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MAY 13,1966

GEORGE C. MARSHALL SPACE FLIGHT CENTER
HUNTSVILLE, ALABAMA

# INTERFACE CONTROL DOCUMENT DEFINITION OF SATURN SA-502 FLIGHT SEQUENCE PROGRAM

PREPARED BY:
AIRBORNE ELECTRICAL SYSTEMS BRANCH
ASTRIONICS LABORATORY

National Aeronautics and Space Administration

NASA

MSFC - Form 454 (Revised September 1961)

| EFFECTIVE ON: SA-502 | | 40M33622C |
|---|---|---|

DEFINITION OF SATURN SA-502

FLIGHT SEQUENCE PROGRAM

MSFC CCBD 501-8-0171 DRD 2/13/68 V-9009

| | | | | | | |
|---|---|---|---|---|---|---|
| F | | | | | | |
| E | | | | | | |
| D | | | | | | |
| C | J L Felch | 1-17-68 | John D. Stroud | 17 Jan 68 | Phil Youngblood | 1-17-68 |
| B | J. L. Felch | 9-20-67 | John D. Stroud | 9-20-67 | P. Youngblood | 9-20-67 |
| A | Jerald L. Felch | 2-13-67 | John D. Stroud | 2-13-67 | H. J. Fichtner | 2-15-67 |
| ORIG | W. G. Shields | 5-12-66 | R. G. Smith | 5-12-66 | H. J. Fichtner | 5-12-66 |
| | NAME | DATE | NAME | DATE | NAME | DATE |
| | SUBMITTED | | APPROVED | | APPROVED | |

**PREPARED FOR:** ELECTRICAL WORKING GROUP

# SATURN INTERFACE CONTROL DOCUMENT

# SATURN INTERFACE CONTROL DOCUMENT
# CHANGE/REVISION RECORD

| CHANGE/ REVISION | DATE | DESCRIPTION | SHEET | |
|---|---|---|---|---|
| | | | REVISION | ADDED |
| Revision A | 2/15/ 67 | Incorporated IRN #1, #2 and #3. | 1-45 | |
| | | Revised Table of Contents. | | |
| | | Renumbered all pages. | | |
| | | Revised para IIA to include early staging. | 1 | |
| | | Revised para II, Sub para B thru I. This revision includes changes to Time Base #1 through #7 and Additional SA-502 Sequence of Events. | 2, 3 | |
| | | Added para II J, Alternate Time Base #4a ($T_{4a}$) for S-II/S-IVB Early Staging. | | 4 |
| | | Revised para IV. ABBREVIATIONS. | 9 | |
| | | Added Para V. LOGIC DIAGRAMS. | | 9 |
| | | Changed Para V. CHANGES to para VI. and revised comments. | 9 | |
| | | Added logic diagrams for Primary Time Bases #1 thru #7 and Alternate Time Base #4a. | | 10-17 |
| | | Incorporated latest burn time for all stages. | 18-45 | |
| | | Deleted "Command 70 lb Ullage Engines On". | 18-21 | |
| | | Deleted "Command 70 lb Ullage Engines Off". | 18-22 | |
| | | Added a signal to arm the S-IC Inboard Engine Cutoff. | | 19 |

**ASTR Form # 102 (OT), March 12, 1965**

# SATURN INTERFACE CONTROL DOCUMENT
# CHANGE/REVISION RECORD

| CHANGE/ REVISION | DATE | DESCRIPTION | SHEET | |
|---|---|---|---|---|
| | | | REVISION | ADDED |
| | | Revised the time for S-IC/S-II separation and succeeding program times affected by this change. | 21 | |
| | | Revised the time for engine ready bypass. | 25 | |
| | | Revised the closing time of the S-II $LH_2$ recirculation pump discharge valve. | 25 | |
| | | Extended the S-II/S-IVB separation time from S-II engine cutoff by 0.5 seconds and revised the preceding and succeeding times affected by this change. | 25 | |
| | | Moved command "Q-Ball Power Off" from Time Base #2 to Time Base #3 | 25 | |
| | | Revised the times for closing the S-IVB chilldown pilot valves during first burn. | 27 | |
| | | Added a signal to disarm the S-IVB point level sensors after S-IVB Engine cutoff. | | 28 |
| | | Revised the time to switch the flight control computer to S-IVB coast mode after the first burn. | 28 | |
| | | Added command "S-IVB Ullage Engine #1 On". | | 28-34 |
| | | Added command "S-IVB Ullage Engine #2 On". | | 28-34 |
| | | Added command "S-IVB Ullage Engine #1 Off". | | 29-36 |
| | | Added command "S-IVB Ullage Engine #2 Off. | | 29-36 |

# SATURN INTERFACE CONTROL DOCUMENT
## CHANGE/REVISION RECORD

| CHANGE/ REVISION | DATE | DESCRIPTION | SHEET | |
|---|---|---|---|---|
| | | | REVISION | ADDED |
| | | Revised the time to switch the auxiliary hydraulic pump from flight to coast mode after the first S-IVB burn. | 29 | |
| | | Revised the time to cutoff PU boil-off bias. | 28 | |
| | | Revised the times for opening & closing the continuous vent valves. | 29 | |
| | | Revised the time for shutoff of the S-IVB ullage engines before orbital coast. | 29 | |
| | | Added commands to boost close the propellant tank vent valves after orbital coast. | | 34 |
| | | Revised the times for starting the chilldown pumps prior to S-IVB restart. | 34-35 | |
| | | Added "SS/FM Transmitter On". | | 35 |
| | | Added "SS/FM Group On". | | 35 |
| | | Added "SS/FM Transmitter Off". | | 38 |
| | | Added "SS/FM Group Off". | | 38 |
| | | Revised the time to repressurize the LOX tank. | 35 | |
| | | Revised the time for shutoff of the S-IVB ullage engine after fuel lead initiation. | 36 | |
| | | Revised the time for enabling LOX tank pressurization. | 36 | |

# SATURN INTERFACE CONTROL DOCUMENT
# CHANGE/REVISION RECORD

| CHANGE/ REVISION | DATE | DESCRIPTION | SHEET | |
|---|---|---|---|---|
| | | | REVISION | ADDED |
| | | Revised the time for arming the propellant level sensors for second burn cutoff. | 37 | |
| | | Revised the time for deactivating the PU system after second burn. | 38 | |
| | | Revised the times for shutoff of the auxiliary hydraulic system after second burn cutoff. | 38 | |
| | | Added the program times for the $LH_2$ and LOX tank venting sequence after second burn cutoff. | | 38,39 |
| | | Deleted the following commands: | | |
| | | PU Inverter & DC Power Off | 18 | |
| | | PU Inverter & DC Power On | 20 | |
| | | Flight Transmitter Group On | 26 | |
| | | Flight Transmitter Group Off | 20, 26 | |
| | | Flight SCO Group On | 26 | |
| | | Flight SCO Group Off | 20, 26 | |
| | | Orbit Transmitter Group On | 26 | |
| | | Orbit Transmitter Group Off | 20, 26 | |
| | | Added the command "Flight Control Computer S-IVB Burn Mode On "B". | | 25,36 |
| | | Added the command "Flight Control Computer S-IVB Burn Mode Off "B". | | 28,38 |
| | | Revised record and timer initiation of S-II data recorders. | 18, 22, 24, 25 | |
| | | Revised the record and playback time of IU tape recorders | 19, 22, 24, 26, 30 | |
| | | Revised record and playback time of S-IVB tape recorders. | 19, 22, 24, 26 | |
| | | Revised Flight Control Computer Switch Point sequencing time. | 23, 37, 44 | |

ASTR Form # 102 (OT), March 12, 1965

# SATURN INTERFACE CONTROL DOCUMENT
# CHANGE/REVISION RECORD

| CHANGE/ REVISION | DATE | DESCRIPTION | SHEET REVISION | SHEET ADDED |
|---|---|---|---|---|
| | | Deleted Flight Control Computer Switch Point #2. | 9 | |
| | | Added Alternate Time Base #4a ($T_{4a}$) Sequence of Events. | | 41-44 |
| | | Revised the time for "S-IVB Ullage Thrust Present Indication On". | 28, 34 | |
| | | Revised the time for "S-IVB Ullage Thrust Present Indication Off". | 29, 36 | |
| | | Added the command "Fuel Injection Temperature OK Bypass Reset". | | 26, 37 43 |
| | | Revised the time for initiating the command "Water Coolant Valve Open". | 22 | |
| | | Added command "Engine Pump Purge Control Valve Enable On". | | 27 |
| | | Added explanation for S-IVB engine pump purge control valve enable on at $T_5$ - 7.0 seconds. | | 27 |
| | | Revised various other less critical events on either the Nominal Flight Time or computer time base or both as a result of P&VE requirements (P&VE Drawing No. 10M30632, Rev. A). | 1-45 | |
| | | Deleted "Rate Gyro Off" command. | 14 | |
| | | Deleted "AZUSA Transponder Power Off" command. | 19 | |
| | | Revised the time for "Launch Vehicle Engines EDS Cutoff Enable" from $T_1$ + 60 to $T_1$ + 30 seconds. | 18 | |

# SATURN INTERFACE CONTROL DOCUMENT
# CHANGE/REVISION RECORD

| CHANGE/ REVISION | DATE | DESCRIPTION | SHEET | |
|---|---|---|---|---|
| | | | REVISION | ADDED |
| Revision B | 9/20/ 67 | Incorporated IRN's #4 through 10 | 1-47 | |
| Revision C | 1/18/ 68 | Incorporated IRN's #11 through 17 | 19, 21, 25, 35, 36, 37, & 42 | |

TABLE OF CONTENTS

GEORGE C. MARSHALL SPACE FLIGHT CENTER

# DEFINITION OF SATURN SA-502 FLIGHT SEQUENCE PROGRAM

## I. INTRODUCTION

The purpose of this document is to define the flight sequence events, time bases, stage switch selector channel assignments, LVDA Discrete Outputs, Inputs and Interrupts for the Saturn SA-502 vehicle. Special requirements and restrictions defined in this document will be imposed on the Marshall Space Flight Center and its contractors, as applicable, to insure the proper functioning of the equipment in the various stages for required vehicle timing and sequencing to occur as outlined in this Interface Control Document (ICD).

