V32F

EXIT "A" EXIT "B"

FINED IN IN CALLING CALLING PROGRAM/

PROGRAM/ ROJTINE

FROM

R54. SUNITINGS SUNITING

AS DEFINED

PCFT

R54.

AS DE-

ROUTINE

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197 (401)

APOLLO COMPUTER LOGIC CHECKLIST INTERFACE

		GY	RC TERQUING R	COUTINE (R55)		LCGIC PEV 08	01/17/69			
	PUR POSE:	(1			LES FOR FINAL (FINE) AL		RTIAL PLATFORM DUP	ING AN INFLIGHT		
	ASSUMPTION	VS: (1) THE ROUTIN	E IS NORMALLY AUTOMA	TICALLY SELECTED BY THE	INFLIGHT FINE ALI	GN ROUTINE (R51).			
++ (2) IF THE DAP IS CN AND THE CONTROL MODE IS RATE COMMAND/ATTITUDE HOL +08 TO FLVC6N93, THE DAP MAY FIRE RCS JETS WHEN THE STABLE MEMBER IS R +603 THESE JET FIRINGS CAN BE SUPPRESSED BY TURNING OFF THE DAP (GUIDE +08 SWITCH TO CFF), CR BY KEYING IN V76E (MINIMUM IMPULSE CONTROL MODE ++						E MEMBER IS REORIES	REORIENTED BY MEANS OF GYRO TOROUING. CONTROL SWITCH TO AGS OR THE MODE CONTROL			
	PROG CONT		Fec	GREUND	CREW		CHECKLIST	TIME	TOTAL TIMI	
			• LGC • RCUTINE • SELECTIO							
		START RCUTIN	GYRC TORQUING E (R55)							
			•						#10	
		CALCUL TORQUI EACH G								
			•						#20	
	POSS .	TO REC PCNSE GYRC T ANGLES VO6	AND DISPLAY CRQUING: N93	•	MCNITOR DSKY: ORSERVE FLASHING VERB-NOUN AND DISPLAY OF GYRO TORQUING ANGLES		*			
		P.2-Y	GABL GABL		•				#30	

R55/SUNDANCE

	GYRO TORQUING ANGLES-THE ANGLE THRU WHICH EACH GYRO MUST BE TORQUED TO COM- PLETE THE FINE ALIGNMENT. ALL ANGLES IN DEGREES TO NEAREST .001		SHALL I PERMIT TORQUING? CONSIDER MAG- NITUDE OF TORQUING ANGLES.					#40
	DEGREE.		• N	Υ.				
	•		•	•				
	•		•					
	WAIT FCR KEYBOARD	*	KEY IN	- •				
e.	ENTRY		RECYCLE					
		•	(V32E)	•				
								#50
				•			*	
			•	•				
			•	•				*
	TERMINATE FLASH UPON RECEIPT OF PROCEED OR RECYCLE	•	KEY IN	PROCEED				
	.P R.			•				#60
	• R		•	•			*	
	.C C.		•	•				
	.E . C.							
	.E L.		•	•				
	• • •		•					
	•		•	•				
	PULSE IRIGS .		•	• .				#70
	THROUGH CESIRED .		•	•			*	
	ANGLES			•				
			•		*	ž.		
	•		•	•				*
	• •		• • •	• • • •				
		**		-				
	EXIT EXIT		EXIT R55	FXIT R55				#80

198 (402)

144 (402-4)

CHANGE CCATRCL NOTES

LOGIC REV 08 PCN 603.1

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APCLLC COMPUTER LOGIC CHECKLIST INTERFACE

ATTITUDE MANEUVER ROUTINE (R60)

LCGIC RFV 10 01/17/69

PURPOSE:

(1) TO MANEUVER THE ASCENT STAGE ALONE, THE COMPLETE LM, OR THE LM/CSM TO AN ATTITUDE SPECIFIED BY THE PROGRAM IN PRCGRESS.

- ASSUMPTIONS: (1) THE FINAL ATTITUDE DESIRED, DEFINED AS FOLLOWS, HAS BEEN STORED BY THE CALLING PROGRAM:
 - (A) A SPECIFIC BODY FIXED VECTOR AND A DIRECTION IN SPACE TO WHICH THIS VECTOR IS TO BE ALIGNED (THE 3 AXIS FLAG IS RESET)
 - (e) A THREE AXIS (ORTHOGONAL) INERTIAL ORIENTATION TO WHICH THE THREE BODY AXES ARE TO BE ALIGNED (THE THREE AXIS FLAG IS SET).
 - (2) THE MANEUVER MAY BE PERFORMED AUTOMATICALLY BY THE PONCS OR PERFORMED MANUALLY WITH AN OPTIONAL FINAL AUTOMATIC PONCS CONTROLLED TRIM MANEUVER. THIS OPTIONAL TRIM MANEUVER SHOULD BE CONSIDERED ESSENTIAL FOR MANEUVERS TO DPS OR APS THRUSTING ATTITUCES.
 - (3) THE DOCKED CONFIGURATION OF THE VEHICLE(S) HAS BEEN DEFINED TO THE LGC.
 - (4) THE ATTITUDE MANEUVER RATE CESIRED FOR CAP CONTROLLED MANEUVERS HAS BEEN DEFINED TO THE LGC.
 - (5) THE X-AXIS EVERRIDE OPTION IS INHIBITED BY THIS ROUTINE DURING A PONCS CONTROLLED MANEUVER.
 - (6) THE ROUTINE IS ALTOMATICALLY SELECTED BY THE PROGRAM OR ROUTINE REQUIRING THE ATTITUDE MAMEUVER.
 - (7) IF THIS ROLTINE WAS SELECTED BY THE PREFERPED TRACKING ATTITUDE ROUTINE (R61) THE THREE DISPLAYS (V50N18, V06N18 AND V50N19) IN THIS ROUTINE ARE PRIORITY DISPLAYS AND WILL REMAIN UP A MINIMUM OF 5 SECONDS. PESPONSE AFTER 5 SECONDS WILL CAUSE THE PROGRAM TO CONTINUE AS DESCRIBED.
 - (8) WHEN THIS ROUTINE IS SELECTED BY A PROGRAM OTHER THAN P20, ALL DISPLAYS ARE NORMAL.

TOTAL CREW CHECKLIST TIME PROG LGC GREUND CONT TIME

> . LGC . RCUTINE . SELECTION

START ATTITUE MANEUVER ROLTINE (R60)

#10

OBTAIN CESIRED ATTITUDE SPECIFICA-TICN FROM THE CALL-ING PROGRAM

#20

RESET MANUAL FLAG

#30

IS THE 3 AXIS FLAG SET?

. N

#40

CALCULATE FINAL
VEHICLE ATTITUDE
TO MEET THE
DESIRED ATTITUDE
SPECIFICATION
(VECPOINT RCUTINE). THIS FINAL
VEHICLE ATTITUDE
WILL BE CALCULATED TC MEET THE
ATTITUDE SPECIFICATION IN SUCH A
WAY AS TO CCNSERVE RCS FLEL

AND NCT CONSTR-RAIN ANY UNSPEC-IFIED DEGREE OF FREEDOM. #50

SELECT GIMBAL
ANGLES CCRRESPCNCING TC
PREFERRED
VEHICLE ATTITUDE AND PRESENT IMU CRIENTATION

#60

R60/SUNDANCE

202 (404)

203 (405) R60/SUMDANCE #70 TRANSFORM FINAL IML ANGLES TO FINAL FCAT BALL ANGLES. #80 HOL D. FLASH VERB-NOUN TO MCNITOR DSKY: REQUEST PLEASE OBSERVE VERB-NOUN SNAP. PERFORM AUTO FLASH TO REQUEST MANEUVER AND DISPLAY PLEASE PERFORM AUTO FINAL FCAI BALL MANEUVER AND CISPLAY ANGLES: OF FINAL FOAT BALL V50 N18 ANGLES. R1-RCLL R2-PITCH #90 R3-YAW RCLL, PITCH, YAW-FINAL FEAT BALL ANGLES. IN DEGREES TC NEAREST .C1 DEGREE. (NOTE: IF THE FINAL FDAI BALL ANGLES CCMPUTED RESULT IN #100 + CR - 90 CEGREES YAW, THE TRANSFORM-ATICK FROM INU TO FDAI IN RCLL AND PITCH IS INCETER-++ MINATE, AND P1 AND +10 R2 WILL BE SFT TC +446 ZERC. FCR YAW ANGLES NEAR + CR - 90 CEG-REES THE VALUES CF #110 R1 AND R2 MAY NOT BE RELIABLE.) +10

SHALL I PROVICE THE PGNCS WITH THE CAPABILITY TO #120 PERFORM THE MANEUVER AUTOMATICALLY? SELECT PGNCS CONTROL #130 AND PLACE MCDE SWITCH IN AUTO #140 WAIT FOR KEYBOARD DC I WISH TO TERMINATE ENTRY THIS ROUTINE? #150 TERMINATE . V34E EXIT #160 R60/SUNDANCE

204 (40%)

R60/SUNDANCE SELECT PGNCS CONTRCL AND PLACE MODE #170 SWITCH TO ATTITUDE HCLD CP SELECT BACK-UP A/P. KEY IN ENTER #180 TERMINATE FLASH UPCN RECEIPT OF ENTER, KEY IN PROCEED OR TERMINATE PROCEED #190 #200 IS THE CURR-ENT PREGRAM PCO? #210 3 AXIS FLAG FXIT #220 R60/SUNDANCE

205 (407)

#230

#240

#250

#260

R60/SUNDANC				
			•	
		•	• (
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*		• •	3	SET .
			IS THE 3 AXIS FLAG	
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		•	SET MANUAL	•
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		• (• •
			ROO	• •
		•	TERMINATE	٠
			REDUEST .	• •
			0:	•
			•	•
		•	P20 .	• •
		• •	R6C/	• •
				•
			• •	• •
			• •	• •
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8			• •	• •
			Z.	• •
				•
			IS THIS AN REI INITIAT	• •
			•	•
			• •	• •
R60/SUNDANC			•	•
		3	•	•

#270

CALCULATE FINAL

VEHICLE ATTI-

TUDE AND PRES-ENT INU CRIEN-

TATION

TRANSFORM FINAL IMU ANGLES TO FINAL FOAT

BALL ANGLES.

R60/SUNDANCE

VEHICLE ATTITUDE TC MEET THE DESIRED ATTITUDE SPECIFICATION (VECPCINT ROU-TINE). THIS FINAL . VEHICLE ATTITUDE WILL BE CALCU-LATED TO MEET THE . ATTITUDE SPECIFI- . CATION IN SUCH A WAY AS TO CEN-SERVE RCS FUEL AND NOT CONSTR-RAIN ANY LNSPEC-IFIEC CEGREE CF FREEDCM. NOTE: PGNCS CAP-ABILITY TO PER-FERM MANEUVER AUTCMATICALLY WILL BE CCMPRC-MISED IF THE VEHICLE ATTITUDE IS CHANGED BY MANUAL . INPUTS AFTER THIS . TIME SELECT GIMBAL ANGLES CORRES-PCNCING TO PREFERREC

#310

#280

#290

#300

#320

R60/SUNDANCE

	•								
	• .				MO D I	THE PGNCS AUT DE SELECTED AN D I DIRECT THE PERFORM THE M	D LGC	4	#330
	IS PGNCS AUTC M SELECTED?	CDE	Ξ		UV	FR AUTOMATICAL			
	.Y		. N			. Y	. N		
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Û	•		•			•	•		
	IS MANUAL FLAG		•			•	•	4	#340
	SET?							1	
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	DISPLAY FINAL				MC	NITOR DSKY:			
	FCAI BALL	•	•	• •		OBSERVE NON-	•		
	ANGLES:	•	•			ASHING VERB-	•	1	#350
	V06N18	•				UN CISPLAY CF	•		
	R1-RCLL	•	•			NAL FDAT BALL	•		
	R2-PITCH R3-YAW	•	•			GLES UNTIL MPLETION OF	•		
	(NOTE: FOR	•	•			E AUTCMATIC			
	DEFINITION SEE					NEUVER.			
	ABOVE.)	•		•			•		
		•		•		•	•	*	
	•	•	•	•		•	•		#360
	•	•	•	•		•	•	,	作うひひ
	INHIBIT X-AXIS	•		•		•			
	OVERRICE	•	•	•		•	•		
	OPTION IN THE	•	•	•		•	•		
	DAP.	•	•	•		•	•		
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	•	•	•	•		•			#370
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	•	•	•			E X-AXIS OVER-	•		
	•	•	•			DE CPTION IS HIBITED IN THE	•		
	•	•	۰	•		P UNTIL COM-			
	•					ETICN OF THE			
	•	•		•	AU	TOMATIC	•		
	•	•	•	•	MA	MEUVER.	•		
	•	•	•	•			•		#200
	•	•	•			•	•	R60/SUNDANCE	#380
	•	•	•	•		•	•	SCOT SCONTIANCE	
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208 (410)

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				I	• R60/SUNDANCE
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	DC MANEUVER			MCNITCR DSKY:	
	CALCULATION		• •		
-	(KALCMANU).				•
	TURN ON PRO-		•		•
•			•		e .
•	GRAM ALARM AND		•		•
•	STORE ALARM		•	GIMBAL ANGLE	•
•	CCDE (00401)		•	EXCEEDS 70 DEG-	• #390
•	IF FINAL VEHI-			REES?	The second secon
	CLE ATTITUDE				
	RESULTS IN A		· ·	. N .Y	
	MIDDLE GIMBAL		•		•
•			•	• •	•
•	ANGLE GREATER			•	•
•	THAN 70 CEG-		•		•
•	REES WITH THE		•		•
•	PRESENT IMU			. KEY IN VOSNOS	•
	ORIENTATION.			. TO VERIFY	
	(NOTE-NC LGC			. ALARM CODE	*400
	CHECK IS MACE			. 00401?	***************************************
•	FCR PCSSIBLE		•	* 00401:	•
•			•		•
•	GIMBAL LCCK			Y . N	•
•	DURING THE				•
•	ATTITUDE				•
•	MANEUVER		•		9
	SEQUENCE WHICH			CONSULT	
	IS DEFINED BY			BACKUP	
-	KALCMANU).			• PROCEDURES	
•	RAECHARO).			• • INGCEDORES	****
•	A N	• •	•		*410
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•	•	• •		. PREGRAM ALARM	•
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•				. IMPENDING	
				. GIMBAL LCCK.	- 1
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•					*430
				. PRESS KEY	•
_				. RELEASE AND	
-		-	•	. ALAPM RESET	
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•	• •	• •	•		• R60/SUNDANCF
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DA	0	121	IND	AA	10	í

DRIVE ICCUS MONITOR ATTITUDE . TO GIMBAL MANEUVER BY REF-#440 . ANGLES DE-ERENCE TO FDAI . FINED BY . BALL AND ERROR . KALCMANU. . NEEDLES. IS GIM-. (NOTE: . BAL LCCK IMPEND-. KALCMANU . ING OR DO I WISH . MCNITORS . TO COMPLETE THE . THE ATTIT-. MANEUVER MANUAL-. UDE MODE . LY FOR ANY OTHER . CENTREL REASON? . SWITCH. IF #450 . ATTITUCE . HCLD IS . SELECTED . DURING THE EXECUTION PLACE MCDE . OF SWITCH TO . KALCMANU, ATTITUDE HCLD . THE PROGRAM . WILL GC TO . THE V5CN19 #460 . DISPLAY PCINT.) PERFORM/COMPLETE THE ATTITUDE MAN-EUVER MANUALLY USING ACA BY RE-FERENCE TO THE OUT-THE-WINDOW-CUES AND/OR THE FDAI BALL AND #470 ENABLE X-AXIS ATTITUDE ERROR OVERRIDE NEEDLES. THIS OPTION IN THE OPERATION MAY IN-DAP CLUDE ESTABLISH-MENT OF A PREFER-RED CRIENTATION ABOUT THE LGC DEFINED BODY-FIX-ED VECTOR #480 R60/SUNDANCE

210 (412)

211(4		•	• •	•		
(7	13)	•		•	• •	
						R60/SUNDANCE
						KOO7 SOMOANCE
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	•	•			IS THE PGNCS IN AUTO	
	•	•			MODE AND CID I DI-	
	•	•			RECT THE LGC TO PER-	•
	•	•			FORM THE MANEUVER	
	•	•	• •	•	AUTOMATICALLY?	
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	•	•	• •	•	. WAIT FOR COM-	#500
		•	• •		 PLETION OF ICDU DRIVE AND RELEASE 	#500
					. OF X-AXIS CVER-	
					. RIDE CPTION	
		•			. INHIBIT AS INDI-	
		•			. CATED BY NEXT	
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	•	•	• •		• •	#510
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	SNAP		RYPASS OF		FLASH AND CISPLAY CF	
			TRIM MAN-		FINAL FDAT BALL ANG-	
			D CISPLAY		LES TO REQUEST PLEA-	
	•	FINAL FC	AI BALL		SE PERFORM BYPASS OF	
	•	ANGLES:		. •	ATTITUDE TRIM MAN-	
	•	V50 N		•	. EUVER	
	•	RI-RC		•	,	•
	•	R2-PI R3-YA		•	•	#520
	•	κ;- τμ	"	•	•	#530
	•	(NOTE	: FCR CEF-	•		
			CN SEF			
		ABOVE).		•	
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	•		•		• ,	2/2/2/4/2019
	•		•		•	R60/SUNDANCE
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	2				-	

WAIT FOR KEYBOARD ENTRY

REVIEW THE PRESENTLY .
DISPLAYED FINAL FDAI .
BALL ANGLES AND THE .
PRESENT ATTITUDE. AM .
I WITHIN THE PRESENT .
RCS DAP DEADBAND .
LIMITS IN EACH AXIS? .