## II. DEFINITION OF TIME BASES FOR THE TIME SEQUENCING OF SA-502.

### A. General

Seven (7) primary time bases are used in this SA-502 Vehicle Flight Sequence Program in order to achieve an optimum vehicle mission with suitable sequential operation and timing of flight vehicle events. One (1) alternate time base and its sequence of events are programmed for use in early staging of the S-IVB stage.

Safeguards are used where necessary to prevent premature initiation of time bases.

Proper establishment of time bases provides a safe and reliable vehicle on the pad and throughout the flight. Each time base will be established by the normal method when the required criteria, as outlined in this ICD, has been received by the Launch Vehicle Digital Computer (LVDC).

If a time base is not established, subsequent time bases cannot be started and the vehicle mission cannot be completed. Therefore, to further increase mission reliability in the absence of the normal time base signals, backup methods are used for establishing time bases.

Both the normal and backup methods for starting each time base are explained in the following paragraphs.

B. Time Base #1 ($T_1$)

Time Base #1 ($T_1$) is initiated by a liftoff signal provided by the deactuation of the liftoff relay in the IU at the umbilical disconnect. However, as a safety measure, the Launch Vehicle Digital Computer (LVDC) will not recognize the liftoff signal and start $T_1$ prior to receiving Guidance Reference Release plus 16.0 seconds (Liftoff -1.0 second).

A backup method for starting $T_1$ is provided should the LVDC fail to receive or recognize the liftoff signal. If $T_1$ is not initiated within 17.5 seconds after Guidance Reference Release, the LVDC will monitor the vertical accelerometer. If a significant positive acceleration (in excess of 1 g.) exists, the LVDC assumes liftoff has occurred and begins $T_1$. A time adjustment is made by the computer.

No "Negative Backup" (i.e., provisions for the LVDC to return to prelaunch conditions) is provided because the Saturn V vehicle could safely complete $T_1$ on the pad without catastrophic results, in the event $T_1$ began by error.

C. Time Base #2 ($T_2$)

Time Base #2 ($T_2$) is initiated at S-IC inboard engine cutoff by either of two redundant inboard engine out signals. However, the LVDC must arm inboard engine cutoff and sufficient downrange velocity must exist before the LVDC will start $T_2$.

Use of the downrange velocity reading provides a safeguard against starting $T_2$ on the pad should $T_1$ be started without liftoff. Furthermore, if $T_2$ is not established, no subsequent time bases can be started. This insures a safe vehicle requiring at least one additional failure to render the vehicle unsafe on the pad.

D. Time Base #3 ($T_3$)

Time Base #3 ($T_3$) is initiated at S-IC outboard engines cutoff by either of two redundant outboard engines cutoff signals. However, the LVDC must arm outboard engines propellant depletion cutoff prior to starting $T_3$.

E. Time Base #4 ($T_4$)

After arming the S-II engines LOX depletion cutoff sensors, the LVDC will initiate Time Base #4 ($T_4$) upon receiving either of two redundant signals, S-II Engines Cutoff or S-II Engines Out. The S-II engines cutoff signal from the S-II depletion cutoff circuitry is the primary signal for starting $T_4$. The S-II engines out signal from the thrust OK circuitry is a backup.

A redundant S-II engines cutoff command is issued at the start of $T_4$ ($T_4$ + 0.0), as a safeguard against having started $T_4$ with the thrust of the S-II engines present.

F. Time Base #5 ($T_5$)

After a predetermined time, sufficient to allow the S-IVB engine to establish thrust OK, the LVDC will start $T_5$ after receiving any two of four functions monitored by the LVDC. The functions are (1) S-IVB Engine Out "A" (2) S-IVB Engine Out "B" (3) S-IVB Velocity Cutoff which is issued by the LVDC (4) Loss of thrust determined by the LVDC using accelerometer readings.

A redundant S-IVB engine cutoff command is issued at the start of $T_5$ ($T_5$ + 0.0) as a safeguard against having started $T_5$ with the thrust of the S-IVB engine present.

G. Time Base #6 ($T_6$)

Time Base #6 will be initiated by LVDC after solving the restart equation. However, the starting of $T_6$ will be inhibited until a predetermined time on Time Base #5.

H. Time Base #7 ($T_7$)

After a predetermined time, sufficient to allow the S-IVB engine to establish thrust OK, the LVDC will start $T_7$ after receiving any two of four functions monitored by the LVDC. The functions are (1) S-IVB Engine Out "A" (2) S-IVB Engine Out "B" (3) S-IVB Velocity Cutoff which is issued by the LVDC (4) Loss of thrust determined by the LVDC using accelerometer readings.

A redundant S-IVB engine cutoff command is issued at the start of $T_7$ ($T_7$ + 0.0) as a safeguard against having started $T_7$ with the thrust of the S-IVB engine present.

I. Additional SA-502 Sequence Events

(1) The C-Band transponders on SA-502 will be switched by the LVDC through the IU switch selector. The LVDC will be programmed to switch from one to the other or to both according to the vehicle orientation and position. The times for switching will be variable. Commands for switching the C-Band transponders will not interfere with other programmed events of the SA-502 flight sequence program.

(2) After liftoff plus 180 seconds the water coolant valve will be switched open or closed by the LVDC through the IU switch selector.

The LVDC will be programmed to open the collant valve when either of two thermal switches mounted in the water/methanol system close and to close the valve when both of the switches are open. This will not interfere with other events in the flight sequence.

J. Alternate Time Base #4a ($T_{4a}$)

This alternate time base and its sequence of events will be programmed for use in early staging of the S-IVB stage. Alternate Time Base #4a will be initiated by RF Ground Command. However, the starting of time Base #4a will be inhibited until $T_3$ + 1.3 seconds.

If $T_{4a}$ is used, the LVDC will return to Primary Time Base #5 at S-IVB engine cutoff.

## III. LVDA DISCRETE OUTPUTS, INPUTS AND INTERRUPTS

The following tables list the LVDA Discrete Outputs, Discrete Inputs, and Interrupts used on this vehicle to accomplish the flight sequencing program as defined in this Interface Control Document.

### A. LVDA DISCRETE OUTPUTS

| LVDA Connector & Pin Number | Function |
|---|---|
| J17h | Reset Command Decoder |
| J13J | Reset RCA 110A |
| J13e | RCA 110A Interrupt |
| J4AA | Spare (Wired to Control Distributor) |
| J2EE | Guidance Failure |
| J2u | Spare (Wired to Control Distributor) |
| J2c | Spare (Wired to Control Distributor) |
| J2G | Spare (Wired to Control Distributor) |
| J4m | Spare (Wired to Control Distributor) |

A. LVDA DISCRETE OUTPUTS (Continued)

| LVDA Connector & Pin Number | Function |
|---|---|
| J4a | Spare (Wired to Control Distributor) |
| J4d | Spare (Wired to Control Distributor) |
| J4e | Spare (Wired to Control Distributor) |
| J4f | LVDA/LVDC Firing Enable |
| J4S | LVDA/LVDC Firing Commit Inhibit |
| J4C | Switch Selector Address First Digit |
| J4B | Switch Selector Address Second Digit |
| J4A | Switch Selector Address Third Digit |
| J4D | Switch Selector Address Fourth Digit |
| J4Y | Switch Selector Address Fifth Digit |
| J4X | Switch Selector Address Sixth Digit |
| J4W | Switch Selector Address Seventh Digit |
| J4V | Switch Selector Address Eighth Digit |
| J4p | Switch Selector Read |
| J4n | Switch Selector Read |
| J4U | Switch Selector Register Reset |
| J4T | Switch Selector Register Reset |
| J4r | S-IC Switch Selector Enable |
| J4q | S-IC Switch Selector Enable |
| J4Z | S-II Switch Selector Enable |
| J4E | S-II Switch Selector Enable |

A. LVDA DISCRETE OUTPUTS (Continued)

| LVDA Connector & Pin Number | Function |
|---|---|
| J4J | S-IVB Switch Selector Enable |
| J4F | S-IVB Switch Selector Enable |
| J4CC | IU Switch Selector Enable |
| J4BB | IU Switch Selector Enable |
| J4K | Spare (Switch Selector Enable, SS-12D) |
| J4s | Spare (Switch Selector Enable, SS-12) |

B. LVDA DISCRETE INPUTS

| LVDA Connector & Pin Number | Function |
|---|---|
| J13h | RCA 110A Sync |
| J17X | Command Decoder OM/D "A" |
| J17Y | Command Decoder OM/D "B" |
| J2BB | Spare (Wired to S-IVB/IU Interface) |
| J2CC | Spare (Wired to S-IVB/IU Interface) |
| J2e | S-IVB Engine Out "A" |
| J2a | Spare (Wired to Control Distributor) |
| J8i | Spare (Wired to ESE) |
| J8N | Spare (Wired to ESE) |
| J2F | Spare |
| J2t | S-II/S-IVB Separation |
| J2n | S-IC Inboard Engine Out "B" |

B. LVDA DISCRETE INPUTS (Continued)

| LVDA Connector & Pin Number | Function |
|---|---|
| J2p | S-IC/S-II Separation |
| J2q | S-II Inboard Engine Out |
| J2r | S-IC Outboard Engine Out |
| J2Z | S-II Aft Interstage Separation |
| J2E | Prepare for Guidance Reference Release |
| J2U | Spare |
| J2X | S-IC Outboard Engines Cutoff "B" |
| J2V | S-II Engines Out |
| J2W | Spare |
| J4N | S-II Outboard Engine Out |
| J4M | Spare (Wired to Control Distributor) |
| J4L | Spare (Wired to Control Distributor) |
| J2s | Liftoff |
| J4b | Switch Selector Address Verification First Digit |
| J4t | Switch Selector Address Verification Second Digit |
| J4DD | Switch Selector Address Verification Third Digit |
| J4EE | Switch Selector Address Verification Fourth Digit |
| J4u | Switch Selector Address Verification Fifth Digit |

B. LVDA DISCRETE INPUTS (Continued)

| LVDA Connector & Pin Number | Function |
|---|---|
| J4c | Switch Selector Address Verification Sixth Digit |
| J4G | Switch Selector Address Verification Seventh Digit |
| J4H | Switch Selector Address Verification Eighth Digit |
| J2AA | Coolant Thermal Switch #1 |
| J2m | Coolant Thermal Switch #2 |

C. LVDA INTERRUPTS

| LVDA Connector & Pin Number | Function |
|---|---|
| J8BB | Command LVDA/RCA 110 Interrupt |
| J2B | S-IC Inboard Engine Out "A" |
| J8q | RCA 110A Interrupt |
| J2C | S-IVB Engine Out "B" |
| J2A | S-IC Outboard Engines Cutoff "A" |
| J2D | S-II Engines Cutoff |
| J2Y | Guidance Reference Release |
| J17A | Command Decoder Interrupt "A" |
| J17B | Command Decoder Interrupt "B" |
| Internal | TLC - Simultaneous Memory Error |

C. LVDA INTERRUPTS (Continued)

| LVDA Connector & Pin Number | Function |
|---|---|
| J18G | Data Ready From C.I.U. |
| Internal | Switch Selector Interrupt |
| Internal | Minor Loop Interrupt |

## IV. ABBREVIATIONS

| | |
|---|---|
| C.I.U. | Computer Interface Unit |
| EDS | Emergency Detection System |
| ICD | Interface Control Document |
| IU | Instrument Unit |
| L.E.T. | Launch Escape Tower |
| $LH_2$ | Liquid Hydrogen |
| LOX | Liquid Oxygen |
| LVDC | Launch Vehicle Digital Computer |
| LV/SC | Launch Vehicle/Spacecraft |
| P.U. | Propellant Utilization |
| S/S | Single Side Band |

## V. LOGIC DIAGRAMS

The logic diagrams, pages 10 through 17, indicate the conditions that must exist before initiation of each time base programmed for use on the AS-502 mission. Logic diagram, Page 18, indicates conditions that must exist for water valve cycling.

## VI. CHANGES

As requirements change and as the need arises, changes will be approved and released against this document and revisions to incorporate these changes will follow. Questions and requests for changes by all parties concerned should be put in writing and directed to R-ASTR-EAA, Marshall Space Flight Center, Alabama, 35812. The telephone number for R-ASTR-EAA is 876-5463.

# V. LOGIC DIAGRAMS

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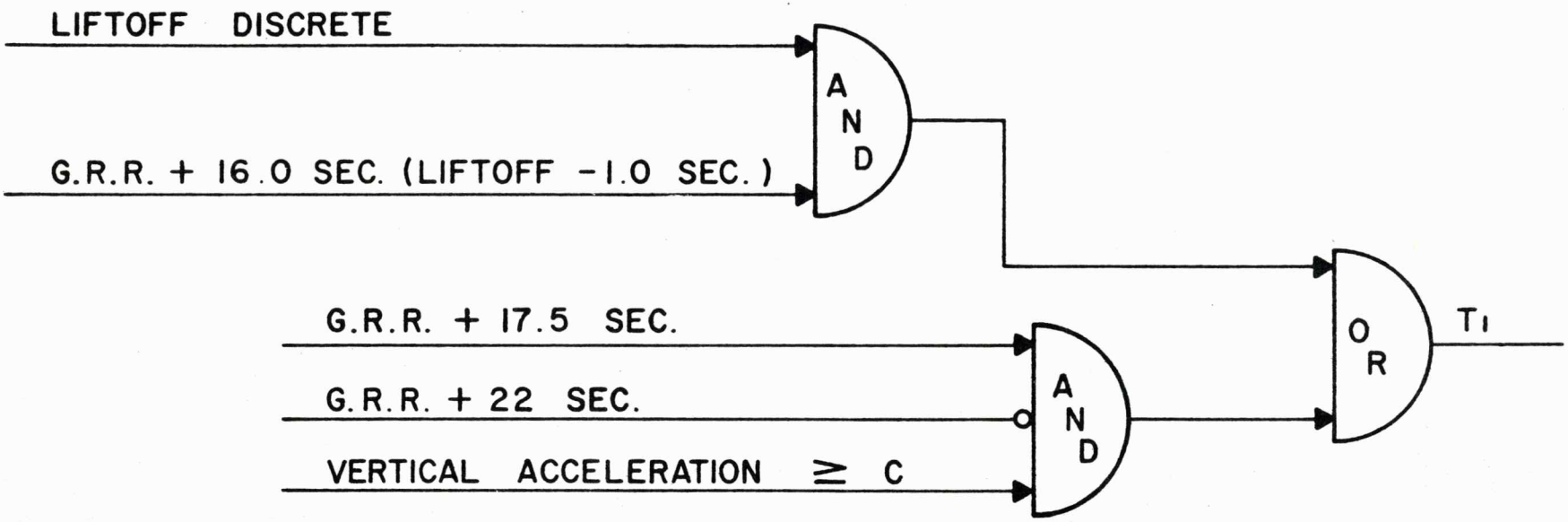
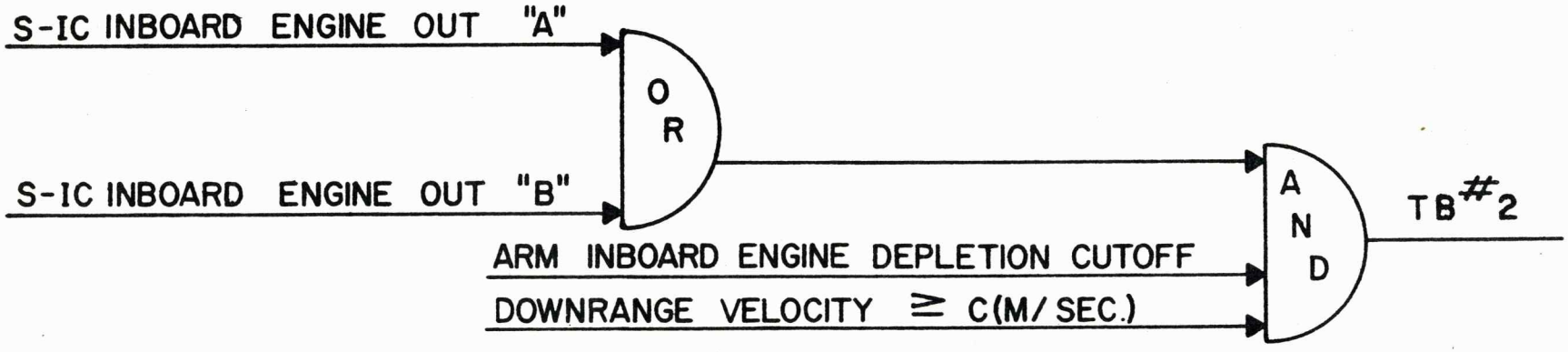
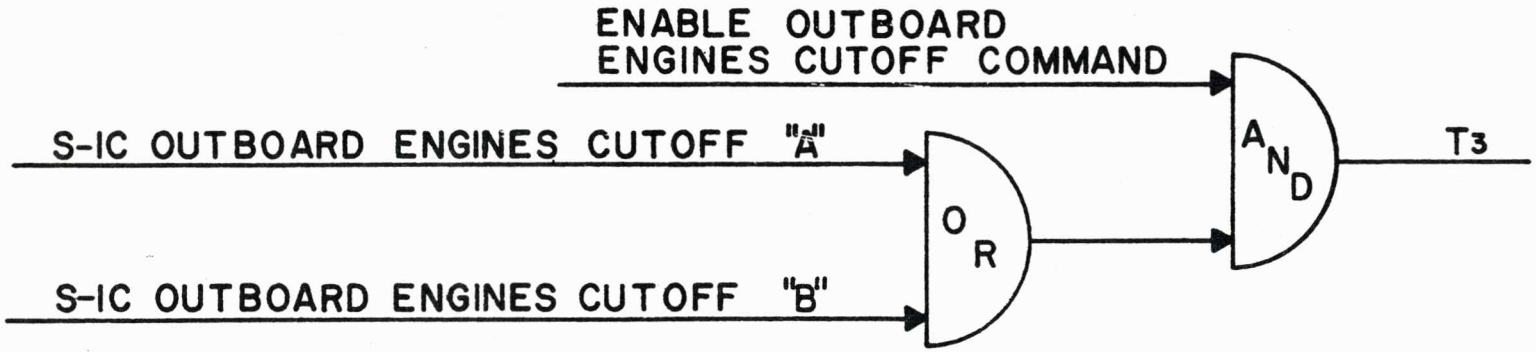


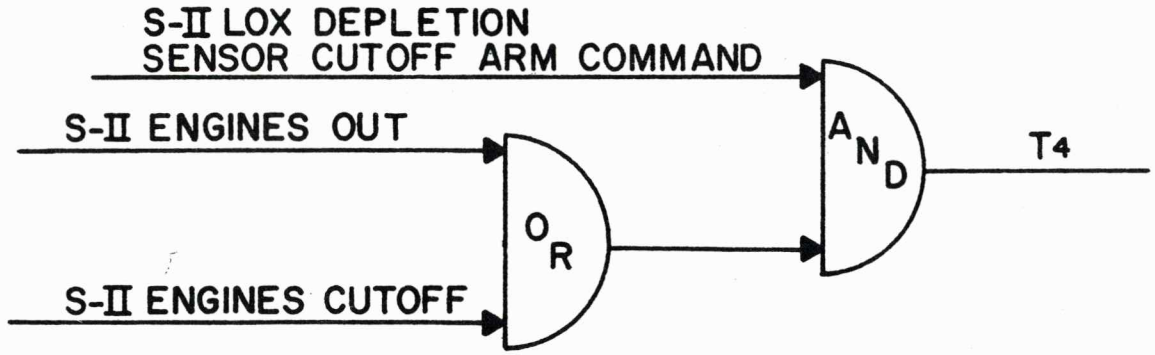

TIME BASE # 1


S-IC INBOARD ENGINE OUT "A"
S-IC INBOARD ENGINE OUT "B"
O
R
ARM INBOARD ENGINE DEPLETION CUTOFF
DOWNRANGE VELOCITY ≥ C(M/SEC.)
A
N
D
TB # 2