DO I WISH
TO FURTHER
ADJUST THE
VEHICLE
ATTITUDE
ABOUT THE
DESIRED

N .

SHALL I
PROVIDE
THE
PGNCS
WITH THE
CAPABILITY TO
PERFORM
A TRIM
MANEUVER
AUTOMATICALLY?

. Y . N

#540

#550

#560

#570

#580

R60/SUNDANCE

212 (414)

213	•				
213 (415)	•	• • • •			
	•	• • •	• • •		P60/SUNDANCE
		• • • •	• •		2607 SUNDANCE
	•				
	•				
	•				#590
	•	EITHER	MANUALLY .		#275
		SELECT .	MANEUVER .		
	•	· · PGNCS	THE VEH		
	•	CONTROL .	ICLF AS .		
	•	• • ng	DESIPED		
	•	PLACE .			
	•	• • MODE .			
	•	SWITCH .			
	•	. NOT IN			****
	•	AUTO	• • • • •		#600
	•		•		
	•	• • • •	1		
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	•				
	•				
		. SELECT			
		. PGNCS			6 F
	• .	. CONT	· 3		
	•	. RCL	•		#610
	•	. AND .			
	•	. PLACE	•		
		. SWITCH .	•		
		· IN			
		. AUTO .			
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	•	•	•		#630
	TERMINATE ELACULUDOS	•	•		
	• TERMINATE FLASH UPCN • RECEIPT OF PROCEED •••••••••••••••••••••••••••••••••••	. KEY IN PROC			
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	• •R •I •E	•			#640
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	• • •	•			R60/SUNDANCE
		•			NOO7 SONDANCE

#650

#660

#670

#680

#690

IS THE CURR-ENT PROGRAM P00? + + + 10 + ED IT RESET THE 3 AXIS FLAG EXIT R6C IS THIS AN R61 INITIATED +10 MANEUVER? EXIT R60/P20 DC FINAL EXIT REC AUTCMATIC REQUEST TERMINATE PCUTINE ROO EXIT

R60/SUNDANCE

214 (414)

RESET MANUAL FLAG

RESET 3
AXIS FLAG

EXIT
REC

CHANGE CENTROL NOTES

R60/SUNDANCE

#700

#710

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APOLLO COMPUTER LOGIC CHECKLIST INTERFACE

	PPEF	FERRED TRACKING /	ATTITUDE ROUTINE	(R61)	LOGIC	REV 07	11/01/67		1,
PURPUSE	(1)	TO NOTIFY THE (CREW THAT AN ATTI	TUDE MANEUVER TO	THE PREFERRE	D TRACKING	ATTITUDE IS REQ	UIRED.	
	(2)	TO COMPUTE THE	PREFERRED TRACKI	NG ATTITUDE OF T	не ги мнісн ел	ABLES RR T	RACKING OF THE C	SM AND CSM TRACKIN	G OF
	(3)	TO PERFORM THE	MANEUVER IO THE	PREFERRED TRACKI	NG ATTITUDE.				*
ASSUMPTIONS:	(1)	THE PREFERRED 1	TRACKING ATTITUDE	IS DEFINED AS FO	OLLOWS:				
96		(A) THE 1M	M +Z AXIS IS ALIG	NED ALONG THE LOS	S TO THE CSM.				
		(B) THE ROLOCK.	DLI. ATTITUDE (ABO	JT LM +Z 4×IS) I	S UNCONSTRAINE	D AND IS D	EFINED IN R60 AS	NECESSARY TO AVOI	D GIMBAL
++ +04	(2)	The second secon	Y BE PERFORMED AU ED TRIM MANEUVER.		HE PGNOS OR PE	AM DEMNCAN	NUALLY WITH AN O	PTIONAL FINAL AUTO	MATIC
**	(3)	THE ROUTINE IS		LLED BY THE REND	EZVOUS NAVIGAT		SHT CVA (029) M	PREFERRED TRACKING	
							£	2	
PROG CONT		L GC	GROUND	CREW			CHECKLIST	TIME	TOTAL TIME
		.LGC .PROGRAM .SELECTION							
TR	ACKING	REFERRED G ATTITUDE (R61)							#10
		:							*
++ +07 IS	TRACE	K FLAG SET?							
+ .	Υ	v. :							#20
+ .	40							R51/SUNDANCE	

: :			*		351/SUNDANCE	
: :						
. IS REVOETVIUS	-					
. FLAG SFT?	_					
v v.	-					
: : :						
						#3
. FXIT TXIT 86	1		is a		9	
. R61 4N1 P20						
•						
CVTRADOLATE LM AND	-					
CS4 STATE VESTURS TO	٦					
PRISENT TIME USING CONIC FOUNTIONS					146	#4
CC-41C(SC117/6)	-					77 **
•						
CALCULATE LOS FROM	-				ě	
LA TO CZM.						
	-			8		
:						#5
	-					
DEFINE THE DESIRED VEHICLE ATTITUDE TO						
BE THE +/ L'A AXIS						
THE CSM.	W ₁					
	-					
						#6
•	_			,		
RESET 3 AVIS FLAG FOR USE BY 250 (SEE						
PELOW)						
	·					
•						
	-					#7
SET PRICEITY DIS- PLAYS FLAG FOR USE						
TY RED (SEE RELOW)			*			
•						
:					₹61/SUNDANCE	
÷						
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421					R61/S	SUNDANCE
++ +04 + + + + +					,	#80
+ + + + + + + + + + + + + + + + + + + +	DO ATTITUDE MANUEVER ROUTINE (R60)		DO ATTITUDE MANEJVER ROUTINE (R60)			*90
++ +07 + + + +07	RESET PRIDRITY DIS- PLAYS FLAG (REFER R60 ABOVE)	*		200		#100
	EXIT R61		EXIT R51			#110

#110

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201

APOLLO COMPUTER LOGIC CHECKLIST INTERFACE

CREW-DEFINED MANEUVER ROUTINE(R62)

LOGIC REV 07 02/12/68

								•	
PURPOSE:	(1)	TO PROVIDE	THE CREW WITH THE ABI	LITY TO SPECI	Y A FINAL VEHI	CLE ATTITUDE	FOR USE BY AN L	GS-CONTROLLED ATTI	TUDE
ASSUMPTION	S: (1)	THE ROUTINE	IS MANUALLY SELECTED	BY THE ASTRO	NAJT BY DSKY EN	TRY.		*	
	(2)	THE DAP DEA	DRAND DURING THIS ROU	TINE IS AS DE	FINED BY THE DA	P DATA LOAD F	ROUTINE (RO3).		
	(3)	THIS ROUTIN	IF CAN ONLY BE ENTERED	FROM THE LGC	IDLING PROGRAM	(P00).			
						*			
								*	
PRDG		L GC	GROUND	CREW			CHECKLIST	TIME	TOTAL
				. C3!	E.A. DGPAM		*		
					ECTION				
				•					
	START CF	REW-DEFINED	•	KFY IN V49E					
	(R62)	ROUTINE	•	•					
		•	•	•					#10
		•		•					
++									
+	IS THE OPENING	P00?	• • • • • • • • • • • • • • • • • • • •	MONITOR DSKY DOES OPER	ATOR				
+	.Y	. N	•	ERROR LIGHT (
+	•	•		ROUTINE CANN					#20
+		TURN ON OPERATOR		TIME?					1120
+		ERROR		. Y	• N				
+		LIGHT	-	•					
+	•			KEY IN	•				
+		:		V37E00E THEN					
+		• • •		RESELECT THIS ROUTINE					#30
+	•	EXIT R62		BY KEYING IN	•				
+					•				
+				:				362/SUNDANCE	
+				•					

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	130			EXIT					
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HOLD .	FLASH VE	OT VUCH-89		SCTINOM	OSKY:				
	REQUEST	RESPONSE AND		DRSERY	/E VERB-VOUN .				
SMAP .		FINAL GIMBAL			REQUEST RE				
STAP .		FINAL SINDAL	•						
•	ANGLES:			SPUNSE AV	DISPLAY .				#50
	V06 N	22		OF FINAL	GIMBAL .				
					0,7,3,5,5				
•	R1- 0			ANGLES.	•				
	R2- I	G							
	R3- M	G							
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	ALL GIMB	AL ANGLES IN		7					
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				NEW GIMBA	AL ANGLES TO .				
					BY ROJTINE .				#60
•		•			OF MUDITAL .			х.	***************************************
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•	WAIT FOR	KEYBOARD		•					
	ENTRY								
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•			•	. KEY	IN V25E AND .				
				I DAT	NEN GIMBAL .				
				. ANGL					
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									#70
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	TERMINAT	E FLASH UPON							
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•		OF PROCEED		KEY IN PE	CICELII				
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424

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		SET 3 AX	IS FLAG FOR			
		USE BY A				
		MANEUVER	ROUTINE		•	
		(R60)			•	
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		DO ATTITI	JDE MANEUVER		DD ATTITUDE MA	VE IVED
		ROUTINE			ROUTINE (R60)	VESVER
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		F, I	XIT R62		EXIT R52	

CHANGE CONTROL NOTES LOGIC REV 07 PCN NO. MIT - 65 R52/SUNDANCE

#90

#130

#110

#120

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72C

APOLLO COMPUTER LOGIC CHECKLIST INTERFACE

	REN	EZVOJS FINAL	ATTITUDE ROUTINE	(863)	LOGIC	REV 07	04/02/68	٠			
PURPOSE:	(1)	TO CALCULATE	AND DISPLAY THE	FINAL FDAI BALL ANGL	ES REQUIRED	TO POINT	THE LM +Z OR +X A	XIS AT THE CSM.			
	(2)	TO SALL THE	ATTITUDE MANEUVER	R ROUTINE (R60) FOR A	TOMATIC MAY	NEUVER CAP	ABILITY.				
ASSUMPTIONS	: (1)		THE LM ATTITUDE CONTROL MODE SHOULD BE PRESELECTED (FOR AUTOMATIC MANEUVERS RO3 SHOULD HAVE BEEN AUTO MODE SELECTED).								
	(2)	THIS ROUTINE	CAN ONLY BE SELE		*						
	(3)	THIS POUTINE	IS SELECTED BY	THE ASTRONAJT BY DSKY	ENTRY						
	131		13 32220120 01	THE ASTRONAST BY SSKT	CWINI						
PPOG CONT		L GC	GROUND	CREW			CHECKLIST	TIME	TOTAL TIME		
				. C R E vi							
				.ROUTINE							
				· SELECTI	O N						
								W.			
-											
		ENDEZVOJS TITUDE		KEY IN V89E							
	OUTINE	(263)	•	•					#10		
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P		GC IDLING (POO) IN		:							
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			TUDAL ON		MONITOR DEAV.					
			TURN ON OPERATOR ERROR LIGHT		DOES OPERATOR FREDRILICAL DOES OPERATOR FREDRILICAL	MC 3				
			•		RELECTED AT THE	3 F		*		#30
		:	•		TIME (NOTE: TO ABLE SELECTION	EN-				
		:	EXIT R63		THIS ROUTINE THE IDLING PROGRAM MUST BE IN PROCE	(2001)	*	*		
		•	EV 11 (03		.Y					
		•			• 1					
									1	#40
						•				
					PRESS ALARM				*	
		•			•	•				
		•			•	•				
		•			• • •	•				
					EXIT R53			,	1	#50
		•				•				
		ROUT	IMU STATUS CHECK TINE (RO2)		ON IMU STATUS COROUTINE (202)	HECK				
			•		:					
			•		•					#60
	• •		•		•		•			
	•	•	•		•	•	•			
	•	•	•		•		•			
							•			
			OT PUCH-RASV HS		MONITOR OSKY:		•			
			JEST RESPONSE AND		OBSERVE VERB-		•			
SNA			PLAY OPTION CODE ASSUMED TRACKING	•	FLASH TO REQUEST		•			
	•		TUDE:		OPTION CODE FOR		•			#70
++			/C4 NO6		ASSUMED TRACKIN		•			
+07			21-00003		ATTITUDE.		•			
++	•		R2-00001				•			
	•	5	R3-BL ANK				•			
240		F1 1	IS THE OPTION				•			
			FOR ASSUMED		•				W.	
	•	TRAC	CKING ATTITUDE				•			
	•				•		•		242/CHNDANCE	
	•				• ,		•		R63/SUNDANCE	
100										
128						,	•			
								*		

	8					R63/SUNDANCE
		•	•			
		•	•	×		
2 IS THE LGC		•				
SSUMED OPTION:		•	•			
00001=PREFERRED(+Z)			•			
10002=0THEP(+X)		•				
		•	•			
•						
•			•			
		•	•			
AIT FOR KEYBOARD		•	•			
NTRY		•	•			
		IC THE ORTION	T A)			
		IS THE OPTION R2 CORRECT?	1 iV			
		NA CONNECT!				*
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		•	• •			
380	•					
		KEY IV				
	•	PROCEED				
, W		•				
TERMINATE FLASH UPON						
RECEIPT OF PROCEED		KEY IN V22	. CVA E			
R NEW DATA		. LOAD DESIR				
		• OPTION COD	Ε			
.NEW .PROCEED						
. DATA .		•				
TORE .		•				
ATA .		•			F	
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VERABOLATE LA AND		•				
XTRAPOLATE LM AND SM STATE VECTORS		•			*	2
ORWARD TO THE		•				
RESENT TIME USING		•				
CNIC EQUATIONS						
		•				
•		•				
		•				

R63/SUNDANCE

++

CALCULATE THE LINE OF SIGHT VECTOR LOS FROM LM TO CSM

#140

IS THE TPACKING ATTITUDE OPTION = 00001?

#150

.NO .YE

SELECT SFLECT +X AXIS +Z AXIS ----- (PREFERRED)

#160

CALCULATE THE SELECTED AXIS TRACKING
ATTITUDE (LM +Z OR
+X) ALIGNED WITH LOS
FROM LM TO CSM).
NOTE: THIS ATTITUDE
WILL BE COMPUTED
(VECPOINT) TO POINT
THE SELECTED AXIS
(+Z OR +X) AT THE
CSM BUT WILL NOT

#170

•

Y AXES.

CONSTRAIN THE NON-CRITICAL (X OR Z) OP

#180

COMPUTE REQUIRED
FDAI BALL ANGLES AT
THE SFLECTED AXIS
(+Z OR +X) TRACKING
ATTITUDE IF THE
PRESENT IMU DRIENTATION IS HELD AND
STORF IN NOUN 18

- R63/SUNDANCE

430

R63/SUNDANCE

•	•			•	•			
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			•		•			
	HAIT FOR KEYBOARD	•		. KEY IN	•			
	FNTRY			· · · · RECYCLE				
				• V32E				
					-			
_			Ĩ.		•			#250
•			•	•	•			#230
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•			KE	Y IN TERMINATE	v			
	*	•		V34E.				
								#250
				-				# L J J
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•	TERMINATE FLASH UPO							
	RECEIPT OF PROCEED,		KEY IN					
	RECYCLE OR TERMINAT	· .	PROCEE					
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	.R .P .T							
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	.C .O .R			•				#270
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•	.E .D .A			EXIT				
	T		•	R63				
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	. EXI	-	•					
		· ·	•				100	
	. R63		•					#280
	•							
	•		•					
	RESET 3 AXIS FLAG							
	FOR USE BY THE		-					
	ATTITUDE MANEUVER		•					
			•					
	ROUTINE (R60).		•					
		-	•					
	•		•					
	•		•					#290
	•				15			
		·						
	DO ATTITUDE MANEUVE	P	DO ATT	ITJDE MANEUVER				
	ROUTINE R60	•		F 360.				
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	•		•				R63/SUNDANCE	
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432

CHANGE CONTROL NOTES: LOGIC REV 07 PCN-MIT-30

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434

APOLLO COMPUTER LOGIC CHECKLIST INTERFACE

13 SPUPIDUS TEST POUTINE (977) LOGIC REV 03 04/16/68 PURPOSE: (1) TO READ OUT THE PANCE AND VELOCITY DATA FROM THE LANGUAGE READ FOR THE LGC DOWNLINK DURING LR SPURIOUS RETURN TESTS. ASSUMPTIONS: (1) THIS ROUTINE IS ONLY USED FOR LP TESTING DURING FARTH ORBITAL MISSIONS. (2) THE LR DATA IS PLACED ON THE DOWNLINK REGARDLESS OF THE STATUS OF THE LR PANGE DATA GOOD AND VELOCITY DATA GOOD DISCRFTES. ++ +03 (3) THIS ROUTING IS MANUALLY SELECTED BY DSKY ENTRY (V78E) AND MAY BE CALLED ONLY WHEN NO OTHER EXTENDED VERB IS IN +03 PROCESS. THE ROUTING MUST BE TERMINATED BY MANUAL DSKY ENTRY (V79E). ++ PPNG I. GC GROUND CREW CHECKLIST TIME TOTAL CONT TIME . PROGRAM .SELECTION START LR SPURIDUS #10 TEST ROUTINE (277) SAMPLE FACH LR VELOCITY BEAM AND THE PANGE BEAM ONCE EACH SECOND #20 AND PUT THIS DATA ON THE LCC DOWNLINK

CHANGE CONTROL NOTES
LOGIC REV 03 PCN-MIT-74

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APOLLO COMPUTER LOGIC CHECKLIST INTERFACE

FRESH START VERB (V36)

LGC

LOGIC REV 03 06/13/68

CHECKLIST

TIME

TOTAL

TIME

PURPOSE:

PPNG

CONT

(1) TO INITIATE A COMPUTER FRESH START

: MCITAMUSSA

- (1) FRESH START IS CREW INITIATED BY DSKY ENTRY.
- (2) ALTHOUGH THE REFSMMAT FLAG IS RESET BY A FRESH START INDICATING THAT THE REFSMMAT IS NOT GOOD, THE ACTUAL PEFSMMAT IS NOT CHANGED.
- (3) FRESH START RESETS THE CSM MOON FLAG AND THE LM MOON FLAG INDICATING EARTH DRBIT FOR STATE VECTOR INTEGRATION.
- (4) IF FRESH START INTERRUPTS STATE VECTOR INTEGRATION, THE STATE VECTOR MAY BE INVALIDATED.

CREW

(5) THIS PROCESS MAY BE SELECTED AT ANYTIME.

C3 CUND

		CREW			
		SELECTION			
		•			
		•			
START CREW INITIATED		KEY IN V36F			
FRESH START	•				
		•			
•		•			
		•			
•		•			*
INDICATE NO RCS JETS		•			
WALTING TO BE TURNED		•			
ON SE STATES					
		•			
•		•			
•		•			
•		•			*
CC. (CD.) (C. CCT.) T		CONFED HITH CO.	21110		
SCHEDULE RESTART DE CURRENT DOWNLIST		CONFER WITH GR		*	
-WENC SM OS TXAN TA		FRASABLE MEMOR			
RUPT		RESTORATION			
		REQUIRED?			
•		. Y	• N		
•		•	•.		
•		•	•		
•		•	•		V36/SUNDANCE

V36/SUNDANCE

#40

#50

#50

#70

#80

FXIT SELECT P27 TO RESTORE ERASABLE MEMORY, THEN SELECT P51 AND 252 TO RE-ESTABLISH REFSMMAT EXIT

ZERO OUTBIT CHAN-NELS: 11 (EXCEPT ENGINE UN, OFF AND ISS WARNING); 13 (EXCEPT TELEMETRY BITS, RESET TRAP BITS AND TERJPT BIT); 14 (EXCEPT GYRO EN-ABLE).

INITIALIZE RADAR

SET TIME 3 = 37777

SET T5RUPT FJR

DAPIDLER PROGRAM.

TIME 4 = 37775TIME 5 = 37774

FLAGS

TERMINATE WAITLISTED TASKS

CLEAR ALL EXECUTIVE REGISTER SETS

V36/SUNDANCE

++

+ + +03 ++

+03 + V36/SUNDANCE

#90

#100

#110

#120

#130

INDICATE NO ACTIVE Jnss MAKE ALL VAC AREAS AVAILABLE ______ SET DIDFLG FOR T4RUPT BLANK DSKY REGISTERS (PROGRAM, VERB, NOUN, R1, R2, R3.) PESET FXTENDED VERB ACTIVITY INTERLOCK INITIALIZE IMU FLAGS TURN OFF DSKY DISCRETE LIGHTS. .

V36/SUNDANCE

CLEAR FAIL REGIS-TERS, SELF CHECK ERROR COUNTER, AND RESTART COUNTER ++ +03 CLEAR SELF CHECK **ERROR REGISTERS AND** +03 MODE REGISTER. INITIALIZE ATTITUDE ERROR DISPLAY FLAGS INITIALIZE DOWNLINK WITH POO DOWNLIST ++ +03 ++ RESET UPSVFLAG ZERO OUTBIT CHANNELS 5 (RCS PITCH AND YAW), 6 (RCS ROLL), 12 (GN AND C), 13 (RADAR AND AGC) AND

14 (IMU)

#140 #150

#160

#170

#180

V36/SUNDANCE

440

+03

+03

++

V36/SUNDANCE SET FNGINE OFF (CHANNEL 11 3IT 14) #190 CLEAR PHASE TABLE INITIALIZE IMU (INHIBIT IMU FAIL) #200 INITIALIZE DAP #210 SELECT 5 DEGREE DEADBAND INHIBIT DAP TURN ON AND ERROR NEEDLE #220 DISPLAY UNTIL ICDU'S ARE ZERDED RESET ALL FLAGWORDS (EXCEPT IDLE=LAG-BIT 7 FLAGWOPD 7 AND #230 R31 FLG-BIT 4 FLAG-WORD 9)

V36/SUNDANCE

#250

SET DRIFT FLAG AND INITIALIZE COMPENSATION

CHANGE CONTROL NOTES

LOGIC REV 03 PCN-MIT-121

WAIT 10 SECONDS

CLEAR IMU FAIL AND ICDU FAIL INHIBIT

EXIT

#260

#240

+++++++

APOLLO COMPUTER LOGIC CHECKLIST INTERFACE

LOGIC REV 03 05/13/68 IMU CDU - ZERO EXTENDED VERB (V40N2)) PURPOSE: (1) TO INSURE SYNCHRONIZATION BETWEEN THE ISS COU COUNTERS AND THE COU COUNTERS IN THE COMPUTER. (2) TO TERMINATE THE IMU COARSE ALION MODE AND ENTER THE FINE ALIGN MODE (INERTIAL IMU). ASSUMPTIONS: (1) THE PROCESS IS CREW SELECTED BY DSKY ENTRY. (2) THE PROCESS MAY NOT BE SELECTED IF THE ISS IS IN THE COARSE ALIGN MODE AND IN GIMBAL LOCK. (3) THE PROCESS IS INTENDED PRIMARILY FOR USE ON THE GROUND. PROG LGC GROUND CREW CHECKLIST TIME TOTAL CONT TIME CREW PROG. SELECTION KEY IN V40N20F #10 CDU ZERO ++ +03 IS A MODE SWITCH OR GYRO TORQUING IN PROGRESS? #20 TURN ON OPER-ATOR ERROR LIGHT #30

V40N20/SDN

+03 EXIT IS ISS IN COARSE ALIGN MODE AND IN GIMBAL LOCK? . TURN ON PROGRAM . ALARM AND STORE . ALARM CODE . (00206) FXIT ENTER CDU ZERO MODE TURN OFF NO ATT LAMP ++

COMMAND DAP OFF.

SET ICOU ZFRO DISCRETE

EXIT

#50

#60

#70

#80

V40N20/SDN

+03

#130

#120

•			
•			
•			
SET INHIBIT ICOU			
DISCRETE			
•			
CLEAP ISS COJ			
READ COUNTERS			
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3			
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Z NONE ICON Z			
DISCPETE			
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•			
WAIT 10 SFC			
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• ,			
REMOVE INHIBIT ICOU			
FAIL DISCRETE			
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C AVO CN			
• 1			
• (ī	×
ENTER FINE	14.		
ALIGN MODE			

V4 0N2 0 / SDN

CHANGE CONTROL NITES

LOGIC REV 03 PCN-MIT-135

APOLLO COMPUTER LOGIC CHECKLIST INTERFACE

	PK COU ZERO EXTE	NOED VERB (V40N72)		LOGIC REV	04 06/13/68	16	
PURPÜSE:	(1) TO ZERO THE		DE .	*			
ASSUMPTI	ONS: (1) THE PROCESS	IS CREW SELECTED B	Y DSKY ENTRY			*<	
	(2) THIS PROCES	S MAY BE SELECTED A	T ANY TIME EXCEPT W	HEN A DESIGNATE O	OR READ SEQUENCE IS IN P	ROGRESS.	
							•
PROG CONT	r ec	GsanAu	CREW		CHECKLIST	TIME	TOTAL TIME
			CREW Program Selectio	V			
			•				
			•				
	START CREW INITIATED RR CDU ZERO	•	KEY IN V45N72E				#10
	:				•		
++ +04 +	IS A DESIGNATE OR READ SEQUENCE IN PROGRESS?					,	
* + +	.N Y.					×	#20
+ + + +	TURN ON OPER- ATOR ERROR LIGHT					к а	
+ + +	:						#30
+ +04 ++	EXIT						

V40N72/SON

IS RE TURY ON FLAG SET? IS REPOSITION FLAG SET? EXIT EXIT SET RR CDU ZERO FLAG SET PR CDU ZERO DISCRETE WAIT 20 MILLISECONDS ZERD LGC RR CDJ COUNTERS ______ REMOVE RR CDJ ZERO DISCRETE

#40

#50

#60

#70

#80

V40N72/SDN

448

.....

				MONITOR DSKY: 1. TRACKER FAIL LISHT WILL BE TURNED DN IF: A. THE R MODE IS AUTH AND THE RROUN'S FAILED		PROCRAM BLARM LIGHT AILL BF TURNED ON IE RP AUTH WORF NOT SELECTED
				MOM 1. LIS		3.
WAIT 10 SECONDS	PESET RR COU ZEPO	NNION HANN S?	T RR SET RR TENNA ANTENN OE TO 1 MODE T	UPDATE TPACKER FAIL	IS RR AUTT WODE DISCRETE PRESENT?	TURN GN PROGRAM ALARM CODE (00510)

#100

#110

#120

490

V40N72/SDN

CHANSE CONTROL NOTES

LOGIC REV 04 PCN-MIT-132

450

APCLLC COMPUTER LOGIC CHECKLIST INTERFACE

		COAR	SE ALIGN ISS	EXTENDED VERB (V41N	201	rceic	* REV 06	01/17/69		
PUR POSE:		(1)	TO ALIEN THE	E IMU TC GIMBAL ANGL	ES SPECIFIED BY TH	HE ASTRONAUT	•			
+06 +EDIT		(2)	TO COARSE AL	IGN TO 0,0,0 WHEN I	N GIMBAL LCCK.					
ASSUMPTION:	s:	(1)	THE PRCCESS	IS CREW SELECTED BY	DSKY ENTRY.				,	
++		(2)	THE PROCESS	MAY BE SELECTED ONL	Y WHEN NO CTHER E	XTENDED VERB	IS ACTIVE.			
		(3)		OF THE ALIGNMENT I		ERANCE CF +2	DEGREES. I	F THIS TOLERAN	CE IS EXCEEDED, THE	
		(4)	V41 MAY CNLY	BE USED WITH N20 C	R N72. REFER TO RE	R COARSE ALI	GN EXTENDED	VERB (V41N72)	٥	
++		(5)	V4CN20 MAY F	EE ENTERED TO TERMIN	ATE THE COARSE AL	IGN MODE.				
+ED IT ++			,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	in the second second						
PROG			LGC	GR CUND	CREW			CHECKLIST	TIME	TOTAL
					.CREW .PROGRA! .SELECT					
	STAR	T CR	EW INITIATED SE ALIGN	•	• KEY IN V41N20E					
					•					#10
. 1			•		•					
			•							
	GYRC		E SWITCH OR QUING IN ?							
			Υ.		•					
	•		•		•					#20
++	•									
+EDIT	•		N CN CPER- R FPROR		. ERROR LIGHT FCR					
+	•	LIG			CICATION OF IMP					
+	•		•	•	PROCEDURE					
+			•	•	•				*	
+	•		•	•	•				V41N20/SDN	
The state of the s			•	-	•					

+	•	•	•	•			V41N20/SDN	
+		•	•	•			V4 INZ 07 50N	
+	•	•	•	•				
+	•	•	•	•				
+	•	٠	•	•				420
+	•		•	•				#30
+		EXIT	•					
+	•		•					
+	•		•	•				
*	IS ANCTHER	EVTENDED	•	•				
+	VERE ACTIVE		•	•				
+			•	•				
+	• N	. Y	•	•				#40
+	•		•	•				#40
+			•					
+		CN OPER-	•	•				
+ 04		ERRCR		•				
+06 ++	• LIGH	· I		•				
	•	•		•				
	•			•	e.			
	•	EXIT		•				#50
	•	LAIT		•				
	•			•				
				•				
	SET EXTENDE			•				
	ACTIVITY IN	VIEKLUUK		•				
		,						
				•				
	•	•		•				#60
	•			•				
HOLD .	FLASH VERB-		•	MONITOR DSKY CBSERVE VERB				
	DESTRED COL			FLASH REQUES				
SNAP .	V21N22		•	LCAD OF CDU				
	R1-CG							
	R2-IG R3-MG			•				#70
	K3-FG			•				
	ALL ANGLES							
	GREES TO NE	APEST .01		SHALL I LCAD	CCU			
	DEGREE			ANGLES?				
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218 (45.2)

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219(453)					
(733)			•		
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	•		•		V41N20/SDN
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	•				
				*	#80
	WAIT FOR KEYBOARD		•		#80
	ENTRY		•		
	CRINI		•		
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		•••••••	LCAD CESIRED .		
		•	ANGLES .		
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++			•		
+06			. DC I WISH TO		#90
+EDIT			. TERMINATE?		
+					
+			. N		
+			• N• • Y		
4					
		*			
+			 KEY IN 		
+			TERMINATE		
+			· (V34E)		

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+06			EXIT		
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	TERMINATE FLACT URCH		• •		
	TERMINATE FLASH UPCN	•			
	RECEIPT OF CATA,		KEY IN		#110
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	•		•		V41N20/SDN

V41N20/5DN

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						V41N20/SDN	
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DISPLAY COARSE ALIC	 GN	MCNITCR OBSERVE	DSKY: DISPLAY OF	-			
V41			ALIGN VERB				
				_			
•		19					
•			•				
•		a a	•				#140
		0	•				
IS ISS IN COARSE ALIGN MCDE?			•				*
		9	•				5
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	•		•				
ZERO ISS ERROR	•	9	•				
CCUNTERS	•						#150
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	•		•				
ENTER COARSE	•		•				
ALIGN MCDE	•		•				
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	-						
•	•		•				#140
•	•		•				#160
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TURN ON NO ATT	•						
LIGHT			-				
210111	•		•				
	•		•				
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	•						
DISABLE DAP AUTO							#170
AND HOLD MODES	•		•				-110
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INGISTI TO FAIL	•		•				
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	-						
RESET TRACK FLAG,	•						
	•		•				
DRIFT FLAG AND	•		•				
REFSMMAT FLAG	•		•				
	•		•				
	_		•				
•	•		-			V41N20/SDN	
•	•		•			A + TINSO L SILIN	
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					*		

220 (454)

221(455)