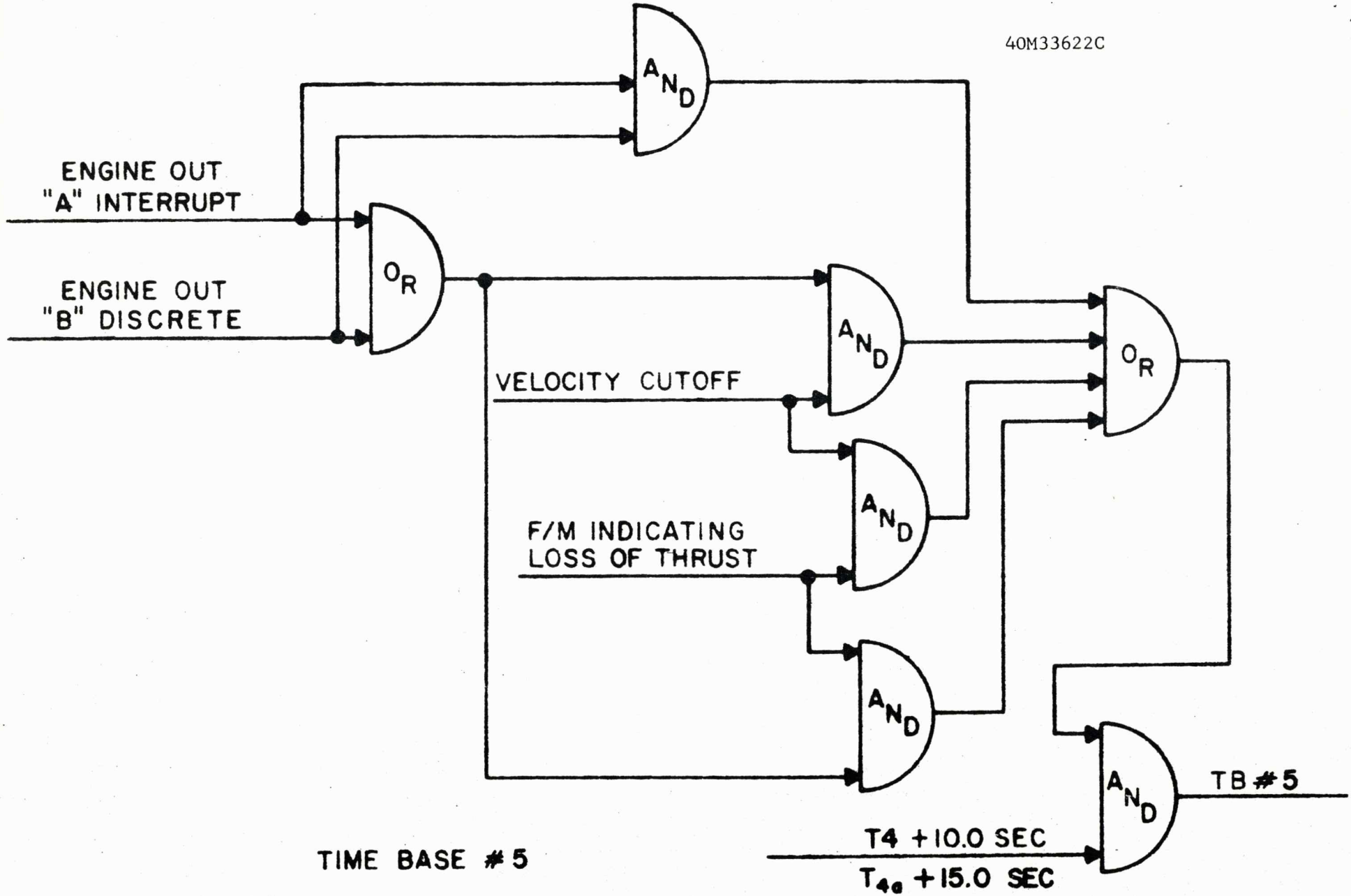
TIME BASE # 2


ENABLE OUTBOARD
ENGINES CUTOFF COMMAND
S-IC OUTBOARD ENGINES CUTOFF "A"
S-IC OUTBOARD ENGINES CUTOFF "B"
OR
AND
T3

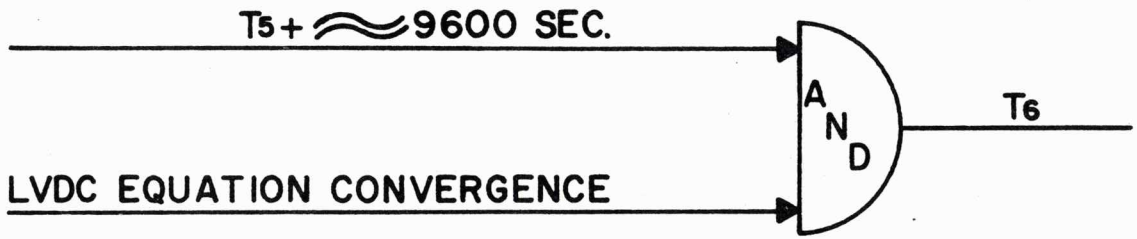
TIME BASE #3


S-II LOX DEPLETION
SENSOR CUTOFF ARM COMMAND
S-II ENGINES OUT
S-II ENGINES CUTOFF
OR
AND
T4

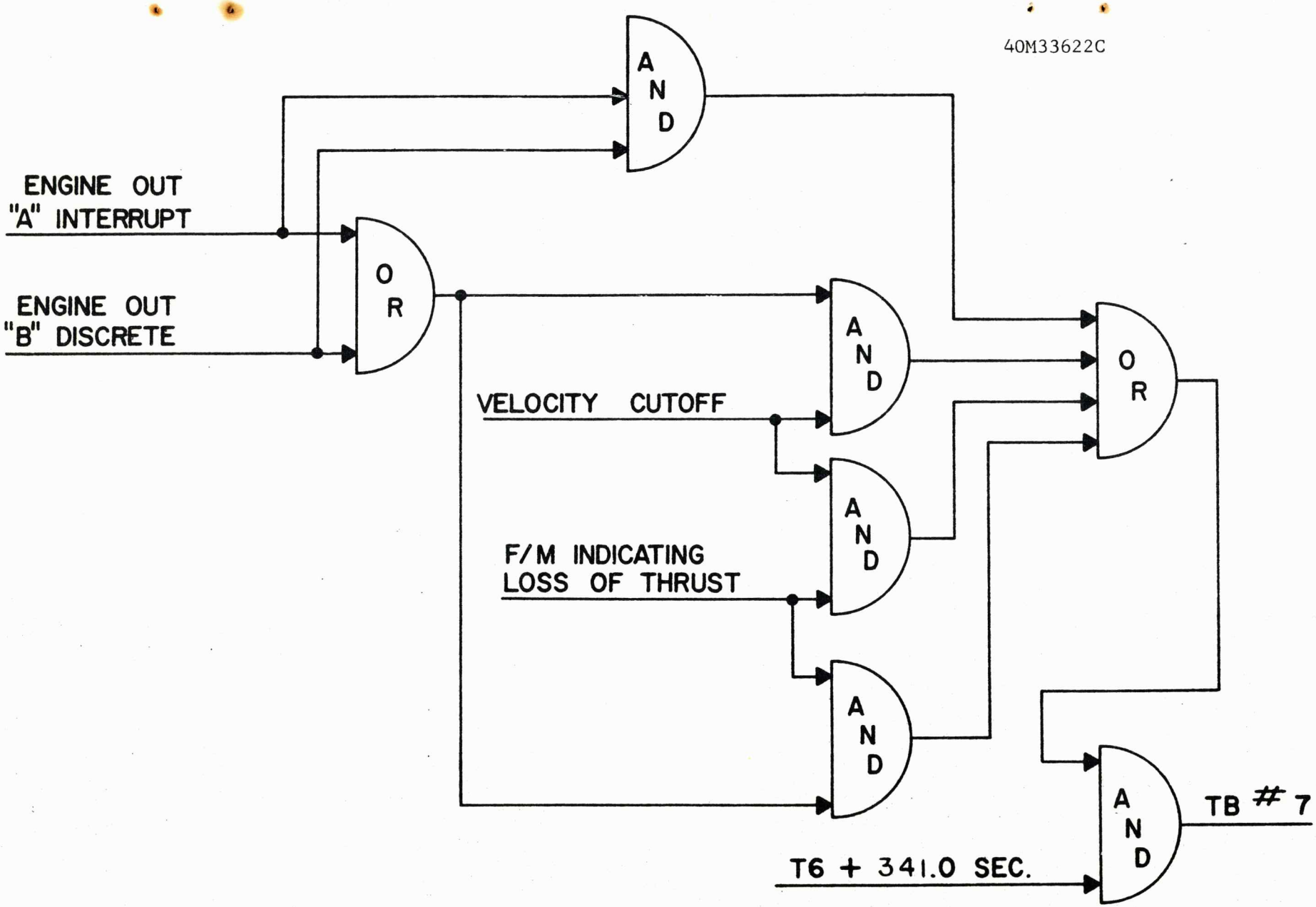
**TIME BASE #4**


40M33622C
AND
ENGINE OUT
"A" INTERRUPT
ENGINE OUT
"B" DISCRETE
OR
AND
VELOCITY CUTOFF
OR
AND
F/M INDICATING
LOSS OF THRUST
AND
AND
TB #5
T4 +10.0 SEC
T4a +15.0 SEC
TIME BASE #5