V41N20/SDN

V41N20/SDN

RESELECT COARSE ALIGN

#240

#250

RESET EXTENCED VERB ACTIVITY INTERLOCK

EXIT

EXIT

CHANGE CONTROL NOTES

LOGIC REV 05 PCN-MIT-135 LOGIC REV 06 ECITORIAL CORRECTIONS

APPLLE COMPUTER LOGIC CHECKLIST INTERFACE

		CEZVCUS RADA LN72)	R COAPSE ALIGN EXTE	NDED VERB	LCGIC * REV	05 01/17/69		
PURPOSE:	(1)	TO DRIVE T	HE PENCEZVOUS RADAR	SHAFT AND TRUNNI	CN TO ANGLES SPECIFIE	ED RY THE ASTPONAUT.		
ASSUMPTIONS:	(1)	THE PROCES	S IS CREW SELECTED	BY DSKY ENTRY.				
	(2)	THE PROCES	S MAY BE SELECTED O	NLY WHEN NO OTHER	EXTENDED VERB IS ACT	IIVF.		
	(3)	THE PROCES	S MAY NOT BE SELECT	ED IF P20 CP P22	IS RUNNING.			
	(4)	THE CONTIN	UCUS CESIGNATE MCCE	MUST BE TERMINAT	FD BY DSKY ENTRY (V44	F).		
	(5)	THE CONTIN	UCUS CESIGNATE ™CCE	INHIBITS RR GIMB	AL MONITCR ROUTING (R	251.		
8	(6)	THE RR SHA	FT AND TRUNNION LIM	ITS APE:				
		(A)	MCDE 1: SHAFT -7C D	EG TO +59 DEG. TR	LANION -55 DEG TO +5	55 DEG.		
					PUNNION -125 DEG TO -			
						DEG. TRUNNION -55 DEG.	TO ASS DEC	
		107	FINE 17 CONTINUES	LESIGNATE UNLT. 3	FART -AJ DEG. TU TJY	DEG., PROMITION -33 DEG.	13 433 066.	
PROG CONT		LGC	GRCUND	CREW		CHECKLIST	TIME	TOTAL MIT
				.CREW .PRTG .SELE	RAM			
	COARS	REW INITIATE SE ALIGN	•	KEY IN V41N72	F			#10
-								*10
RE		SIGNATE OR SUENCE IN S?		•				
-	• N	. Y	- *	•			*	#20
	•	•		•				*20
	•	•		•				

V41N72/5DN

		•	•										
	++ +05 +ED I T +	TURN ON CO	PER-			OBSERVE OPE ERROR LIGHT DICATION OF	FOR IN-	٠					
	+ .					PROCEDURE							
	+	•		•									
	+			•									
	+	• • • •	•	•		• '							#30
	+	• EXI	т .	•		•							
	+	• • • • • • • • • • • • • • • • • • • •		•		•							
	. +	•		•									
	÷ +	IS ANCTHER EXT	ENDEC	•		•							
	*.	A)		•		• .							
	+	. N	• Y	•					*				#40
	+												# 70
	+			•			•						
	.	IS RENDEZVOUS FLAG SET? (SEE	•	•		•							
	+	P20/P22	•	•		•							7
	+												
	+	. N . Y		•									
	÷		•	•		•							
	+												#50
	+ +05 ++	TURN ON C ATCR FRRC LIGHT		•		•		, ,					
		• E1011											
		•		*				1 .				(8)	
		• •				•							
		• •				• 1					*		
				*							.*		
		• FXIT	4										#60.
		•			*						*		
1	5			•									
		SET EXTENDED V	ERB							4 9			
		ACTIVITY INTER	LECK										
				•		•	380						
						•							
	,	•		*					9 E				
	++ +05 +EDIT	CLEAR CONTINUO DESIGNATE AND	us			•					*		#70
	+	DESIGNATE IN				•					-		
	+05	PROGRESS FLACS				•							
	- ·			-		•							
		•									V	41N72/SDN	
		•				•							
224	(458)	•				•							
	(,,,,,					•							X.

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225	(459)	•						
(70 7)							
				•				V41N72/
		Ĭ.		•				1414127
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		•		•				
		•		•				
		•	*	•		*		
		•		•				
	++		•	•				
	+05		•	•				
	+EDIT		•	•				
	+		•					
	+	FLASH VERB-NOUN TO		MONITOR DSI	KY:			
	HOLD .	REQUEST LCAD OF NEW		OBSERVE VE	RB-NOUN			
		RR SHAFT AND TRUNN-		FLASH REQUI	ESTING			
	SNAP .	ICN ANGLES	•	LOAD OF NEI	W RR SHAFT			
	+	V21N73		AND TRUNNI	ON ANGLES			
	+	R1-TRUNNION	•					
	+	R2-SFAFT						
	+	R3-BLANK						
	+	3 3 C	-					
		TRUNNICN-360 MINUS	•					
	4	RR TRUNNIEN COU VAL-	•	DO I WISH	TO LOAD			
		UE. IN CEGREES TO	•	NEW SHAFT				
			•					
	Ť.	NEAREST . 01 DEGREE.	•	TRUNNION A	NGLES!			
	•	(PLUS IS DEFINED AS	•					
	+	A NEGATIVE ROTATION	•	. Y	• N			
	+	ABOUT LM +X AXIS) IN	•	•	•			
	+	MCDE I.	•	•	•			
	+		•	•	•			
	+	SHAFT-RR SHAFT	•	•	•			
	+	ANGLE. IN CEGREES TO	•		•			
	+	NEAREST . 01 CEGREE.	•					
	+		•					
	+	•	•					
	+	•	•					
	+	•						
	+							
	+	WAIT FOR KEYBOARD						
	+	ENTRY	•					
	+			LCAD DESIR	FD -			
	+							
				AWOLLS				
			• •		•			
			•	•	•			
		TERMINATE FLASH UPON	•	•	•			
	7	RECEIPT OF TERMINATE		•	KEY IN			
	Ť.		• •	•				
	*	OR DATA	• • • • • • • • • • • • • • • • • • • •	• • • • • • • • • •	TERMINATE			
	+		• •	•	(V34F)			
	+	•T •C •P		•				
	+	•E •A •R		•	• '			
	+	.R .T .C	•	•	•			
	+	. M . A . C	•	•	•			
	+			•	• • •			
	+	•N • •F	•		•			
	+	• A • • C	•	•	FXIT			
	+	• T	•	•				
	+	• E	•	•				
1 14	+		•	•				
	+			•				
	+							
				•				V/. 1 N 7 2

41N72/SDN

#80

#90

#100

#110

#120

#130

V41N72/SDN

	100										
+					•						
+										V41N72/SDN	1
+		•			•						
+											
+					•						
+	RESET EXTENCED .				•						
	VERB ACTIVITY .	•			•						
	INTERLOCK .										
+											
+		•									
+		•			•						
+		F. 6			•						#1/0
+	• • • •	•			•						#140
	EXIT .				•						
÷	V41 .										
+											
+											
+					•						
+		•		97							
+			•		•						
+05	•	•	•		•		• •				#150
++		•	•		•		• •				#150
HOLD .	FLASH VERB-NOUN	TO	•		MONITOR 1	DSKY:					
	REQUEST RESPONSE				OBSERVE 1		Ν .				
SNAP .	DISPLAY CPTION C		•	•	FLASH TO	REQUEST	•				
	FOR ASSUMED PR	DES-	•		RESPONSE	AND DIS	PLAY .				
	IGNATE MODE:		•		OF OPTION	N CODE F	OR .				
	V04 N06	1	•		ASSUMED	RR DESIG	NATE .				
	R1-00006		•		MODE		•				
	R2-0000X R3-BLANK	4	•								#140
	R1 IS THE OPTION	d	•			•	•				#160
	CODE FOR ASSUMED		•			•					
	DESIGNATE MODE		•		A	•					
	R2 IS THE LCC 45	5-	•			•	•				
	SUMED CPTION:		•			•	•				
	OCOO1-LCCK CN		•			•					
	00002-CCNTINUOUS	S	•			•	•				
	DESIGNATE		•			•	•				
			•			•	•				#170
	•	3	•			•					41.0
	•		•			•					
			•			•	•			*	
	WAIT FOR KEYBOAR	RC	•								
	ENTRY		•		IS THIS		•				
			•		IGNATE M	ODE I	•				
	¥		•		DESIRE?		•				
			•		. Y		N .				
			•		• '	•					#180
			•								7130
			• •				•				
					KEY IN						
			• •		PROCEED		•				
			•			•	•				
			•		•	•	•				
			•		•	•	•			V41N72/SD	N
			•		•		•				
6 (460)			•		•	•	•				

227(461)

V41N72/SDN

#190

#200

#210

#220

#230

V41	N72	/SDN

		•			
		•			
		•		•	• •
		•		•	
		•		•	
		• •		•	KEY IN V22E .
			 		AND LOAD THE . DESIRED DESIG
		• •		•	NATE CODE IN P2 .
				•	THATE CODE IN TE
		•			
		•		•	
		•		•	
		•		•	
	FLASH UPCN	•		•	
RECEIPT C		•		•	
OR NEW CA	1.6	•			
• P	. N	•		•	
• R	• E				
•0	• k				
• C					
• E	• C			•	
• E	• C	•		•	
• D	• D	•			
•	• E	•		•	
•	•	•		•	
•	•	•		•	
•	CICDE CORE	•		•	
•	STORE CODE	•		•	
IS OPTION		•		•	
CCDE					
00001?					
			•		
. Y . N				•	
	LCKCPETC TC			•	
	LCKCNFLG TC TE PP LOCK			۰	
	DESTREC			•	
				•	
	•		ě		
	•				*
	•			•	
				•	
	E NC RP			•	
. MCN FL	AG				
				•	
•	•			•	165
•	•			•	
•	•				

• •		•	V41N72/SDN	
• •		•		4340
• SET CONTINUOUS • DESIGNATE FLAG • (CPTICN 2)		•		#240
• • • •		•		
· · · · · · · · · · · · · · · · · · ·		•		
SET LCKCNFLG TC . INDICATE RP LCCK . ON DESIREC .		•	,	#250
		•		
DISPLAY CCARSE ALIGN VERB	•	MONITOR DSKY: OBSERVE DISPLAY OF		
V41		COARSE ALIGN VERB		#260
•		•		
RESET EXTENDED VERE ACTIVITY INTERLOCK		•		
•		•		#270
IS THE DESIRED LCS WITHIN THE LIMITS OF THE PRESENT RR MODE?		•		#210
. Y . N		•		
IS THE DESIRED LOS WITHIN THE LIMITS OF THE CTHER MODE?		•		#280
		•		
		•		
		•		
		•	V41N72/SDN	
• • • •		•		

228 (462)

229 (463)		4	•		
(765)	• •		•		V/ 1N72 / CDN
	• • •		:		V41N72/SDN
			•		
			•		
++ +05 +EDIT +	• TURN ON PRC- • GRAM ALARM AND • STORE ALARM • CODE (CO502)		MGNITOR DSKY: PROGRAM ALARM LIGHT WILL BE LIT IF THE DESIRED LOS IS NOT WITHIN THE LIMITS OF	•	#290
+ + +	• • •		EITHER RR MODE. DO I WISH TO CBSERVE THE PROGRAM ALARM CODE?		
+	• • • • • • • • • • • • • • • • • • • •				
+	• • EXIT		.Y .N		
+	• •				#300
+	• •		•		
+	• •		CALL PROGRAM		
+ + +	SET REMODE FLAG		ALARM CODE DIS- PLAY (V05N09) TO IDENTIFY FAILURE.		
+	•		ALARM 00502 INDI CATES A BAC RADAR . GIMBAL ANGLE IN		#310
+ +			PUT. WHEN FINISH ED, PUSH KEY RE LEASE TO RECALL.		4-1-
÷ +	•		PREVIOUS DISPLAY.		
* *			•		
* * *	•	÷	PRESS ALARM RESET . TO RESET PROGPAM . ALARM .	· - A _x	#320
+	•		. :		
+	•		: :		
.			• • • •		
+	•		•		
+	•		EXIT .		#330
+	•				#330
+			•		
*	SET DESIGNATE FLAG	*	•		
+	•		•		
•	•		•		
+	•		•		
•	•		:		

V41N72/SDN

IS REPOSITION FLAG IS REMCDE FLAG SET? · INTERRUPT REPCSITION CCMPLETE REPCSITION . RESET RE-. PCSITICN . FLAG IS REMCCE FLAG SET? IS CURPENT RR MCCE 1?

#340

#350

#360

#370

#380

#390

V41N72/SDN

230 (464)

V41N72/SDN

#420

#400

#410

#430

#440

V41 172/50N

SET DESIGNATE COUN-TFR =6C.

. SET RR MCCE . • TC 2

. RESFT REMCDE . FLAG

	•			•				
	• .			•				
				•				
		•		•				
								# 4
		-		-				,,
COMPLE	E DD CHAFT AND	•		•				
	E RR SHAFT AND	•		•				
	ON ERIVE CCM-	•		•				
MANDS				•				
		•		•				
	•	•		•				
	•	•		•				
	•	•		•				
		•						
IS CENT	TINUOUS CESIG-			_				#4
		•		•	4			77
	LAG SET?	•		•				
		•		•				
. Y	• N	•						
		•		•				
•	•	•		•			140	
-		•		•				
. IS !	DESIGNATE FLAG	•		•				
. SET		_						
		•		•				
•		•		•				-
	Y .N	•		•				#4
		•		•	*			
•		•		•				
• 0		•		•				
	IS RRCDU	•		•				
	FAIL DISCRETE	•		•				
	PRESENT?	•		2				
		•		•		N.		
		•	San.	•				
• •	. Y . N	•		•				
		•		•				
								#4
		-						-
	• • • • •	•		•				
	• •	•		•				
	EXIT	•		•				
	•	•		•				
		•						
		•		···				
	TURN CN PRO-	•	. MONITOR DSK					
	GRAM ALARM		PROGRAM ALA	ARM LIGHT				
	AND STORE	•	. WILL BE LIT					
	ALAPM CODE	•						#4
		•	HAS BEEN A					〒4
	(00503)	•	ANTENNA DES		*			
		•	FAIL. DC I	WISH TO				
		-	OBSERVE THE					
		•						
	•	•	ALARM CODE?					
	•	•						
	• • •	•	. Y	• N				
	•							
- •	•	•	•					
		•	•	•				
	EXIT	•	•	•				
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			•	•				
			•	•				
		•					V41N72/SDN	
		•	•				4-1 415 1 3 DIV	
• • •		•	•	•			44141273014	
		•	•	•			V-1 (727 3DW	
• • • • • • • • • • • • • • • • • • • •			•	•			V-1 V/2 / 35/0	

23 THE

232		•	•		
(467)+	• •	•	•		
(10.)+	• •	•			
+	• •	•			V41N72/SDN
+		•			
+					
+		-			
4		•	•		
	•	•	•	,	
¥	• •	•	CALL DD CCDAM		
*	• •	•	CALL PROGRAM .		#500
*	• •	•	ALARM CODE DIS		
+	• •	•	PLAY (V05N09) TO .		
+	• •	•	IDENTIFY FAILURE		
+		•	ALARM 00503 IN		
+			DICATES RADAR .		
+			ANTENNA DESIGNATE .		
+			FAIL. WHEN FIN		
		•			
	• •	•	ISHED, PUSH KEY .		
	• •	•	RFLEASE TO RECALL .		
+	• •	•	THE PREVIOUS .		#510
+	• •	•	DISPLAY		
+	• •	•			
+		•			
+					
+			1 1		
		•	•		
i		•	•		
	HAVE (O ATTEMPTS	•	20555 41484 25		
Ţ	. HAVE 60 ATTEMPTS	•	PRESS ALARM RE		
*	. ELAPSED WITHCUT	•	SFT TO RESET PRO		
+	 RECEIVING DATA 	•	GRAM ALARM .		#520
+	GCOD DISCRETE?	•			
+		•	•		
+	N .Y				
+		•			
+		-			
		•			
	• •	•			
Ţ	• •	•	EXIT .		
•	• • •	•	•		
+		•	•		
+	 RESET CESIG- 	•			#530
+	NATE FLAG	•	•		
*		•	•		
+					
+					
		•			
		•	•		
	. CLEAR RR AUTC	•	•		
		•	•		
*	TRACKER ENABLE	•	•		
+ 1		9	•		
+	• •	•			#540
+	• •	•	•		
+		•	•		
+		•			
+	CLEAR ERRCR				
	CCUNTEP ENABLE	-	•		
	• • CCONTER ENABLE	•	•		
		•	•		
•	• • •	•	•		
+	• • •	•	•		
	• • •	•	•		
+		•	•		
+		•			
+					
			•		V41N72/SDN
i		•	•		AATA (S. SUN
*			•		

•	•	•			•			****
TUDN	CN PRO-	•		MONITOR DEVY				#550
	ALARM AND	•	•	MONITOR DSKY:				
				PROGRAM ALARM				
• STORE		•	•	WILL BE LIT IF				
. CODE	(00503)	•		HAS BEEN A PAD				
		•		ANTENNA DESIGN				
•	•	•		FAIL. DO I WIS				
•	•	•		OBSERVE THE PR	OGRAM			•
•	•	.•		ALARM CODE?				
•	• • •	•				* .		
•	•	•		• Y	• N			#560
•	EXIT	•		•	•			
•		•		•	•			
•		•		•	•			
		•		•	•			
	T DESIG-	•		•	•			
NATE CCU	INTER	•		•	•			
		•		•	•			*
•	i	•						
		•		CALL PROGRAM	•			*
•		•		ALARM CODE DIS		*		#570
•	i	•		PLAY (VO5NO9)	TO .			
	•	•		IDENTIFY FAILU	RE .			
•	•	•		(ALARM CODE	•			
	•	•		005031. WHEN F	IN			
•		•		ISHED, PUSH KE	Y .			
	i.	•		RELEASE TO REC	ALL .			
		•		THE PREVIOUS	•			
	•	•		DISPLAY.	•			
	1	•						
		•		•				#580
	•	•		•				
	,			•				
				•				
	,			•				
IS RR WI	THIN .5			PRESS ALARM RE	SET .			
	LOS DEF-			TO RESET PROGR				
INED BY		•		ALARM.				
SHAFT AN								
NION AND								#590
. N	. Y							
	•			***				
•				•				
	-			EXIT	EXIT			
	•							
	-							
	-	Ĭ						
	•							
	•							#600
	•							

V41N72/SDN

234 21

V41N72/SDN IS LCKCNFLG SET? #610 ENABLE RR AUTO TRACK- . IS RR DATA GCCD DIS-#620 CRETE PPE-SENT? . RESET DESIG-. NATE FLAG #630 CLEAR RR . ERRCR CCUN-. TEP ENABLE #640 SENC SHAFT AND TRUNNION CCMMANDS TO RRCDU S #650 WAIT .5 SECONDS

235 +

V41N72/SDN

LOGIC REV 04 PCR 96 + PCR 95 + PCN-MIT-131 + PCN-MIT-132 LOGIC REV 05 EDITCRIAL CORRECTIONS

APOLLO COMPUTER LOGIC CHECKLIST INTERFACE

TORQUE GYROS EXTENDED VERB (V42)

LOGIC ' REV 05 06/13/68

PURPOSE:

(1) TO FINE ALIGN THE STABLE MEMBER BY TORQUING THE GYROS.

ASSUMPTIONS: (1) THE PROCESS IS CREW SELECTED BY DSKY ENTRY.

(2) THE PROCESS MAY BE SELECTED ONLY WHEN NO OTHER EXTENDED VERB IS ACTIVE.

CHECKLIST TIME PPDG L GC GROUND CREN TOTAL CONT TIME

> DO I DESIRE TO LOAD A DELTA GYRD ANGLE GREATER THAN +99.999 DEGREES?

. 1

THE ASTRONAUT HT DAC THE THREE DOJ3LE PRE- . CISION LGC

REGISTERS: KEY V21 V02E 02500E

XXXXXE V15E

> XXXXXEE YYYYYEE YYYYYE

ZZZZZFE ZZZZZE

BIT 14 OF THE HIGH ORDER RE-PRESENTS 130

DEGREES; 3IT 13, 90 DEGREES; . ETC.

THE MAXIMUM NE-GATIVE GYRO TORQUING ANGLE

IS 37777, 37743; THE MAX-

IMUM POSITIVE

#10

#20

#30

V42/SUNDANCE

		GYRO TORQUING ANGLE IS 40000, 40034. ANY ANGLE OF GREATER MAGNITUDE THAN THE GIVEN MAXIMUM WILL RESULT IN A COMMANDED TOR- QUING ANGLE OF ZERO.	•	,		#40
		(NOTE: THE LOADING OF TOR- QUING ANGLES	•			#50
		GREATER THAN 93 DEGREES SHOULD NOT BE PERFORM- ED DURING FLIGHT. THIS	•			
٠		PROCEDURE IS INTENDED FOR USE ON THE GROUND.)	•			#50
			•			
START OF FINE AL	CREW INITIATED	 KEY V42E				#70
	•					
	DDE SWITCH OR DRQUING IN SS?	•				
. N	Y. :	•				#80
	JRN ON OPER- RROR LIGHT	•				
•	:					#90
•		•			V42/SUNDANCE	
:	•	:				

470

++ +05

471	+	•	•							
7/1	+	•	•							
	+	•	•		•				V42/SUNDANCE	
	+	•								
	+	•	•							
	+	•	•		•					
	+05	•	•							
	++	•	EXIT		•					
		•			•					Y_
		•								
					•	*				
			THER EXTENDED							
		VERB A	CTIVE?							
					•					****
		• N	. Y		•				*.	#130
		•	•		•					
		•	•		•					
		•	TUDA DA		•					(.6)
		•	TURN ON		•					
		•	OPR ERR LIGHT		•					
		•			•				*	
		•	•		•					
		•	•							
		•	•		•					#110
		•	•		•					#110
		CET EV	TENDED .		•					
			CTIVITY .		•					
					•					×
		INTERL	.UCK •		•					
		9.	•		•					
		•	•		•					
		•	•		•			383		
		•	•		•	<i>ii</i>			*	
		•			•					#120
		•	EXIT		•					#120
		•			•					
		•			•					
					•					
		FLASH	VERB-NOUN TO		MONITOR OSK	V •				
	HOLD .		T LOAD OF	~	DBSERVE VI					
			GYRO ANGLES		FLASH REQUE					
	SNAP .		N93		LOAD OF DEL					
	J.C.A.		-XGYRU	•	ANGLES	14 0/10			16	
			-YGYRO							#130
			ZGYRD		_					#130
		,,_			-					
		DEL TA	GYRO ANGLES -							
			IGLES THROUGH							
			EACH GYRO MUST		DID I LOAD	THE 230				
			QUED TO COM-		REGISTERS B					
			THE FINE		KEYING V42F		*			
			IENT. ALL ANG-							
		LES IN	DEGREES TO		. Y	• N			,	
		NEARES	T .OUL DEGREES			•				#140
										7170
									V42/SUNDANCE	
									FTETOUNDANCE	

WAIT FOR KEYBOARD ENTRY PROCEED #150 ... LDAD DESIRED . DELTA GYRO . ANGLES TERMINATE FLASH UPON #150 RECEIPT OF PROCEED OR DATA DISPLAY FINE ALIGN YVYSC SCTIVOM OBSERVE DISPLAY #170 OF FINE ALIGN VERB IS IMU BEING CAGED? #180 EXIT ENTER FINE ALIGN MODE #190 EXIT COM CTUA PAGE STARAM HOLD MODES

V42/SUNDANCE

472

....

V42/SUNDANCE

#200

#210 .

#220

CHANGE CONTROL NOTES

TURN DEE NO ATT

LEAVE IMU FAIL INHI-BIT ON FOR 5 SEC

PULSE IRIGS THROUGH DESIRED ANGLES

RESET EXTENDED VERB ACTIVITY INTERLOCK

EXIT

LAMP

LOGIC REV 05 PCN-MIT-135

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475

APOLLO COMPUTER LOGIS CHECKLIST INTERFACE

	LOAD IMU ATTITUD (V43)	F ERROR METERS EXTEN	DED VERB	LOGIC	REV 03	05/28/68		Ÿ
PURFOSE:	(1) TO DISPLAY	ASTRONAUT SPECIFIED	ANGLES ON THE FDAT	ERROR NEF	DLES.			
ASSUMPTIONS	: (1) THE PROCESS	IS CREW SELECTED BY	DSKY ENTRY.					
	(2) THE PROCESS	MAY NOT BE SELECTED	IF THE IMU IS IN	THE COARSE	ALIGN OR Z	ERO ICDU MODE.		
++ +03		ANGLE WHICH MAY BE 16.88 DEGREES. THE M					IS MAXIMUM WILL BE	
++	(4) THIS PROCES	S MAY BE SELECTED ON	LY IN POO.					
							*	
PROG CONT	LGC	GROUND	CREW			CHECKLIST	TIME	TOTAL TIME
0.5141								• • • • •
			CR EW PROGRAM					
			SELECTION					
			•					
			•	*			*	w , -
			• • •					
_	TART CREW INITIATED		. KEY IN V43F					#10
	OAD OF IMU ATTITUDE		. KET IV VYSI					#10
	RROP METERS		•					
_			•			9		
	•		•					
			•					
• •			•					
	S MODE CONTOL IN FF. POSITION?		•					
			•					#20
+	Y. N.							
+			•					
+			•					
+	. TURN ON THE		•		*			
+	. OPERATOR ERROR							
+	· LIGHT							
+			•					
+	: :		•					#30
+								# J U
+			•					
+	• ,		•				,,	_
+	•		•				V43/SUNDANC	E

+03

EXIT

IS THE COARSE ALIGN FNABLE BIT SET?

.N ...

IS PROGRAM 00 OPERATING?

IS ANOTHER EXTENDED ...

TURN ON

LAMP

SET EXTENDED VERB ACTIVITY INTERLOCK

· ·

CLEAR ERROR COUNTEP ENABLE #40

#50

#50

#70

#80

V43/SUNDANCE

476

......

	•		•					
	•		•					
	FLASH VERB-NOUN TO REQUEST LOAD OF ERROR ANGLES V21 N22 R1 - OG R2 - IG R3 - MG		MONITOR DSKY: OBSERVE VER FLASH REJEST LOAD OF ERROR	RB-NDUN FING R ANGLES				#90
	DEGREES TO NEAREST							
			•					
	•		•					****
	•		•	*			· ·	#100
							8	
	WAIT FOR KEY30ARD ENTRY		DO I WANT TO ERROR ANGLEST	?				
			. Y	. V	*			
			•	•				
		•	LOAD DESIRED					#110
			•	•				
						,		
	TERMINATE FLASH UPON RECEIPT OF DATA OR TERMINATE (V34E)		•	KEY IN V34F				1, 4
	D) T4		•					#120
	.DATA .V34E		•	:				#120
			•	• • •			*	
	 RESET EXTENDED VERB ACTIVITY INTERLOCK 			EXIT				
10.								
								#130
	. FXIT						d at a	
			•					
	•		•					

V43/SUNDANCE DISPLAY ERROR METER . MONITOR DSKY: LOAD VERB DBSERVE DISPLAY OF V43 ERROR METER LOAD VERB #140 ENABLE ERROR COUNTER EXIT #150 WAIT 320 MILLI-SECONDS TURN ON CDUX, CDUY, AND CDUZ DRIVES #160 RESET EXTENDED VERB ACTIVITY INTERLOCK #170 EXIT

CHANGE CONTROL NOTES

LOGIC REV 03 PCN 118

W MATRIX RMS ERROR DISPLAY

APOLLO COMPUTER LOGIC CHECKLIST INTERFACE

LOGIC . REV 00 06/13/68

	(V45)			2,7010	. (1. 03 00,13)	9	*	ŭ.
PURPOSE:	(1) TO P	ROVIDE A MEANS OF DI	SPLAYING W MATRIX IN	FORMATION AND RE	EINITIALIZING THE W	MATRIX IF DESIR	ED.	•
ASSUMPTION	NS: (1) NO 0	THER EXTENDED VERBS	ARE ACTIVE.					
		PROCESS IS CREW SELE			¥			
					2 10 1015 22011105			10 C THE
		W VALUES OF RMS POST TIME A MEASUREMENT T		RRUKS ARE LUADE	D IN THIS RUUTINE,	MAIRIX INTITAL	IZATION UCCU	JK2 THE
							*	
PRDG	L GC	GROUND	CREW		CHEC	CLIST	TIME	TOTAL
0041								IIME
			. 3 R	EAL				
	× *		. V E	RB LECTION				
			•	2201134				
	**		• • • •			,		
	START EXTENDED	VERB				w *		#10
	45 ROUTINE							
	•					ė.		
	:							
	IS EXTENDED VI			ATOR ERR-				
	. N	.Y	OR LIGHT CO					#20
*			PROCESS?	3 IS IN				
*		DEDATOR	. N	. Y				
	· FRROR LIGI			• 1				
			:				,	
			. COMPLE . TERMIN					
			. ACTIVE . VERB R	EXTENDED				#30
	EXIT			OPERATOR .				
	• EXII		• EKKJK	L1071,				
			•		**	V 4	5/SUNDANCE	

	•				3 "	
	SET EXTENDED VERB		THEN PESELECT THIS ROUTINE BY KEYING IN V455			
	ACTIVITY INTERLOCK		: : :	•	#40	
	•			*		
	RESET V45 FLAG		· · ·			
	RESET V45 FL46		• EXIT	*		
	:					
	CALCULATE RMS POSI- TION AND VELOCITY ERRORS.		•		#5 O	
			•			
		:		•		
HOLD .	FLASH VERB-NOUN TO	•	MONITOR DSKY:	•	#60	
SNAP .	PEQUEST RESPONSE AND . DISPLAY: V06 N99 R1 POS ERR R2 VEL ERR R3 BLANK		OBSERVE VERB-NOUN FLASH TO REQUEST RESPONSE AND DISPLAY OF W MATRIX RMS VALUES OF POSITION AND VELOCITY ERRORS.	•		
	P1 - POS ERR - RMS VALUE OF POSITION ERROR IN NM TO NEAR- EST .01 NM.	:	:	•	#70	
	R2 - VEL ERR - RMS	•	AM I SATISFIED WITH THESE VALUES?	:		
	VALUE OF VELOCITY ERROR IN F.P.S. TO NEAREST -1 F.P.S.		. Y . V	•		
	:	•	CT HZIW I OO .	•	#80	
	:		AND REINITALIZE THE W-MATRIX?	:		
		•	v	•		
		•		•		
	:	•		:	V45/SUNDANCE	
180	•	•		•		
	:	:	: : :	:		

	•	•		•	•	• •						
	•	•		•	•	• . •					W. 5. 45 W. 5. 4 W. 5.	
	•	•		•	•						V45/SUNDANCE	
	•			•								
	•	•			•							
	•											
	WAIT FOR KFY30ARD			KEY IN			4			(5)		
	FNTRY.			PROCEED	•							#90
				-								
					•						1961	
		•		•	•							
		•		•	•							
		•			•							
		•			•							
		•		EXIT	•						18	
		•										
		• •			IN							
				TFF	SALMATE							#100
				V34	ŧ E							
		•										
											9	
		•										
		•		r	· · · · · · ·							
		•			XIT	• •						
		•							W.			#110
		•										#110
	TERMINATE FLASH UPON RECEIPT OF PROCEED,	• • • • • • • • • • • • • • • • • • • •			/ IN V24E							
	TERMINATE OR NEW		*		VO MEN CY	A I A				15		
	DATA	•										
		•			•							
	.T .P .NEW	•										
	.E .R .DATA	•										
	.R .O .	•										
	.M .C .	•										
	.I .E											#120
	.N .E STORE NEW											
	.A .D DATA											
	.T	-										
	.E .	•										
		•										
		•									797	
	• • •											
		•										
	. SET V45 FLAG	•										
	GC IO	•										
	11 A 11	•										#130
	BELOW	•										
		•										
(8)								100				
	e											
	•											
											A	
	IS THE V45 F_AG SET?											
	N. Y.											
												#140
												#140
	• •											
	• • • • • • • • • • • • • • • • • • • •										11/6 /CHUDANG=	
	•										V45/SUNDANCE	

GO TO

COMPUTE NEW # MATRIX

INITIALIZATION VALUES BASED ON THE NEW RMS POSITION AND VELO-

CITY ERRORS.

•

RESET RENDWFLAG.