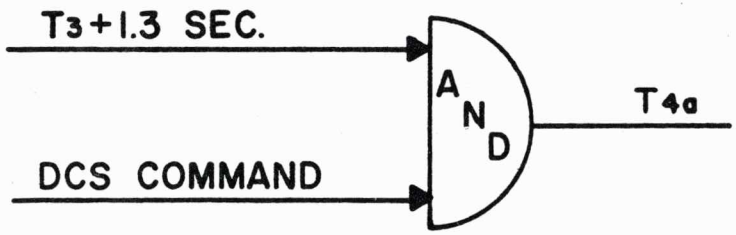
40M33622C




TIME BASE #6

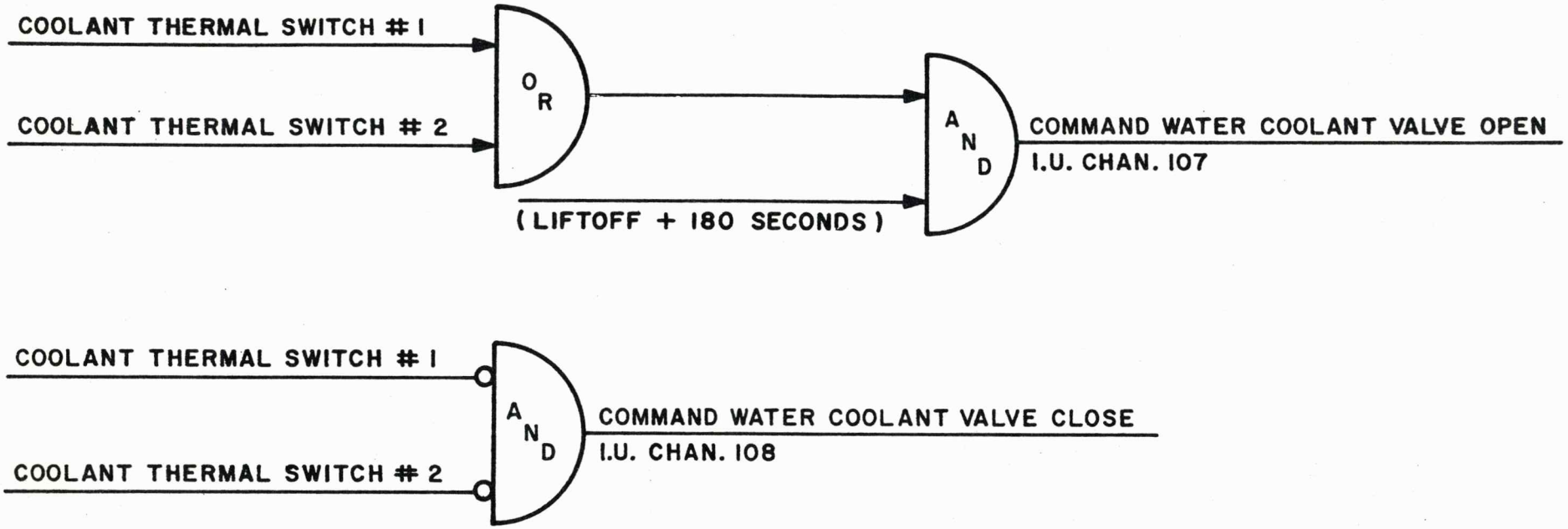

AND
ENGINE OUT
"A" INTERRUPT
ENGINE OUT
"B" DISCRETE
OR
AND
VELOCITY CUTOFF
AND
F/M INDICATING
LOSS OF THRUST
AND
OR
AND
TB # 7
T6 + 341.0 SEC.

TIME BASE # 7




TIME BASE #4a - (EARLY STAGING)