FROM ABOVE

ABOVE

RESET EXTENDED VERB

EXIT

CHANGE CONTROL NOTES

LOGIC REV OO PCN-MIT-103

4.82

#150

#160

#170

#180

APOLLO COMPUTER LOGIC CHECKLIST INTERFACE

INCREMENT LGC TIME EXTENDED VERB (V55)

LOGIC

REV 04 06/13/68

PURPOSE	• /1) TO THANCE THE	ICC CLOCK TIME	HSING INCREMENTS	/ DO DECREMENTS)	LOADED BY THE ASTRONAUT.		
		N.			EXTENDED VERB IS	28		
ASSUMPT	101/2 - (1) THE PROCESS MA	AT DE SELECTEU L	INLY WHEN NO STAFF	EXTENDED VEND 13	ACTIVE.		
	(2) THE PROCESS IS	CREW SELECTED	BY DSKY ENTRY.		ec.		
								2
PROG. CONT			GROUND	CREW		CHECKLIST	TIME	TOTAL
CONT							. *	
				•CRE				
				• PROC • SELS	SKAM			
				•				
		CREW INITIATED	•	KEY IN V55E				
			•			-		
		•		•				#10
++		•		•				
+04 +	IS AND	THER EXTENDED		•				
+04 ++		CTIVE?		•				
	•N	. Y						
	. •	•		•			*	
				•				#20
		TURN ON OPR ERR LAMP		•				
	•			•				
		•		•				17
*		•		.•				
		•		•				
		EXIT		•		-		#30
	•			•				
		(TENDED VERB		•				
				•				
	is y						V55/SUNDANCE	
				•			VOO/ SUNDANCE	

V55/SUNDANCE

				•				
HOLD		TO.		MONITOD NO				#40
HOLD .	FLASH VERR-NOUN	10		SC SCTINOM				#40
	REQUEST, LOAD OF				FLASH JF			
SNAP .	DELTA TIME			VERB-NOUN				
	V21 N24			LOAD OF DE	LTA CLOCK			
	R1-HOURS			TIME				
	R2-MINUTES						*	÷
	R3-SECONDS							
	3233.03							
	TIME TO NEAREST	0.1		•				
		• 01						
	SECONDS							***
				DO I DESIR				#50
	•			DELTA CLOC				
		,						
				. Y	. V			
	WAIT FOR KEYSOAR	0						
	ENTRY	5			•			
				•	•			
	1,1			•	•			
		14	•					
		• •		LOAD DESIR				
			•	TIME INCRE	MENTS .			#60
>)								30
1								
				•				
	TERMINATE FLASH	HDON		•				
				•	KEN IN		*	
	RECEIPT OF DATA	V.34E	•		KEY IN			
	OR PROCEED			•	PRD OR			
			•		V34E			
	• PRO	. D						
	• DR	. A						#70
	. V34F	. T						
	•••	. A			•			
	•			•	•			
	•	•		•				
	•	•		•				
	•	•		•	EXIT			
		•		•				
	RESET EXTENDED	•						
	VERB ACTIVITY		*	•				71 90
	INTERLOCK			EXIT				
								#80
		•						#50
	•	•						
	•	•						
	,•	. •						
*	• • •	•						
	•	•				177		
	EXIT					*		
*								
		-				*		
		•						
		•				*		
		•						
		•						

06#

V55/SUNDANCE

RESET EXTENDED VERB
ACTIVITY INTERLOCK

EXIT

CHANGE CONTROL NOTES

LOGIC REV 04 PCN-MIT-123

485

ADD LOADED DELTA TIME TO LGC SLOCK TIME THIS PAGE INTENTIONALLY LEFT BLANK

APOLLO COMPUTER LOGIC CHECKLIST INTERFACE

			4.0220 00	TOTAL ENGIC CITED	CIDI INICA	-0.2			
	CCMN	AND LR TO POSIT	ICN 2 EXTENDED V	ERB (V61)	rceic	. REV 04	01/17/60		
PUR POSE	(1)	TO DRIVE THE L	ANDING RADAR TO	POSITION 2 (FINAL	APPROACH).				
				and the second s					
ASSUMPTIO	NS: (1)	THE PROCESS MA	Y BE SELECTED AN	Y TIME ANOTHER PRO	GRAM IS NOT	USING EITH	FP LR CR PR.		
	(2)	THE PROCESS IS	CREW SELECTED B	Y DSKY ENTRY.					
PROG		LGC	GROUND	CREW			CHECKLIST	TIME	TOTA
CONT		LGC	GACOND	CKEW			CHECKLIST	TIME	TIM
				CREW PROGRAI	,				
				SELECT					
				•					
				•					
				•					
	START CR	EW INITIATED	•	KEY IN V61E					#10
	CCMMAND	LR TO POS-	•						
	TICN 2								
		•							
		•							
		•							
		ER PROGRAM							
	USING E	THER RACAR?							#20
	• N	. Y							
	•	•							
		TURN CN							
	•	CPR ERR LAMP							2
	•								
		•							
	•	•		*					#30
*	•	•							
	•								

V61/SUNDANCE

V61/SUNDANCE IS LR ALREADY IN POSITION 2? #40 · Y EXIT #50 COMMAND LR TO POS-ITION 2 WAIT 7 SECONDS #60 +04 SET MAXIMUM SCAN +601 LIMIT TO 17 #70 IS LR IN POSITION 2? . · N +04 #80 +601 FAVE 17 SCANS BEEN MADE? .Y .N V61/SUNDANCF 238 (488)

239 (489)	•		
	•		
	•		•
	•		•
			•
++	WAIT 1	• •	•
+04	SECCND	•	•
+EDIT	FCR LR	· CECRE-	•
++	TC SET-	. MENT	•
	TLE	· SCAN	•
		• CCUN-	•
	•	• TER	•
*	•		•
	•	• •	•
	•	• •	•
++			
+04	REMOVE	. WAIT	1 .
+EDIT	CCM-	• SECCI	\D -
+04	MAND		
++	CF LR		
	TC PC-		
	SITION		
	2		
			•
	•		
	•	•	
	•	•	
	•		
		TURN ON	
		REGRAM	
		AL ARM	
		INC	
		STCRE	
		LARM	
		COCE	
	•	(00523)	
	•		
	•	•	
	• • •		
	EXIT	•	
		•	
		EXIT	

CHANGE CENTROL NOTES

LOGIC REV C3 PCN-MIT-130 LOGIC REV C4 PCN 601, EDITOPIAL CORRECTIONS V61/SUNDANCE

#90

#100

#110

#120

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APOLLO COMPUTER LOGIC CHECKLIST INTERFACE

RESTART EXTENDED VERB (V69)

LOGIC RFV 03 06/13/68

PURPOSE:

PROG.

CONT

(1) TO CAUSE A COMPUTER RESTART.

- ASSUMPTIONS: (1) THE RESTART IS CREW INITIATED BY DSKY ENTRY.
 - (2) V69E DOES NOT DIRECTLY SELECT RESTART PROCESSING. IT CAUSES A SITUATION WHICH SATISFIES ONE OF THE CONDITIONS FOR AN AUTOMATIC RESTART, I.E. TOO MANY CONSECUTIVE TO INSTRUCTIONS.

L GC	GROUND	CREA	CHECKLIST	TIME	TOTAL TIME
					*
		CREW PROG SELECTION			
		•			
START CREW INITATED		KEY IN V59E			#10
:					
:		•			
· · · · · · · · · · · · · · · · · · ·					
BRANCH (TC) TO SELF		MONITOR DSKY: DDES PROGRAM ALARM LIGHT COME ON INDICATING RESTART DIFFICULTIES?			#23
·		.y .N			
NOTE: THE LOGIC FROM THIS POINT IS NOT UNIQUELY ASSOCIATED WITH V69. IT IS THE		KEY VOSNOSE TO . DISPLAY A_ARM	* ;	*	#30
PROCESSING WHICH TAKES PLACE WITH ANY HARDWARE IMITIATED RESTART, THE CONDI-		O1107-BAD PHASE . TABLE .			
ACTION TO COMPT				V69/SUNDANCE	

TION CAUSED BY V69E AND SENSED BY THE COMPUTER HARDWARE #40 WHICH INITIATES A RESTART IS TO TRAP-TOO MANY CONSECUTIVE CONFER WITH GROUND TC'S IF POSSIBLE. IS ERASABLE MEMORY AND RESTORATION REQUIRED? INCREMENT RESTART #50 COUNTER EXIT TURN ON RESTART SELECT P27 TO LIGHT RESTORE ERASABLE MEMORY, THEN SELECT #50 P51 AND P52 TO REESTABLISH REFSMMAT IS NO ATT LIGHT ON? . RETURN ISS TO #70 . COARSE ALIGN INDICATE NO RCS JETS WAITING TO BE TURNED ON #80 FXIT SCHEDULE RESTART OF CURRENT DOWNLIST AT NEXT 20MS DOWNRUPT #90 V69/SUNDANCE

492

++ +03

+03

INITIALIZE RADAR FLAGS SET TIME 3 = 37777TIME 4 = 37775TIME 5 = 37774SCHEDULE T5RJPT FOR DAP IDLER PROGRAM ZERO DUTBIT CHANNELS 11 (EXCEPT ENGINE ON, OFF AND ISS WARNING); 13 (EXCEPT TELEMFTRY BITS, RESET TRAP BITS AND TERUPT BIT); AND 14 (EXCEPT GYRO ENABLE) TERMINATE WAITLISTED TASKS CLEAR ALL EXECUTIVE PEGISTER SETS INDICATE NO ACTIVE JOBS

#100

#110

#120

#130

#140

MAKE ALL VAC AREAS AVAILABLE #150 -----SET DIDELG FOR TARUPT #160 BLANK DSKY REGISTERS (PROGRAM, VERB, NOUN, R1, R2, R3) #170 RESET EXTENDED VERB ACTIVITY INTERLOCK RESET DISPLAY/ASTRO-NAUT INTERFACE FLAGS #180 INITIALIZE IMU FLAGS #190 WAS AN ERASABLE MEMORY CHECK IN PROCESS WHEN THE RESTART OCCURRED? . 1 V69/SUNDANCE

494

++

+03

++

+03 ++ V69/SUNDANCE

#200

*

#210

#220

#230

#240

V59/SUNDANCE

. HAS THERE BEEN . AN OSCILLATOR . FAIL? . IS THE AGC . WARNING JN? . HAVE 30TH THE . MARK REJECT . AND ERROR . RESET BUTTONS . BEFN PRESSED? CLEAR SELF CHECK ERROR REGISTERS AND MODE REGISTER . INITIALIZE DOWN-LINK WITH POD DOWNLIST RESET UPSVELAG

#250

#260

#270

#280

#290

#300

V69/SUNDANCE

ZERO OUTBIT
CHANNELS 5 (RCS
PITCH AND YAW), 6
(RCS ROLL); 12
(GN AND C), 13
(RADAR), AND 14
(IMU)

SET ENGINE OFF (CHANNEL 11 BIT 4)

CLEAR PHASE TABLE .

INITIALIZE IMU FLAGS (INHIBIT IMU FAIL)

WAIT 10 SECONDS

CLEAR IMU FAIL
INHIBIT

INITIALIZE DAP

496

++ +03

•	•					•	•	•		•		•	0	•	•	•					•					•		•	•				1		1				Ld			-		!
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INITIALIZE IMU FLAGS

++

164

#310

V69/SUNDANCE

#320

#330

#340

(INHIBIT IMU FAIL)		
		#350
RESET IMU FAILURE CODES		
:		
INITIALIZE DAP	-	
:	-	#370
TURN ON THROTTLE COUNTER	-	
	- ·	#380
IS ENGONFLG SET?		
.N .Y		
TURN ENGINE ON (BIT 13 CHANNEL 11)	*	#390
:		
TEST PHASE TABLE. IS IT CORRECT?		
.N .Y		#400
TURN ON PEOG . ALARM AND . STORE ALARM .		
CODE 1107		
	V69/SUNDANCE	#410
	•	

DISPLAY PROGRAM

WERE ANY GROUPS
RUNNING?

EXIT

VIA

EXIT

TO

SWRETURN IDLELOOP

V69/SUNDANCE

#420

#430

CHANGE CONTPOL NOTES

LOGIC REV 03 PCN-MIT-124

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APOLLO COMPUTER LOGIC CHECKLIST INTERFACE

INITIALIZE FRASABLE DUMP VIA DOWNLING EXTENDED VERB (V74) LOGIC REV 04 05/28/68

... (1) TO DUMP ALL EIGHT BANKS OF ERASABLE MEMDRY VIA DOWNLINK.

- ASSUMPTIONS: (1) THE PROCESS IS CREW SELECTED BY DSKY ENTRY.
 - (2) THE PROCESS MAY BE SELECTED ONLY WHEN NO OTHER EXTENDED VERB IS ACTIVE.
 - . (3) 4, 2, OR 1 COMPLETE DUMPS MAY BE CALLED BY THE ASTRONAUT BY LOADING 20000, 10000, DR 04000 RESPECTIVELY IN LOCATION (DUMPONT). THIS MAY BE DONE BEFORE OR AFTER KEYING V74E.
 - (4) THE DUMP OF EACH BANK IS PRECEDED BY AN ID WORD, SYNCH BITS, ECADR AND TIME.
 - (5) THE E BANKS ARE DUMPED IN ORDER, STARTING WITH E BANK ZERD.
 - (6) THE TIME REQUIRED FOR 4 COMPLETE DUMPS IS 83.2 SECONDS.

PROG LGC GROUND CREW CHECKLIST TIME TOTAL TIME CONT

START CREW INITIATED ... DOWNLINK ERAS-ABLE #10 IS ANOTHER EXTENDED VERB ACTIVE? SPECIFY NJMBER OF DUMPS DESIRED BY LUADING THE FOUR HIGH ORDER BITS DE INDAMED NEITADOT TURN ON OPR KEY V21V01E #20 ERR LAMP XXXXE SCCCXX

V74/SUNDANCE

XX-20 FOR 4 DUMPS 10 FOR 2 DUMPS 04 F32 1 DUMP EXIT #30 +04 SET EXTENDED VERB +04 ACTIVITY INTERLOCK ++ TERMINATE CURRENT DOWNLIST #40 SET E BANK COUNTER, WORD COUNTER, AND DUMP COUNTER=0 #50 INITIALIZE E BANK DUMP. DUMP ID, SYNCH BITS, ECADR AND TIME1. #60 DUMP E BANK #7(INCREMENT E BANK COUNTER AND SET WORD COUNTER=O. V74/SUNDANCE

503 V74/SUNDANCE ALL 8 BANKS DUMPED? INCREMENT DUMP COU-NTER AND SET F BANK COUNTER=0 DUMP COUNTER= PEQUIRED DUMP COUNT (DUMPENT)? #100 RESTORE INTERRUPTED DOWNLIST #110 RESET EXTENDED VERB ACTIVITY INTERLOCK #120 FXIT

#80

#90

CHANGE CONTROL NOTES

LOGIC REVISION 04 PCN-MIT-122

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50%

FXIT

APOLLO COMPUTER LOGIC CHECKLIST INTERFACE

MINIMUM IMPULSE MODE EXTENDED VERB (476) LOGIC REV 03 PURPOSE: (1) TO ENABLE THE MINIMUM IMPULSE MODE OF THE DAP. ASSUMPTIONS: (1) TO OBTAIN THE MINIMUM IMPULSE MODE, THE GUID CONT SWITCH MUST BE AT PGNS AND THE MODE CONTROL SWITCH AT ATT HOLD. (2) THE MINIMUM IMPULSE MODE WILL REMAIN ENABLED UNTIL CANCELLED BY RATE MODE SELECTION (SEE V77) OR A FRESH START. (3) THE PROCESS IS CREW SELECTED BY DSKY ENTRY. (4) THE PROCESS MAY BE SELECTED AT ANY TIME. PROG L GC GROUND CREW CHECKLIST TIME TOTAL TIME CONT CREW PROSRAM SFLECTION #10 START CREW INITIATED KEY IN V76F MINIMUM IMPULSE MODE SELECTION SET MINIMUM IMPULSE #20 ACA MODE FLAG . . .

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APOLLO COMPUTER LOGIC CHECKLIST INTERFACE

RATE COMMAND EXTENDED VERB (V77) LOGIC REV 03 01/29/68 PURPOSE: (1) TO ENABLE THE RATE COMMAND MODE OF THE DAP. (2) TO SET DESIRED COU ANGLES EQUAL TO ACTUAL COU ANGLES. ASSUMPTIONS: (1) TO DETAIN THE RATE COMMAND MODE, THE GUID CONT SWITCH MUST BE AT PGNS AND THE MODE CONTROL SWITCH AT ATT HOLD. (2) THE RATE COMMAND MODE WILL REMAIN ENABLED JNTIL CANCELLED BY MINIMUM IMPULSE MODE SELECTION (SEE V76). (3) THE PROCESS IS CREW SELECTED BY DSKY ENTRY. (4) THE PRICESS MAY BE SELECTED ANY TIME. PROG LGC CHECKLIST GROUND CREW TIME TOTAL CONT TIME CREW PROGRAM SELECTION #10 START CREW INITIATED KEY IN V77E RATE COMMAND MODE SELECTION RESET MINIMUM IM-PULSE ACA MODE FLAG #20 SET DESIRED CDJ ANGLES = CURRENT CDU ANGLES

#30

V77/SUNDANCE

EXIL

80,4

509

EXIT

APOLLO COMPUTER LOGIC CHECKLIST INTERFACE

ENABLE W MATRIX INITIALIZATION EXTENDED LOGIC REV 02 01/19/68 VERB (V93) PURPOSE: (1) TO REQUEST REINITIALIZATION OF THE RENDEZVOUS W MATRIX. ASSUMPTIONS: (1) THIS PROCESS RESETS THE RENDWELAG INDICATING THAT THE RENDEZVOUS W MATRIX IS NOT VALID AND MUST BE REINITIALIZED BEFORE BEING USED. THE RENDWELAG IS AUTOMATICALLY SET FOLLOWING W MATRIX INITIALIZATION OR REINITIALIZATION. (2) THE PROCESS IS CREW SELECTED BY DSKY ENTRY. (3) THIS PROCESS MAY BE SELECTED AT ANY TIME. PROG LGC GROUND CREW CHECKLIST TIME TOTAL CONT TIME CREW PROGRAM SELECTION #10 START CREW INITIATED KEY IN V93E RENDEZVOUS W MATRIX NCITALIZATION RESET RENDWFLAG #20

APOLLO COMPUTER LOGIC CHECKLIST INTERFASE

Tr.	EXTENDED VESS OF			LUGIC 9EV 00 05/28/68		
PURPOSE:	(1) TO PROVIDE	IDMAPQUE TE SVATM	NG STATE VECTOR INTEGRA	ATION.		3. 2.
ASSUMPTIONS:	(1) IF THE COAS	TING INTEGPATION RO	MCITARAGE VI SI BNITU	IT IS TERMINATED AT THE END OF THE	CURRENT TIME STEP	۰.
	(2) THE CURRENT	PROGRAM IS TERMINA	TED			
	(3) THE LGC IDL	ING PROGRAM (POO) I	S ACTIVATED.		*	
	(4) THE FIRST PONEW PROGRAM IS SE		A TAHT EZ CEZZAGYE ZI T	NO STATE VECTOR INTEGRATION OCCURS F	OR TEN MINUTES, U	JNLESS A
	(5) THIS ROUTING	F DOES NOT MAINTAIN	STATE VECTOR SYNCHRONI	IZATIDN THEREFORE INCORRECT W MATRIX	EXTRAPOLATION MA	/A
PROG CONT	LGC	GROUND	CRE₩	CHECKLIST	TIME	FOTAL TIME
			• CREW • EXTENDED • VERB • SELECTION •			
TE	ART STATE VECTOR RMINATION ROJTINE.		KEY IN V95E	•		#10
	•					
SE	T QUIT FLAG					
	:				3	#20
(P	TO IDLING PROGRAM 00) VIA ROJTINE 00)				× 1	

V96/SUNDANCE

GD TO

CHANGE CONTROL NOTES

LOGIC REV 00 PCN-MIT-15

6/1

APOLLO COMPUTER LOGIC CHECKLIST INTERFACE

PROCEDURAL POUTINE ONE (PRI)

LOGIC REV 00 04/16/68

PURPUSE:

(1) TO PROVIDE MANUAL CAPABILITY OF CHANGING FLAG WORD BITS.

- ASSUMPTIONS: (1) THIS PROCEDURE CAN BE PERFORMED AT ANY TIME.
 - (2) THIS PROCEDURE IS NOT RESTRICTED TO FLAG WORDS BUT CAN MODIFY ANY LEGITIMATE ERASABLE LOCATION.

- DESCRIPTION: (1) NOUN 7 WILL BE LOADED BY STANDARD PINBALL TECHNIQJES, E.G. V25 N7E
 - (2) NOUN 7 IS A THREE COMPONENT OCTAL NOUN WITH THE ECLLOWING DEFINITION.
 - R1 = ECADE OF AN ERASABLE LOCATION (E.G. FOR FLAGWORD 8 R1 = 104).
 - R2 = UP TO FIVE OCTAL DIGITS REPRESENTING BITS IN THE WORD TO BE SET (E.G. 200 IS PIT 8).
 - P3 = NON-ZERO (OR NON-BLANK) INDICATES 4 1 IS TO BE SET INTO BIT POSITIONS SPECIFIED IN R2. ZERO OR BLANK INDICATES - A J.
 - (3) AS AN EXAMPLE, SETTING OF BITS 1, 3 AND 13 TO 1 IN FLAGWORD 8 REQUIRES THE FOLLOWING SEQJENCE:

V25N7E 1045

10005F

1 5

SFTTING THE SAME BITS TO O REQUIRES THE SEQUENCE:

V25N7E

104F

10005F

0 E

CHANGE CONTROL NOTES. LOGIC REV 00 PCR - 79

519

241

APOLLE COMPUTER LOGIC CHECKLIST INTERFACE

. REV 06 01/17/69

4.5 THIS LIST REPRESENTS THE VERBS USED IN PROGRAM SUNDANCE.

4.5.1 REGULAR VERBS

- 00 NCT IN USE
- 01 DISPLAY OCTAL CCMP 1 IN R1
- 02 DISPLAY OCTAL COMP 2 IN R1
- 03 DISPLAY CCTAL COMP 3 IN PI
- 04 DISPLAY OCTAL COMP 1,2 IN R1, R2
- 05 DISPLAY OCTAL CCMP 1,2,3 IN F1,R2,R3
- 06 DISPLAY DECIMAL IN R1 CR R1, R2 CR R1, R2, R3
- 07 DISPLAY DP DECIMAL IN R1, R2 (TEST ONLY)
- 08 SPARE
- 09 SPARE
- 10 SPARE
- 11 MCNITCR CCTAL CCMP 1 IN R1
- 12 MCNITOR OCTAL CCMP 2 IN P1
- 13 MCNITCR OCTAL CCMP 3 IN P1
- 14 MCNITCR OCTAL COMP 1,2 IN R1,R2
- 15 MCNITCR OCTAL CCMF 1,2,3 IN R1,R2,P3
- 16 MENITOR DECIMAL IN R1 OR R1, R2 CR R1, R2, P3
- 17 MONITOR DP DECIMAL IN R1, R2 (TEST ONLY) (GRD USE)
 - 18 SPARF
 - 19 SPARE
 - 20 SPARE
 - 21 LEAD COMPENENT 1 INTO P1
 - 22 LEAD COMPENENT 2 INTO E3

VERBS/SUNDANCE

23	LCAD COMPCNENT 3 INTO R3			
24	LCAD COMPCNENT 1,2 INTO R1,R2			
25	LCAD COMPONENT 1,2,3 INTO R1,R2,R3			
26	SPARE			
27	DISPLAY FIXED MEMCRY (GRD USE)		9	
28	SPARE			
29	SPARE			
30	REQUEST EXECUTIVE (GRC USE)			
31	REQUEST WAITLIST (GRD USE)			
32	RECYCLE			
33	PROCEED			
34	TERMINATE			
35	TEST LIGHTS	*		
36	REQUEST FRESH START			
. 37	CHANGE PREGRAM			
38	SPARE			
39	SPARE			
	4.5.2 EXTENDED VERBS		CALLABLE IN PROGRAM (C) — CALLABLE WITH ANOTHER	EXTENDED VERB IN USE.
40	ZERO CDU (SPECIFY N20 OR N72)	(C)	ALL	
41	COARSE ALIGN CDU (SPECIFY N20 CR N72)		ALL (SEE V41 DESCRIPTION)	
42	FINE ALIGN IMU		ALL	
43	LCAD FDAI ERROR NEEDLES (TEST CNLY)		00	
44	TERMINATE CONTINUCUS DESIGNATE	(C)	ALL	
45	DISPLAY W-MATRIX RMS ERRCPS		ALL	
46	SPARE			
47	INITIALIZE AGS (R47)		ALL	
48	LCAD DAP DATA (RO3)		ΛLL	

242 (516)

VERBS/SUNDANCE

	49	START CREW DEFINED MANEUVER (R62)			90 .
	50	PLEASE PERFORM			NCNE
	51	SPARE			
	52	MARK X-RETICLE			NONE
	53	MARK Y-RETICLE			NONE
	54	MARK X CR Y-RETICLE			NONE
	55	INCREMENT LGC TIME (DECIMAL)			ALL
	56	TERMINATE TRACKING (P20 AND P25)	(C)		20, 25
	57	SPARE			
	58	SPARE			
	59	SPARE			
+ + -	60	DISPLAY DAP FOLLOWING ATTITUDE ERRORS	(C)		ALL
+	61	CCMMAND LR TC POSITION 2			ALL
⊢	62	START RR/LR SELF TEST (RO4)			(SEF RO4 DESCRIPTION)
+	63 PCR	DISPLAY TOTAL ATTITUDE ERRORS WITH RESPECT -164, EDIT	TO N22	(C)	ALL
	64	SPARE			
+ 4	65 + PC	DISABLE U, V JETS DURING CSM DCCKED BURNS	(C)		ALL
		SET LM STATE VECTOR INTO CSM STATE VECTOR	(C)		ALL
	67	SPARE			
	68	SPARE			
	69	RESTART	(C)		ALL
	70	UPDATE LIFTOFF TIME (P27)			00
	71	UNIVERSAL UPDATE-BLOCK ACR (P27)			00
	72	UNIVERSAL UPCATE-SINGLE ADP (P27)			00
	73	UPDATE LGC TIME (CCTAL) (P27)			00
	74	INITIALIZE ERASAELE CUMP VIA COWNLINK			ALL
	+ 75 + PC*	ENABLE U. V JETS CUPING CSM CCCKEC PUPNS	(C)		۸۱۲

71	MINIMUM INDUSES COMMAND MOSE	101	0.7 0
16	MINIMUM IMPULSE COMMAND MODE	(C)	ALL
77	RATE COMMAND AND ATTITUDE FOLD MODE	(C)	ALL
78	START LR SPURIOUS TEST (R77)	*	ALL
79	STOP LR SPURIOUS TEST (R77)	(C)	ALL
80	UPDATE LM STATE VECTOR	(C)	ALL EXCEPT R32
81	UPDATE CSM STATE VECTOR	(C)	ALL EXCEPT R32
82	REQUEST ORBIT PARAM DISPLAY (R30)		ALL
83	REQUEST REND PARAM DISPLAY (R31)	* 4	ALL
84	START TARGET DELTA V (R32.)		ALL
85	SPARE		
86	SPARE		
87	SPARE		
88	SPARE		
89	START REND FINAL ATTITUDE MANEUVER (R63)		00
90	REQUEST REND CUT CF PLANE DISPLAY (R36)		ALL
91	BANKSUM	9	00
92	START IMU PERFORMANCE TESTS (GRD USE)		00
93	ENABLE W MATRIX INITIALIZATION	(C)	. ALL
94	SPARE		
95	NO UPDATE OF EITHER STATE VECTOR	(C)	ALL .
96	TERMINATE STATE VECTOR INTEGRATION	(C)	ALL
97	SPARE		
68	SPARE	w	
99	ENABLE ENGINE IGNITION		NONE

CHANGE CENTREL NOTES

REV C5 PCN-MIT-120 REV C6 PCR-164, PCN-483 , EDITCRIAL CORRECTIONS

00261000

OO NET IN USE

APCLLC COMPUTER LOGIC CHECKLIST INTERFACE

. RFV 07 01/17/69

4.6 THIS LIST REPRESENTS THE NOUNS USED IN PROGRAM SUNDANCE.

CALLABLE IN:

CODE:

(L) - NOUNS WHICH MAY BE LOADED IN LGC

* - ALSO P40, P41, P42 OR P52 IF SELECTED IN SEQUENCE AFTFR THIS PRETHRUST PROGRAM

P20(L280+)-INDICATES NOUN MAY RE CALLED IN P20 AFTER LINE COUNT #180 (APPROX) AND IN ANY SUB-SEQUENT PROGRAM UNTIL PECALCULATED.

(W R30) - WITH, OR BY MEANS OF, ROUTINE 30

P00(R62) - NOUN MAY BE CALLED IN P00 DURING ROUTINE 62

00	NCI IN USE			
01	SPECIFY ADDRESS (FRAC)	(L)	• XXXXX FRAC • XXXXX FRAC • XXXXX FRAC	ALL
02	SPECIFY ADDRESS (WHCLE)	(L)	XXXXX. INTEG XXXXX. INTEG XXXXX. INTEG	ALL
03	SPECIFY ADDRESS (DEGREE)	(L)	XXX.XX DEG XXX.XX DEG XXX.XX DEG	ALL
04	SPARE			
05	ANGULAR ERROR/DIFFERENCE		XXX.XX DEG	NCNF
06	CPTICN CODE	(L)	CCT CCT	NONE
07	FLAGWERD CPFRATOR	FCACR BIT ID ACTION	CC T CC T	
08	ALARM DATA		CCT CCT	ALL

09	ALARM CEDES		OCT OCT		ALL
10	CHANNEL TO BE SPECIFIED (L-EXC	EPT CHANNEL 7)	CCT		ALL
11	SPARE				
12	SPARE				
13	SPARE				
14	CHECKLIST (USED INTERNALLY BY VERBS CNLY) (N25 IS PASTED AFTER	2	xxxxx.		NONE
15	INCREMENT ADDRESS (L-W NO1,NO2	,N03,N10)	OCT		ALL
16	TIME CF EVENT (USED BY EXTENDE	C VERBS ONLY)	00XXX. 000XX. 0XX.XX	MIN	R32* R36, R47
17	SPARE				
18	DESTRED AUTO MANEUVER FDAT BAL	. Р	XXX. XX XXX. XX	DEG	P00(R62,R63) P20(1280+) P25(L130+) P40(L220+)
					P41(L160+) P42(L210+)
19	BYPASS ATTITUCE TRIM MANEUVER (DESIRED FCAI BALL ANGL	ES) P	XXX.XX XXX.XX XXX.XX	DEG	NONE
20	ICDU ANGLES	IG	xxx.xx xxx.xx xxx.xx	DEG	ALL
21	PIPAS	Y	xxxxx. xxxxx. xxxxx.		ALL
22	DESIRED ICDU ANGLES	IG	XXX.XX XXX.XX XXX.XX	DEG	SAME AS N18
23	SPARE				
24	DELTA TIME FOR LGC CLOCK	(L)	00XXX. 000XX. 0XX.XX	MIN	V55
25	CHECKLIST (USED WITH V50)		XXXXX.		NONE

26	PRIO/DELAY, ADRES, EBCON (L-h	V3C,V31)	CCT OCT CCT	GRD. USF
27	SELF TEST CN/OFF SWITCH	(L)	xxxxx.	ALL
28	SPARE			
29	SPARE			
30	GETI (CSI)	(L)	OOXXX. HRS OOOXX. MIN OXX.XX SEC	P32(L70+)* P72(L70+)
31	GETI (CCH)	(L)	OOXXX. HRS OOOXX. MIN OXX.XX SEC	P33(L80+)* P73(L80+)
32	TIME FRCM PERIGEE		OOXXX. HRS OOOXX. MIN OXX.XX SEC	ALL (EXCEPT P06, P21, P27, R30)
33	GETI	(L)	00XXX. HRS 000XX. MIN 0XX.XX SEC	P30*
34	TIME OF EVENT	(L)	OOXXX. HRS OOOXX. MIN OXX.XX SEC	P21,P52,P51,(R53)
35	TIME TO GC TC EVENT		OOXXX. HRS OOOXX. MIN OXX.XX SEC	
36	TIME OF LGC CLOCK		-OOXXX. HRS OOOXX. MIN OXX.XX SEC	ALL
37	GETI (TPI)	(1.)	OOXXX. HRS OOOXX. MIN OXX.XX SEC	P32(L180+)* -P34(L80+)* P72(L180+) P74(L80+)
38	SPARE		*	
39	SPARE			
40	TIME FROM IGNITION/CUTOFF VG DELTA V (ACCUMULATED)		XXBXX M-S XXXX.X FPS XXXX.X FPS	P40(L400+) P42(L400+)
41	TARGET AZIMUTH FLEVATION - LAT/2	(L)	XXX.XX DEG XX.XXX DEG	GRD USE