40M33622C




# ECS WATER COOLANT VALVE LOGIC

# VII. FLIGHT SEQUENCE PROGRAM

| NOMINAL FLT. TIME HR: MIN: SEC | COMMAND | SWITCH SELECTOR | | | TIME FROM BASE SECONDS |
|---|---|---|---|---|---|
| | | CODE | STAGE | CHAN | |
| 00:00:00.0 | Lift Off - Start of Time Base #1 ($T_1$) | | | | $T_1$ + 0.0 |
| | | | | | |
| 00:00:05.0 | Auto-Abort Enable Relays Reset | 0001 0001 | IU | 16 | $T_1$ + 5.0 |
| 00:00:05.2 | Sensor Bias On | 0001 0101 | IU | 109 | $T_1$ + 5.2 |
| 00:00:14.0 | Multiple Engine Cutoff Enable | 0110 0010 | S-IC | 3 | $T_1$ + 14.0 |
| 00:00:24.8 | Telemeter Calibrate On | 0101 1111 | S-IC | 2 | $T_1$ + 24.8 |
| 00:00:27.0 | Telemetry Calibrator In-Flight Calibrate On | 0010 0010 | IU | 23 | $T_1$ + 27.0 |
| 00:00:29.8 | Telemeter Calibrate Off | 0111 1111 | S-IC | 1 | $T_1$ + 29.8 |
| 00:00:30.0 | Launch Vehicle Engines EDS Cutoff Enable | 0011 0001 | IU | 38 | $T_1$ + 30.0 |
| 00:00:32.0 | Telemetry Calibrator In-Flight Calibrate Off | 0001 0010 | IU | 24 | $T_1$ + 32.0 |
| 00:00:49.5 | Fuel Pressurizing Valve No. 2 Open & Tape Recorder Record | 0000 0010 | S-IC | 5 | $T_1$ + 49.5 |
| 00:01:14.1 | Start Data Recorders | 0001 0111 | S-II | 71 | $T_1$ + 74.1 |
| 00:01:15.0 | Cooling System Electronic Assembly Power Off | 0011 0100 | IU | 110 | $T_1$ + 75.0 |
| 00:01:30.0 | Telemetry Calibrator In-Flight Calibrate On | 0010 0010 | IU | 23 | $T_1$ + 90.0 |
| 00:01:35.0 | Telemetry Calibrator In-Flight Calibrate Off | 0001 0010 | IU | 24 | $T_1$ + 95.0 |
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| NOMINAL FLT. TIME HR: MIN: SEC | COMMAND | SWITCH SELECTOR | | | TIME FROM BASE SECONDS |
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| | | CODE | STAGE | CHAN | |
| 00:01:35.3 | Fuel Pressurizing Valve No. 3 Open | 0010 1101 | S-IC | 6 | $T_1$ + 95.3 |
| 00:01:45.0 | Flight Control Computer Switch Point No. 1 | 0111 1101 | IU | 26 | $T_1$ + 105.0 |
| 00:01:55.0 | Telemeter Calibrate On | 0101 1111 | S-IC | 2 | $T_1$ + 115.0 |
| 00:01:59.2 | Regular Calibrate Relays On | 0011 1010 | S-IVB | 64 | $T_1$ + 119.2 |
| 00:02:00.0 | Telemeter Calibrate Off | 0111 1111 | S-IC | 1 | $T_1$ + 120.0 |
| 00:02:00.2 | Flight Control Computer Switch Point No. 2 | 0100 0001 | IU | 21 | $T_1$ + 120.2 |
| 00:02:04.2 | Regular Calibrate Relays Off | 0010 1010 | S-IVB | 65 | $T_1$ + 124.2 |
| 00:02:09.7 | Start First PAM-FM/FM Calibration | 0000 0011 | S-II | 30 | $T_1$ + 129.7 |
| 00:02:13.5 | Fuel Pressurizing Valve No. 4 Open | 0001 1101 | S-IC | 7 | $T_1$ + 133.5 |
| 00:02:14.5 | Fast Record On | 0100 1100 | S-IVB | 105 | $T_1$ + 134.5 |
| 00:02:14.7 | Stop First PAM-FM/FM Calibration | 0001 0011 | S-II | 9 | $T_1$ + 134.7 |
| 00:02:14.9 | Tape Recorder Record On | 0000 1111 | IU | 39 | $T_1$ + 134.9 |
| 00:02:15.1 | LOX Tank Strobe Lights Off | 0110 0001 | S-IC | 4 | $T_1$ + 135.1 |
| 00:02:15.3 | S-IC Two Engine Out Auto-Abort Inhibit Enable | 0000 1110 | IU | 51 | $T_1$ + 135.3 |
| 00:02:15.5 | S-IC Two Engine Out Auto-Abort Inhibit | 0001 1110 | IU | 35 | $T_1$ + 135.5 |
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| NOMINAL FLT. TIME HR: MIN: SEC | COMMAND | SWITCH SELECTOR | | | TIME FROM BASE SECONDS |
|---|---|---|---|---|---|
| | | CODE | STAGE | CHAN | |
| 00:02:15.7 | Excess Rate (P,Y,R) Auto-Abort Inhibit Enable | 0110 1111 | IU | 15 | $T_1$ + 135.7 |
| 00:02:15.9 | Excess Rate (P,Y,R) Auto-Abort Inhibit | 0101 1111 | IU | 2 | $T_1$ + 135.9 |
| 00:02:16.1 | Two Adjacent Outboard Engines Out Cutoff Enable | 0001 1111 | S-IC | 17 | $T_1$ + 136.1 |
| 00:02:16.3 | Inboard Engine Cutoff Enable | 0011 1111 | S-IC | 8 | $T_1$ + 136.3 |
| 00:02:16.5 | Inboard Engine Cutoff Backup Enable | 0001 0001 | S-IC | 16 | $T_1$ + 136.5 |
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| NOMINAL FLT. TIME HR: MIN: SEC | COMMAND | SWITCH SELECTOR | | | TIME FROM BASE SECONDS |
|---|---|---|---|---|---|
| | | CODE | STAGE | CHAN | |
| 00:02:23.1 | Inboard Engine Cutoff-Start Time Base #2 ($T_2$) | | | | $T_2$ + 0.0 |
| | | | | | |
| 00:02:23.2 | S-II Ordnance Arm | 0111 0011 | S-II | 11 | $T_2$ + 0.1 |
| 00:02:23.4 | Separation and Retro EBW Firing Units Arm | 0110 0011 | S-IC | 10 | $T_2$ + 0.3 |
| 00:02:23.6 | Separation Camera On | 0100 1101 | S-IC | 12 | $T_2$ + 0.5 |
| 00:02:23.7 | Camera Lights On | 0011 0111 | S-II | 67 | $T_2$ + 0.6 |
| 00:02:23.9 | Telemetry Measurement Switch Over | 0111 0010 | S-IC | 13 | $T_2$ + 0.8 |
| 00:02:24.1 | Outboard Engines Cutoff Enable | 0001 0011 | S-IC | 9 | $T_2$ + 1.0 |
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| NOMINAL FLT. TIME HR: MIN: SEC | COMMAND | SWITCH SELECTOR | | | TIME FROM BASE SECONDS |
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| | | CODE | STAGE | CHAN | |
| 00:02:28.1 | Outboard Engines Cutoff - Start of Time Base #3 ($T_3$) | | | | $T_3$ + 0.0 |
| | | | | | |
| 00:02:28.2 | Camera Motor On | 0110 0111 | S-II | 85 | $T_3$ + 0.1 |
| 00:02:28.4 | S-II $LH_2$ Recirculation Pumps Off | 0010 1100 | S-II | 48 | $T_3$ + 0.3 |
| 00:02:28.6 | S-II Ullage Trigger | 0001 0010 | S-II | 24 | $T_3$ + 0.5 |
| 00:02:28.8 | S-IC/S-II Separation | 0110 1111 | S-IC | 15 | $T_3$ + 0.7 |
| 00:02:28.9 | Camera Event Mark | 0010 1001 | S-II | 69 | $T_3$ + 0.8 |
| 00:02:29.0 | Switch Engine Control to S-II; S-II Engine Out Indication "B" | 0001 1100 | IU | 33 | $T_3$ + 0.9 |
| | Enable; S-II Aft Interstage Separation Indication "B" Enable | | | | |
| 00:02:29.1 | S-II Engines Cutoff Reset | 0010 0011 | S-II | 31 | $T_3$ + 1.0 |
| 00:02:29.2 | Engines Ready Bypass | 0110 1110 | S-II | 20 | $T_3$ + 1.1 |
| 00:02:29.3 | Prevalves Lockout Reset | 0101 0010 | S-II | 19 | $T_3$ + 1.2 |
| 00:02:29.5 | S-II Engine Start | 0001 1100 | S-II | 33 | $T_3$ + 1.4 |
| 00:02:29.6 | Camera Event Mark | 0010 1001 | S-II | 69 | $T_3$ + 1.5 |
| 00:02:29.8 | S-II Engine Out Indication "A" Enable & S-II Aft Interstage | 0010 1100 | IU | 48 | $T_3$ + 1.7 |
| | Separation Indication "A" Enable | | | | |
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| NOMINAL FLT. TIME HR: MIN: SEC | COMMAND | SWITCH SELECTOR | | | TIME FROM BASE SECONDS |
|---|---|---|---|---|---|
| | | CODE | STAGE | CHAN | |
| 00:02:30.0 | Engines Ready Bypass Reset | 0000 1100 | S-II | 49 | $T_3$ + 1.9 |
| 00:02:30.5 | Q-Ball Power Off | 0111 1111 | IU | 1 | $T_3$ + 2.4 |
| 00:02:31.1 | S-II Hydraulic Accumulators Unlock | 0100 1101 | S-II | 12 | $T_3$ + 3.0 |
| 00:02:34.5 | Chilldown Valves Close | 0101 1100 | S-II | 88 | $T_3$ + 6.4 |
| 00:02:34.8 | S-II Start Phase Limiter Cutoff Arm | 0011 1101 | S-II | 25 | $T_3$ + 6.7 |
| 00:02:35.0 | Activate P.U. System | 0100 0011 | S-II | 32 | $T_3$ + 6.9 |
| 00:02:35.8 | S-II Start Phase Limiter Cutoff Arm Reset | 0010 1101 | S-II | 6 | $T_3$ + 7.7 |
| 00:02:39.5 | Stop Data Recorders | 0111 0111 | S-II | 104 | $T_3$ + 11.4 |
| 00:02:39.7 | Fast Record Off | 0111 0101 | S-IVB | 106 | $T_3$ + 11.6 |
| 00:02:39.9 | Tape Recorder Record Off | 0001 1111 | IU | 17 | $T_3$ + 11.8 |
| 00:02:58.8 | S-II Aft Interstage Separation On | 0010 0010 | S-II | 23 | $T_3$ + 30.7 |
| 00:02:58.9 | Camera Event Mark | 0010 1001 | S-II | 69 | $T_3$ + 30.8 |
| 00:02:59.9 | Camera Event Mark | 0010 1001 | S-II | 69 | $T_3$ + 31.8 |
| 00:03:04.5 | Launch Escape Tower Jettison "A" On | 0010 1110 | IU | 52 | $T_3$ + 36.4 |
| 00:03:04.7 | Launch Escape Tower Jettison "B" On | 0011 1110 | IU | 36 | $T_3$ + 36.6 |
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| NOMINAL FLT. TIME HR. MIN. SEC | COMMAND | SWITCH SELECTOR | | | TIME FROM BASE SECONDS |
|---|---|---|---|---|---|
| | | CODE | STAGE | CHAN | |
| 00:03:06.1 | Camera Eject #1 | 0000 1001 | S-II | 87 | $T_3$ + 38.0 |
| 00:03:06.7 | Camera Eject #2 | 0101 0111 | S-II | 86 | $T_3$ + 38.6 |
| 00:03:07.2 | Camera Eject #3 | 0001 1001 | S-II | 68 | $T_3$ + 39.1 |
| 00:03:29.5 | Flight Control Computer Switch Point No. 3 | 0101 0001 | IU | 22 | $T_3$ + 61.4 |
| 00:05:30.0 | Start Second PAM-FM/FM Calibration | 0000 0011 | S-II | 30 | $T_3$ + 181.9 |
| 00:05:35.0 | Stop Second PAM-FM/FM Calibration | 0001 0011 | S-II | 9 | $T_3$ + 186.9 |
| 00:05:39.5 | Flight Control Computer Switch Point No. 4 | 0110 0001 | IU | 4 | $T_3$ + 191.4 |
| 00:05:50.0 | Telemetry Calibrator In-Flight Calibrate On | 0010 0010 | IU | 23 | $T_3$ + 201.9 |
| 00:05:55.0 | Telemetry Calibrator In-Flight Calibrate Off | 0001 0010 | IU | 24 | $T_3$ + 206.9 |
| 00:06:00.8 | Measurement Control Switch #2 Activate | 0010 0111 | S-II | 90 | $T_3$ + 212.7 |
| 00:07:00.7 | Start Third PAM-FM/FM Calibration | 0000 0011 | S-II | 30 | $T_3$ + 272.6 |
| 00:07:05.7 | Stop Third PAM-FM/FM Calibration | 0001 0011 | S-II | 9 | $T_3$ + 277.6 |
| 00:07:48.1 | S-II $LH_2$ Step Pressurization | 0001 1101 | S-II | 7 | $T_3$ + 320.0 |
| 00:07:57.0 | Regular Calibrate Relays On | 0011 1010 | S-IVB | 64 | $T_3$ + 328.9 |
| 00:07:57.2 | Telemetry Calibrator In-Flight Calibrate On | 0010 0010 | IU | 23 | $T_3$ + 329.1 |
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| NOMINAL FLT. TIME HR: MIN: SEC | COMMAND | SWITCH SELECTOR | | | TIME FROM BASE SECONDS |
|---|---|---|---|---|---|
| | | CODE | STAGE | CHAN | |
| 00:08:02.0 | Regular Calibrate Relays Off | 0010 1010 | S-IVB | 65 | $T_3$ + 333.9 |
| 00:08:02.2 | Telemetry Calibrator In-Flight Calibrate Off | 0001 0010 | IU | 24 | $T_3$ + 334.1 |
| 00:08:02.6 | Charge Ullage Ignition On | 0111 0100 | S-IVB | 54 | $T_3$ + 334.5 |
| 00:08:02.8 | S-II/S-IVB Ordnance Arm | 0011 1111 | S-II | 8 | $T_3$ + 334.7 |
| 00:08:03.0 | Tape Recorder Record On | 0000 1111 | IU | 39 | $T_3$ + 334.9 |
| 00:08:03.2 | Fast Record On | 0100 1100 | S-IVB | 105 | $T_3$ + 335.1 |
| 00:08:03.4 | Start Data Recorders | 0001 0111 | S-II | 71 | $T_3$ + 335.3 |
| 00:08:03.6 | S-II LOX Depletion Sensors Cutoff Arm | 0110 0010 | S-II | 3 | $T_3$ + 335.5 |
| 00:08:03.8 | S-II $LH_2$ Depletion Sensors Cutoff Arm | 0101 1110 | S-II | 42 | $T_3$ + 335.7 |
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| NOMINAL FLT. TIME HR: MIN: SEC | COMMAND | SWITCH SELECTOR | | | TIME FROM BASE SECONDS |
|---|---|---|---|---|---|
| | | CODE | STAGE | CHAN | |
| 00:08:38.8 | Cutoff S-II J-2 Engines - Start of Time Base #4 ($T_4$) | 0011 0011 | S-II | 18 | $T_4$ + 0.0 |
| | | | | | |
| 00:08:38.9 | Start Recorder Timers | 0100 1001 | S-II | 66 | $T_4$ + 0.1 |
| 00:08:39.0 | Prevalves Close Off | 0110 1001 | S-IVB | 83 | $T_4$ + 0.2 |
| 00:08:39.1 | S-IVB Engine Cutoff Off | 0111 0010 | S-IVB | 13 | $T_4$ + 0.3 |
| 00:08:39.3 | Engine Ready Bypass | 0110 0011 | S-IVB | 10 | $T_4$ + 0.5 |
| 00:08:39.4 | LOX Chilldown Pump Off | 0010 0010 | S-IVB | 23 | $T_4$ + 0.6 |
| 00:08:39.5 | Fire Ullage Ignition On | 0101 0100 | S-IVB | 56 | $T_4$ + 0.7 |
| 00:08:39.6 | S-II/S-IVB Separation | 0000 0010 | S-II | 5 | $T_4$ + 0.8 |
| 00:08:39.7 | S-IVB Engine Start Interlock Bypass On | 0000 0100 | S-IVB | 74 | $T_4$ + 0.9 |
| 00:08:39.8 | S-IVB Engine Start On | 0001 0011 | S-IVB | 9 | $T_4$ + 1.0 |
| 00:08:39.9 | Flight Control Computer S-IVB Burn Mode On "A" | 0010 0011 | IU | 31 | $T_4$ + 1.1 |
| 00:08:40.0 | Flight Control Computer S-IVB Burn Mode On "B" | 0000 0100 | IU | 74 | $T_4$ + 1.2 |
| 00:08:40.4 | S-IVB Engine Out Indication "A" Enable | 0001 0011 | IU | 9 | $T_4$ + 1.6 |
| 00:08:40.6 | S-IVB Engine Out Indication "B" Enable | 0111 0011 | IU | 11 | $T_4$ + 1.8 |
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| NOMINAL FLT. TIME HR. MIN. SEC | COMMAND | SWITCH SELECTOR | | | TIME FROM BASE SECONDS |
|---|---|---|---|---|---|
| | | CODE | STAGE | CHAN | |
| 00:08:41.0 | Fuel Chilldown Pump Off | 0110 1011 | S-IVB | 59 | $T_4$ + 2.2 |
| 00:08:42.6 | LOX Tank Flight Pressure System On | 0111 1001 | S-IVB | 103 | $T_4$ + 3.8 |
| 00:08:42.8 | Fuel Injection Temperature OK Bypass | 0111 0011 | S-IVB | 11 | $T_4$ + 4.0 |
| 00:08:43.0 | S-IVB Engine Start Off | 0101 1101 | S-IVB | 27 | $T_4$ + 4.2 |
| 00:08:44.6 | First Burn Relay On | 0001 1001 | S-IVB | 68 | $T_4$ + 5.8 |
| 00:08:46.6 | Emergency Playback Enable On | 0110 0101 | S-IVB | 107 | $T_4$ + 7.8 |
| 00:08:46.8 | Fast Record Off | 0111 0101 | S-IVB | 106 | $T_4$ + 8.0 |
| 00:08:47.8 | P.U. Activate On | 0000 0010 | S-IVB | 5 | $T_4$ + 9.0 |
| 00:08:48.6 | Charge Ullage Jettison On | 0110 0100 | S-IVB | 55 | $T_4$ + 9.8 |
| 00:08:51.6 | Fire Ullage Jettison On | 0001 1010 | S-IVB | 57 | $T_4$ + 12.8 |
| 00:08:52.8 | Fuel Injection Temperature OK Bypass Reset | 0001 0001 | S-IVB | 16 | $T_4$ + 14.0 |
| 00:08:54.4 | Ullage Charging Reset | 0101 1100 | S-IVB | 88 | $T_4$ + 15.6 |
| 00:08:54.6 | Ullage Firing Reset | 0010 1011 | S-IVB | 73 | $T_4$ + 15.8 |
| 00:08:57.7 | Tape Recorder Record Off | 0001 1111 | IU | 17 | $T_4$ + 18.9 |
| 00:09:00.1 | Emergency Playback Enable Off | 0100 0101 | S-IVB | 108 | $T_4$ + 21.3 |
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| NOMINAL FLT. TIME HR: MIN: SEC | COMMAND | SWITCH SELECTOR | | | TIME FROM BASE SECONDS |
|---|---|---|---|---|---|
| | | CODE | STAGE | CHAN | |
| 00:09:01.2 | Telemetry Calibrator In-Flight Calibrate On | 0010 0010 | IU | 23 | $T_4$ + 22.4 |
| 00:09:06.2 | Telemetry Calibrator In-Flight Calibrate Off | 0001 0010 | IU | 24 | $T_4$ + 27.4 |
| 00:09:10.6 | Regular Calibrate Relays On | 0011 1010 | S-IVB | 64 | $T_4$ + 31.8 |
| 00:09:15.6 | Regular Calibrate Relays Off | 0010 1010 | S-IVB | 65 | $T_4$ + 36.8 |
| 00:10:39.5 | Engine Pump Purge Control Valve Enable On * | 0001 0010 | S-IVB | 24 | $T_5$ - 7.0 |
| | | | | | |
| | * During the S-IVB first burn the LVDC is programmed to initiate an S-IVB engine purge by issuing the command "Engine Pump Purge Control Valve Enable On" through the switch selector 7.0 seconds ±1.0 second prior to velocity cutoff of the S-IVB engine. The purpose of this purge is to remove the moisture in the seal cavities. | | | | |
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| NOMINAL FLT. TIME HR: MIN: SEC | COMMAND | SWITCH SELECTOR | | | TIME FROM BASE SECONDS |
|---|---|---|---|---|---|
| | | CODE | STAGE | CHAN | |
| 00:10:46.5 | Cutoff S-IVB Engine - Start of Time Base #5 ($T_5$) | 0100 1101 | S-IVB | 12 | $T_5$ + 0.0 |
| | | | | | |
| 00:10:46.6 | Point Level Sensor Disarming | 0100 0100 | S-IVB | 98 | $T_5$ + 0.1 |
| 00:10:46.8 | S-IVB Ullage Engine #1 On | 0101 1110 | S-IVB | 42 | $T_5$ + 0.3 |
| 00:10:46.9 | S-IVB Ullage Engine #2 On | 0011 0110 | S-IVB | 101 | $T_5$ + 0.4 |
| 00:10:47.1 | S-IVB Ullage Thrust Present Indication On | 0111 1110 | IU | 43 | $T_5$ + 0.6 |
| 00:10:47.2 | First Burn Relay Off | 0010 1001 | S-IVB | 69 | $T_5$ + 0.7 |
| 00:10:47.4 | P.U. Activate Off | 0010 1101 | S-IVB | 6 | $T_5$ + 0.9 |
| 00:10:47.6 | LOX Tank Flight Pressure System Off | 0111 0111 | S-IVB | 104 | $T_5$ + 1.1 |
| 00:10:47.8 | Coast Period On | 0110 1010 | S-IVB | 79 | $T_5$ + 1.3 |
| 00:10:48.0 | Engine Pump Purge Control Valve Enable On | 0001 0010 | S-IVB | 24 | $T_5$ + 1.5 |
| 00:10:48.2 | P.U. Fuel Boiloff Bias Cutoff On | 0001 1110 | S-IVB | 35 | $T_5$ + 1.7 |
| 00:10:50.0 | Flight Control Computer S-IVB Burn Mode Off "A" | 0100 1101 | IU | 12 | $T_5$ + 3.5 |
| 00:10:50.2 | Flight Control Computer S-IVB Burn Mode Off "B" | 0001 0100 | IU | 75 | $T_5$ + 3.7 |
| 00:10:50.4 | Aux. Hydraulic Pump Coast Mode On | 0000 0011 | S-IVB | 30 | $T_5$ + 3.9 |
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| NOMINAL FLT. TIME HR: MIN: SEC | COMMAND | SWITCH SELECTOR | | | TIME FROM BASE SECONDS |
|---|---|---|---|---|---|
| | | CODE | STAGE | CHAN | |
| 00:10:50.6 | Aux. Hydraulic Pump Flight Mode Off | 0011 1100 | S-IVB | 29 | $T_5$ + 4.1 |
| 00:10:56.5 | S-IVB Engine Out Indication "A" Enable Reset | 0011 0011 | IU | 18 | $T_5$ + 10.0 |
| 00:10:56.7 | S-IVB Engine Out Indication "B" Enable Reset | 0010 0001 | IU | 53 | $T_5$ + 10.2 |
| 00:10:58.7 | Telemetry Calibrator In-Flight Calibrate On | 0010 0010 | IU | 23 | $T_5$ + 12.2 |
| 00:10:58.9 | Regular Calibrate Relays On | 0011 1010 | S-IVB | 64 | $T_5$ + 12.4 |
| 00:11:03.7 | Telemetry Calibrator In-Flight Calibrate Off | 0001 0010 | IU | 24 | $T_5$ + 17.2 |
| 00:11:03.9 | Regular Calibrate Relays Off | 0010 1010 | S-IVB | 65 | $T_5$ + 17.4 |
| 00:11:08.5 | SS/FM Transmitter Off | 0010 0001 | S-IVB | 53 | $T_5$ + 22.0 |
| 00:11:08.7 | SS/FM Group Off | 0100 1110 | S-IVB | 41 | $T_5$ + 22.2 |
| 00:11:45.5 | $LH_2$ Tank Continuous Vent Valve Open On | 0000 1010 | S-IVB | 111 | $T_5$ + 59.0 |
| 00:11:47.5 | $LH_2$ Tank Continuous Vent Valve Open Off | 0100 1011 | S-IVB | 112 | $T_5$ + 61.0 |
| 00:12:14.5 | S-IVB Ullage Engine #1 Off | 0111 1110 | S-IVB | 43 | $T_5$ + 88.0 |
| 00:12:14.6 | S-IVB Ullage Engine #2 Off | 0010 0110 | S-IVB | 102 | $T_5$ + 88.1 |
| 00:12:14.8 | S-IVB Ullage Thrust Present Indication Off | 0100 0010 | IU | 46 | $T_5$ + 88.3 |
| 00:12:15.0 | Emergency Playback Enable On | 0110 0101 | S-IVB | 107 | $T_5$ + 88.5 |
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| NOMINAL FLT. TIME HR: MIN: SEC | COMMAND | SWITCH SELECTOR | | | TIME FROM BASE SECONDS |
|---|---|---|---|---|---|
| | | CODE | STAGE | CHAN | |
| 00:12:15.7 | Tape Recorder Playback Reverse On | 0101 0010 | IU | 19 | $T_5$ + 89.2 |