DELTA V (REQUIRED) XXXX.X FPS			
43 LATITUDE XXX.XX DEG (+ NORTH) P21(LCNGITUDE XXX.XX DEG (+ EAST) ALTITUDE XXXX.X NM	(L100+)		
AFOGEE XXXX.X NM ALL PERIGEE XXXX.X NM P27, TFF XXBXX M-S	,(R30)		
TF GETI OF NEXT BURN XXBXX M-S P32(MGA XXX.XX DEG P33(P34((L450+)* (L700+)* (L510+)* (L710+)* (L360+)*		
46 DAP CONFIG (L) OCT POO,	,P20,P3X,P4X,P5X,(R03)		
47 THIS VEHICLE WT (L) XXXXX. LBS POO. OTHER VEHICLE WT XXXXX. LBS	P00,P20,P3X,P4X,P5X,(R03)		
48 GIMBAL PITCH TRIM (L) XXX.XX DEG POO, GIMBAL ROLL TRIM XXX.XX DEG	P00,P20,P3X,P4X,P5X,(R03)		
49 DELTA R DELTA V XXXX.X FPS	NONF		
	(L400+)* (L280+)*		
51 SPARE			
52 CENTRAL ANGLE OF ACTIVE VEH XXX.XX DEG P34,	,P35		
53 SPARE			
FANGE XXX.XX NM ALL XXXX.X FPS THETA XXX.XX DEG	(R31)		
	(L120+)* (L150+)*		
56 SPARE			
57 DELTA P XXXX.X NM LUMI	INARY ONLY		
DELTA V (TPF) DELTA V (TPF) XXXX.X NM XXXX.X FPS XXXX.X FPS	(1430+)*		

59	DELTA V LOS		XXXX.X FPS	P34(L630+)*
			XXXX.X FPS XXXX.X FPS	P35(L280+)*
60	SPARE			LUMINARY ONLY
61	SPARE			
62	SPARE			LUMINARY ONLY
63	SPARE			LUMINARY ONLY
64	SPARE		9.32	LUMINARY ONLY
65	SAMPLED LGC TIME (FETCHED IN INTERRUPT)		COXXX. HRS OOOXX. MIN OXX.XX SEC	ALL
66	LR SLANT RANGE LR POSITION		XXXXX. FT 03001/00002	ALL EXCEPT P20 (R04) R2(ALL)
67	LR VX VY VZ		XXXXX. FPS XXXXX. FPS XXXXX. FPS	ALL EXCEPT P20 (R04)
68	SPARE			LUMINARY ONLY
69	SPARE			
70	ADT DETENT CCCE/STAR CCCE (BEFORE MARK)	(L)	ОСТ	P52 (R52)
71	AOT DETENT CODE/STAP CODE (AFTER MARK)	(L)	OCT	P51,P52 (R53)
72	RR TRUNNION ANGLE RR SHAFT ANGLE		XXX.XX DEG XXX.XX DEG	Δξξ
73	DESIRED RR TRUNNION ANGLE DESIRED RR SHAFT ANGLE	(L)	XXX.XX DEG XXX.XX DEG	W V41 N72
74	SPARE			
75	SPARE			
76	SPARE			
77 ++	SPARE			
+ 78 + ++ P(RR RANGE RR PANGE RATE EN 449 SFARE		XXXXXX FPS	ALL EXCEPT P20 (P04)

80	DATA INCICATOR		XXXXX.		NONE
	CMEGA		XXX.XX	DEG	
81		(L)	XXXX°X		P32(L480+AFTER RECYCLE)*
	DELTA VY(LV)		XXXX° X		P33(L350+AFTER RECYCLE)*
	DELTA VZ(LV)		XXXX.X	FPS	P34(L500+AFTER FINAL CALC)*
					P35(L140+AFTEP FINAL CALC)*
82	DELTA VX(LV)	(L)	XXXX.X	FPS	P30(L100+)*
	DELTA VY(LV)		XXXX.X	FPS	P32(L590+AFTER PECYCLE)*
	DELTA VZ(LV)		XXXX.X	FPS	
83	DELTA VX(LM)		XXXX.X	FPS	P47(L9C+)
	DELTA VY(LM)		XXXX.X	FPS	
	DELTA VZ(LM)		XXXX.X	FPS	
84	DELTA VX(O VEH) (RXV)XR	(L)	XXXX.X		P00, P20 (R32)
	DELTA VY(O VFF) (VXR)		XXXX.X		
	DELTA VZ(O VEH) (-R)		XXXX.X	FPS	
85	VGX (LM)		xxxx.x		P40(L1030+)
	VGY (LM)		XXXX°X	50 1 31 1 	P41(L170+)
	VGZ (LM)		xxxx.x	FPS	P42(L960+)
86	VGX(LV)		xxxx.x		P40,P41,P42
	VGY (LV)		XXXX°X		
	VGZ(LV)		XXXX°X	FPS	
0.7	BACKUS OBTICS LOS ATTIMES				
8 #	BACKUP OPTICS LOS AZIMUTH	(L)	xxx.xx		P51, P52, (R52, R53)
	ELEVATION		xxx.xx	DEG	
0.0	CELESTIAL BODY 1/2 UNIT VECTO	OD (1)	v vvvv		DE1 DE2 (DE2 DE2)
00	CELESTIAL BULY 1/2 UNII VECT	UK (L)	X • XXXXX		P51, P52, (R52, R53)
			Y .XXXXX		
			Z .XXXXX		
0.0	SPARE				
0 7	JFARE				
90	REND OUT OF PLANE PARAMETERS	V	XXX.XX	NIM	R36(IN P32,P33,P34,P35)
90	KEND OUT OF PLANE PARAPETERS	Y DCT	XXXX.X		K30(1N P32, P33, P34, P37)
		PSI	XXX.XX		
		P 21	^^^^	. OFG	
91	SFARE				
7 1	STANL				
92	SPARE				
72	SPARL				
93	DELTA GYRC ANGLES	(L)	x xx.xxx	neg	P52 (R55)
, ,	SEETA STAC ACCULA	, _ /	Y XX.XXX		122 1.221
			7 XX. XXX		
			. ^^•/^^	1720	
94	SPARE				
V -1					
95	SPARE				

96 SPARE

97	SYSTEM	TEST	INPUTS		(L	.)	XXXXX.	GRD	USF
98	CVCTEM	TCCT	RESULTS	440	IA CUT C		xxxxx.		1
70	31316	1031	KESUL IS	AND	INFUIS	(L)	***** *****	GRD	USE
99	RMS PCS RMS VEL						XXX.XX NM XXXX.X FPS	ALL	(V45)

CHANGE CENTREL NOTES

REV C6 PCN-MIT-119 + PCN-MIT-136 REV C7 PCN 449

APOLLO COMPUTER LOGIC CHECKLIST INTERFACE

REV 33

06/13/58

THIS LIST REPRESENTS THE CHECKLIST REFERENCE CODES USED WITH THE "PLEASE PERFORM CHECKLIST" REQUEST (VERB 50 NOUN 25)

R1 CODE

ACTION TO BE EFFECTED

00011 KEY IN AUTO OPTICS POSITIONING OPTION

00012 KEY IN TARGET DATA

00014 KEY IN FINE ALIGNMENT OPTION

00015 PERFORM STAR ACQUISITION

00016 KEY IN TERMINATE MARK OPTION

20017 PERFORM ADDITIONAL SIGHTINGS

00031 KEY IN ENGINE ON OPTION

00035 PERFORM LGC PREPARATION

00036 PERFORM THRUST FERMINATION

00062 SWITCH LGC POWER DOWN

00201 SWITCH RR MODE TO AUTOMATIC

00202 KEY IN SIGHTING CHECK OPTION

00203 SWITCH GUIDANCE CONT TO GNC, MODE TO AUTO, THR CONT TO AUTO

00204 KEY IN ENABLE GIMBAL TRIM OPTION

00205 PERFORM MANUAL ACQUISITION OF CSM WITH RR

* SWITCH-DENOTES CHANGE POSITION OF A CONSOLE SWITCH

PERFORM-DENOTES START OR END OF A TASK

KEY IN-DENOTES KEY IN DE DATA THRU THE DSKY

CHANGE CONTROL NOTES

808

APOLLO COMPUTER LOGIO CHECKLIST INTERFACE

REV 33

06/13/68

4.8 THIS LIST REPRESENT THE OPTION CODES DISPLAYED IN R1 IV CONJUNCTION WITH VERS 34 NOUN 06 TO REQUEST THE ASTRONAUT TO LOAD INTO P2 THE OPTION HE DESIRES FOR PROGRAM SUNDANCE.

THE SPECIFIED OPTION CODES WILL BE DISPLAYED IN RI IN CONJUNCTION WITH FL VO4 NO6 TO REQUEST THE ASTRONAUT TO LOAD INTO R2 THE OPTION HE DESIRES.

R1

OPTION

CODE PURPOSE INPUT FOR R2

00001 SPECIFY IMU ORIENTATION 1=PREF, 2=NOM, 3=REFSMMAT, 4=LAND SITE

00002 SPECIFY VEHICLE 1=THIS, 2=CTHER (P21, R30)

00003 SPECIFY TRACKING ATTITUDE 1=PERFERRED, 2=OTHER (R63)

00004 SPECIFY RADAR 1=RR, 2=LR(RD4)

00006 SPECIFY RR CDARSE ALIGN 1=_DCK, 2=CONT. DESIG. (V41N72)

REV 03 PCN-WIT-134



00405

00421

00501

APOLLO COMPUTER LOGIC CHECKLIST INTERFACE

P52

R23

INTEGRV

						056				
						REV	04		01/17/6	9
4.9 TI	HIS	LIST REPRESENTS THE ALARM CODES USED WITH VE	PR 05	NCUN	09 FCF	PROG	RAM SUN	NDANC	E.	
R1										
CODE		PURPOSE	SET	ВУ						×
00105		AOT MARK SYSTEM IN USE	ACTM	ARK						
00107		MORE THAN 5 MARK PAIRS	ACTM	ARK						
00111		MARK MISSING	AOTM	ARK						
00112		MARK OR MARK REJECT NOT BEING ACCEPTED	ACTM	ARK						
00113		NC INBITS	ACTM	ARK						
00114		MARK MACE BUT NOT DESIRED	AOTM	ARK						
00115		NC MARKS IN LAST PAIR TO REJECT	ACTM	ARK						
00206		ZERO ENCODE NOT ALLOWED WITH COARSE ALIGN + GIMBAL LOCK	IMU	MODE	SWITCH					
00207		ISS TURNON REQUEST NCT PRESENT FCR 90 SEC	T4RU	IPT						
00210		IMU NCT CPERATING	IMU	MODE	SWITCH	IMU	2, RO2	, P51		
00211		COARSE ALIGN ERPER	IMU	MODE	SWITCH					
00212		PIPA FAIL BUT PIPA IS NCT BEING USED	IMU	MODE	SWITCH	T4RU	IPT			
00213		IMU NCT OPERATING WITH TURN-CN REQUEST	T4RU	IPT						
00214		PROGRAM USING IMU WHEN TURNED OFF	T4RL	JPT						
00215		PREFERRED ORIENTATION SELFCIED BUT NOT SPECIFIED	P52							
00217		BAD RETURN FROM STALL ROUTINES	CURT	TAINS						
00220		IMU NOT ALIGNED (BAC REFSMMAT)	R47,	PC2	165					
00401	*	DESIRED GIMBAL ANGLES YIELD GIMBAL LOCK	INF	AL IGN	, IMU2	, R60				

TWO STARS NOT AVAILABLE

RADAR ANTENNA REYOND PRESENT MODE LIMITS

W-MATRIX OVER FLOW

00502		LCS OUTSIDE OF LIMITS OF BOTH RR ANTENNA MODES	V41N72
00503		RACAR ANTENNA CESIGNATE FAIL	R21, V41N72
00510		RADAR AUTO DISCRETE NCT PRESENT	R25
00514		RACAR GOES CUT OF AUTO MODE WHILE IN USE	R25
00515		RR CDU FAIL DISCRETE PRESENT	R25
00520		RADARUPT NOT EXPECTED AT THIS TIME	P20
00521		RR DATA COOD NOT PRESENT	P20
00522		LANDING RADAR POSITION CHANGE	RADAR READ
00523		LR ANTENNA CIDN'T ACHIEVE POSITION 2	V61
00525		DELTA THETA GREATER THAN 3 DEG	R22
00526		RANGE GREATER THAN 400 MILES	P20
00527		LOS OUTSIDE OF ANTENNA MODE LIMITS	R24
+00600 ++ ED IT		IMAGINARY RCCTS ON FIRST ITERATION	P32
00601		PERICTR ALTITUDE (POST CSI) LESS THAN 85 NM	P32
00602		PERICTR ALTITUDE (PCST CDH) LESS THAN 85 NM	P32
00603		CSI TO COH TIME LESS THAN 10 MIN	P32
00604		CDH TO TPI TIME LESS THAN 10 MIN	P32
00605		NUMBER OF ITERATIONS EXCEEDS LOOP MAXIMUM	P32
00606		DV EXCEEDS WAXIMUM	P32
00611		NC GETI FOR GIVEN ELEV ANGLE	P33,P34
00777		PIPA FAIL CAUSED THE ISS WARNING	TARUPT
01102		LGC SELF TEST ERROR	SELF CHECK
01103	*	UNUSED CCS BRANCH EXECUTED	ABCPT
01104	*	DELAY ROUTINE BUSY	EXEC
01105		DOWNLINK TOO FAST	T4RUPT
01106		UPLINK TOO FAST	TARUPT

ALARMS/SON

01107		PHASE TABLE FAILURE. ASSUME ERASABLE MEMORY IS DESTROYED	RESTART
01201	*	EXECUTIVE OVERFLOW-NO VAC AREAS	EXEC
01202	*	EXECUTIVE OVERFLOW-NC CORE SETS	EXEC
01203	*	WAITLIST OVERFLOW-TOC MANY TASKS	WAITLIST
01206	*	SECOND JOB ATTEMPTS TO GO TO SLEEP VIA KEYBOARD AND DISPLAY PROGRAM	PINBALL
01207	. *	NO VAC AREA FOR MARKS	AOTMARK
01210	. *	TWC PROGRAMS USING DEVICE AT SAME TIME	IMU MODE SWITCH
01211	*	ILLEGAL INTERRUPT OF EXTENDED VERB	ACTMARK
+01301		ARCSIN-ARCCCS ARGUMENT TOC LARGE.	INTERPRETER
** PCR 59 01302		SQRT CALLED WITH NEGATIVE ARGUMENT. ABORT	INTERPRETER
01407		VG INCREASING	S40.8
01501	*	KEYBOARD AND DISPLAY ALARM DURING INTERNAL USE (NVSUB). ABORT	PINBALL
01502	*	ILLEGAL FLASHING DISPLAY	GOPLAY
01520		V37 REQUEST NOT PERMITTED AT THIS TIME	V37
01600		OVERFLOW IN DRIFT TEST	CPT PRE ALIGN CALIB IMU 4 (LEM)
+01601 ++ EDIT		BAC IMU TOPQUE.	OPT PRE ALIGN CALIB. IMU 4 (LEM)
01703		LESS THAN 45 SECS TO IGNITION	P41, P42
01706		CSM DOCKED BIT SET IN ASCENT (NC SUCH DAP) P40 SELECTED WITH DESCENT UNIT STAGED P42 SELECTED WITHOUT DESCENT UNIT STAGED	R03
01711		STATE VECTOR INTEGRATION NOT FINISHED PRIOR TO TIG - 30 SECONDS.	P4C, P41, P42
02000	*	DAP STILL IN PPCGRESS AT NEXT TIMES RUPT	DAP
02001		JET FAILURES HAVE DISABLED Y-Z TRANS.	CAP
02002		JET FAILUPES HAVE DISABLED X TRANSLATION	CAP
02003		JET FAILUPES HAVE MISABLED P-ROTATION	DAP

02004	JET FAILURES HAVE CISABLED U-V RCTATION	DAP
03777	ICDU FAIL CAUSED THE ISS WARNING	T4RUPT
04777	ICDU, PIPA FAILS CAUSED THE ISS WARNING	T4RUPT
07777	IMU FAIL CAUSED THE ISS WARNING	T4RUPT
10777	IMU, PIPA FAILS CAUSED THE ISS WARNING	T4RUPT
13777	IMU, ICCU FAILS CAUSED THE ISS WARNING	T4RUPT
14777	IMU, ICCU, PIPA FAILS CAUSED THE ISS WENING	T4RUPT

^{*} INCICATES ABORT TYPE. ALL CTHERS ARE NON-ABORTIVE EXCEPT 401 WHICH IS BOTH.

NOTE: FOR VO5 NO9 DISPLAYS:
R1-OXXXX (FIRST ALARM TO OCCUR AFTER LAST RESET).
R2-OXXXX (SECOND ALARM TO OCCUR AFTEP LAST RESET).
R3-OXXXX (ALARM WHICH OCCURRED LAST).

CHANGE CONTROL NOTES

REV 03 PCR MIT 137
REV 04 PCR 593.1 , EDITORIAL CORRECTIONS

R-557

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