| 00:13:28.0 | Emergency Playback Enable Off | 0100 0101 | S-IVB | 108 | $T_5$ + 161.5 |
| 00:13:28.7 | Slow Record On | 0111 1111 | S-IVB | 1 | $T_5$ + 162.2 |
| 00:13:38.7 | Slow Record On | 0111 1111 | S-IVB | 1 | $T_5$ + 172.2 |
| 00:13:39.7 | Tape Recorder Playback Reverse Off | 0110 0010 | IU | 3 | $T_5$ + 173.2 |
| 00:20:49.1 | Engine Pump Purge Control Valve Enable Off | 0011 1101 | S-IVB | 25 | $T_5$ + 602.6 |
| 00:37:40.0 | Slow Record On | 0111 1111 | S-IVB | 1 | $T_5$ + 1613.5 |
| 00:38:12.0 | Slow Record Off | 0101 1111 | S-IVB | 2 | $T_5$ + 1645.5 |
| 00:38:12.2 | Recorder Playback On | 0100 1001 | S-IVB | 66 | $T_5$ + 1645.7 |
| 00:41:00.0 | Recorder Playback Off | 0011 0111 | S-IVB | 67 | $T_5$ + 1813.5 |
| 00:41:00.2 | Slow Record On | 0111 1111 | S-IVB | 1 | $T_5$ + 1813.7 |
| 00:41:10.2 | Slow Record On | 0111 1111 | S-IVB | 1 | $T_5$ + 1823.7 |
| 00:54:00.0 | Telemetry Calibrator In-Flight Calibrate On | 0010 0010 | IU | 23 | $T_5$ + 2593.5 |
| 00:54:00.2 | Regular Calibrate Relays On | 0011 1010 | S-IVB | 64 | $T_5$ + 2593.7 |
| 00:54:05.0 | Telemetry Calibrator In-Flight Calibrate Off | 0001 0010 | IU | 24 | $T_5$ + 2598.5 |
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| NOMINAL FLT. TIME HR: MIN: SEC | COMMAND | SWITCH SELECTOR | | | TIME FROM BASE SECONDS |
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| | | CODE | STAGE | CHAN | |
| 00:54:05.2 | Regular Calibrate Relays Off | 0010 1010 | S-IVB | 65 | $T_5$ + 2598.7 |
| 01:28:05.0 | Telemetry Calibrator In-Flight Calibrate On | 0010 0010 | IU | 23 | $T_5$ + 4638.5 |
| 01:28:05.2 | Slow Record On | 0111 1111 | S-IVB | 1 | $T_5$ + 4638.7 |
| 01:28:05.4 | Regular Calibrate Relays On | 0011 1010 | S-IVB | 64 | $T_5$ + 4638.9 |
| 01:28:10.0 | Telemetry Calibrator In-Flight Calibrate Off | 0001 0010 | IU | 24 | $T_5$ + 4643.5 |
| 01:28:10.4 | Regular Calibrate Relays Off | 0010 1010 | S-IVB | 65 | $T_5$ + 4643.9 |
| 01:28:37.2 | Slow Record Off | 0101 1111 | S-IVB | 2 | $T_5$ + 4670.7 |
| 01:28:37.6 | Recorder Playback On | 0100 1001 | S-IVB | 66 | $T_5$ + 4671.1 |
| 01:34:34.0 | Recorder Playback Off | 0011 0111 | S-IVB | 67 | $T_5$ + 5027.5 |
| 01:34:34.4 | Slow Record On | 0111 1111 | S-IVB | 1 | $T_5$ + 5027.9 |
| 01:34:44.4 | Slow Record On | 0111 1111 | S-IVB | 1 | $T_5$ + 5037.9 |
| 01:44:00.0 | Telemetry Calibrator In-Flight Calibrate On | 0010 0010 | IU | 23 | $T_5$ + 5593.5 |
| 01:44:00.2 | Regular Calibrate Relays On | 0011 1010 | S-IVB | 64 | $T_5$ + 5593.7 |
| 01:44:05.0 | Telemetry Calibrator In-Flight Calibrate Off | 0001 0010 | IU | 24 | $T_5$ + 5598.5 |
| 01:44:05.2 | Regular Calibrate Relays Off | 0010 1010 | S-IVB | 65 | $T_5$ + 5598.7 |
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| NOMINAL FLT. TIME HR: MIN: SEC | COMMAND | SWITCH SELECTOR | | | TIME FROM BASE SECONDS |
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| | | CODE | STAGE | CHAN | |
| 02:10:07.0 | Slow Record On | 0111 1111 | S-IVB | 1 | $T_5$ + 7160.5 |
| 02:10:39.0 | Slow Record Off | 0101 1111 | S-IVB | 2 | $T_5$ + 7192.5 |
| 02:10:39.2 | Recorder Playback On | 0100 1001 | S-IVB | 66 | $T_5$ + 7192.7 |
| 02:15:09.8 | Recorder Playback Off | 0011 0111 | S-IVB | 67 | $T_5$ + 7463.3 |
| 02:15:10.0 | Slow Record On | 0111 1111 | S-IVB | 1 | $T_5$ + 7463.5 |
| 02:15:20.0 | Slow Record On | 0111 1111 | S-IVB | 1 | $T_5$ + 7473.5 |
| 02:28:00.0 | Regular Calibrate Relays On | 0011 1010 | S-IVB | 64 | $T_5$ + 8233.5 |
| 02:28:00.2 | Telemetry Calibrator In-Flight Calibrate On | 0010 0010 | IU | 23 | $T_5$ + 8233.7 |
| 02:28:05.0 | Regular Calibrate Relays Off | 0010 1010 | S-IVB | 65 | $T_5$ + 8238.5 |
| 02:28:05.2 | Telemetry Calibrator In-Flight Calibrate Off | 0001 0010 | IU | 24 | $T_5$ + 8238.7 |
| 02:51:50.0 | Slow Record On | 0111 1111 | S-IVB | 1 | $T_5$ + 9663.5 |
| 02:52:22.0 | Slow Record Off | 0101 1111 | S-IVB | 2 | $T_5$ + 9695.5 |
| 02:52:22.2 | Recorder Playback On | 0100 1001 | S-IVB | 66 | $T_5$ + 9695.7 |
| 02:56:47.0 | Recorder Playback Off | 0011 0111 | S-IVB | 67 | $T_5$ + 9960.5 |
| 02:56:47.2 | Slow Record On | 0111 1111 | S-IVB | 1 | $T_5$ + 9960.7 |
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| NOMINAL FLT. TIME HR: MIN: SEC | COMMAND | SWITCH SELECTOR | | | TIME FROM BASE SECONDS |
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| | | CODE | STAGE | CHAN | |
| 02:56:57.2 | Slow Record On | 0111 1111 | S-IVB | 1 | $T_5$ + 9970.7 |
| 02:58:41.5 | Aux. Hydraulic Pump Flight Mode On | 0111 1100 | S-IVB | 28 | $T_5$ + 10075.0 |
| 02:58:41.7 | Aux. Hydraulic Pump Coast Mode Off | 0010 0011 | S-IVB | 31 | $T_5$ + 10075.2 |
| 02:59:31.5 | LOX Chilldown Pump On | 0101 0001 | S-IVB | 22 | $T_5$ + 10125.0 |
| 02:59:36.5 | Fuel Chilldown Pump On | 0011 1001 | S-IVB | 58 | $T_5$ + 10130.0 |
| 02:59:46.5 | Prevalves Close On | 0001 0110 | S-IVB | 82 | $T_5$ + 10140.0 |
| 03:06:00.0 | Telemetry Calibrator In-Flight Calibrate On | 0010 0010 | IU | 23 | $T_5$ + 10513.5 |
| 03:06:00.2 | Regular Calibrate Relays On | 0011 1010 | S-IVB | 64 | $T_5$ + 10513.7 |
| 03:06:05.0 | Telemetry Calibrator In-Flight Calibrate Off | 0001 0010 | IU | 24 | $T_5$ + 10518.5 |
| 03:06:05.2 | Regular Calibrate Relays Off | 0010 1010 | S-IVB | 65 | $T_5$ + 10518.7 |
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| NOMINAL FLT. TIME HR. MIN. SEC | COMMAND | SWITCH SELECTOR | | | TIME FROM BASE SECONDS |
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| | | CODE | STAGE | CHAN | |
| 03:04:31.7 | Begin Restart Preparations - Start of Time Base #6 ($T_6$) | | | | $T_6$ + 0.0 |
| | | | | | |
| 03:04:31.9 | S-IVB Ullage Engine #1 On | 0101 1110 | S-IVB | 42 | $T_6$ + 0.2 |
| 03:04:32.0 | S-IVB Ullage Engine #2 On | 0011 0110 | S-IVB | 101 | $T_6$ + 0.3 |
| 03:04:32.2 | S-IVB Ullage Thrust Present Indication On | 0111 1110 | IU | 43 | $T_6$ + 0.5 |
| 03:04:32.5 | $LH_2$ Tank Vent Valve Boost Close On | 0110 0110 | S-IVB | 77 | $T_6$ + 0.8 |
| 03:04:32.7 | LOX Tank Vent Valve Boost Close On | 0011 1011 | S-IVB | 95 | $T_6$ + 1.0 |
| 03:04:32.9 | $LH_2$ Tank Continuous Vent Valve Close On | 0101 1001 | S-IVB | 84 | $T_6$ + 1.2 |
| 03:04:33.1 | C-Band Transponders No. 1 and No. 2 On | 0111 0100 | IU | 54 | $T_6$ + 1.4 |
| 03:04:34.5 | $LH_2$ Tank Vent Valve Boost Close Off | 0111 0110 | S-IVB | 78 | $T_6$ + 2.8 |
| 03:04:34.7 | LOX Tank Vent Valve Boost Close Off | 0001 1011 | S-IVB | 96 | $T_6$ + 3.0 |
| 03:04:34.9 | $LH_2$ Tank Continuous Vent Valve Close Off | 0000 1001 | S-IVB | 87 | $T_6$ + 3.2 |
| 03:04:37.7 | Fuel Chilldown Pump On | 0011 1001 | S-IVB | 58 | $T_6$ + 6.0 |
| 03:04:42.7 | LOX Chilldown Pump On | 0101 0001 | S-IVB | 22 | $T_6$ + 11.0 |
| 03:04:52.7 | Prevalves Close On | 0001 0110 | S-IVB | 82 | $T_6$ + 21.0 |
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| NOMINAL FLT. TIME HR. MIN. SEC | COMMAND | SWITCH SELECTOR | | | TIME FROM BASE SECONDS |
|---|---|---|---|---|---|
| | | CODE | STAGE | CHAN | |
| 03:06:11.7 | LOX Tank Repressurization Control Valve Open On | 0110 0010 | S-IVB | 3 | $T_6$ + 100.0 |
| 03:07:00.0 | Telemetry Calibrator In-Flight Calibrate On | 0010 0010 | IU | 23 | $T_6$ + 148.3 |
| 03:07:05.0 | Telemetry Calibrator In-Flight Calibrate Off | 0001 0010 | IU | 24 | $T_6$ + 153.3 |
| 03:07:51.7 | $LH_2$ Tank Repressurization Control Valve Open On | 0000 1111 | S-IVB | 39 | $T_6$ + 200.0 |
| 03:08:00.0 | SS/FM Group On | 0010 1111 | S-IVB | 40 | $T_6$ + 208.3 |
| 03:08:00.2 | SS/FM Transmitter On | 0010 1110 | S-IVB | 52 | $T_6$ + 208.5 |
| 03:09:00.0 | Regular Calibrate Relays On | 0011 1010 | S-IVB | 64 | $T_6$ + 268.5 |
| 03:09:05.0 | Regular Calibrate Relays Off | 0010 1010 | S-IVB | 65 | $T_6$ + 273.5 |
| 03:09:18.7 | P.U. Valve Hardover Position On | 0001 1111 | S-IVB | 17 | $T_6$ + 287.0 |
| 03:09:47.9 | Prevalves Close Off | 0110 1001 | S-IVB | 83 | $T_6$ + 316.2 |
| 03:09:48.7 | S-IVB Restart Alert | 0111 1100 | IU | 28 | $T_6$ + 317.0 |
| 03:09:57.3 | S-IVB Engine Cutoff Off | 0111 0010 | S-IVB | 13 | $T_6$ + 325.6 |
| 03:09:57.5 | Engine Ready Bypass | 0110 0011 | S-IVB | 10 | $T_6$ + 325.8 |
| 03:09:57.7 | $LH_2$ Tank Repressurization Control Valve Open Off | 0000 0101 | S-IVB | 81 | $T_6$ + 326.0 |
| 03:09:57.9 | Fuel Chilldown Pump Off | 0110 1011 | S-IVB | 59 | $T_6$ + 326.2 |
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| NOMINAL FLT. TIME HR: MIN: SEC | COMMAND | SWITCH SELECTOR | | | TIME FROM BASE SECONDS |
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| | | CODE | STAGE | CHAN | |
| 03:09:58.1 | LOX Chilldown Pump Off | 0010 0010 | S-IVB | 23 | $T_6$ + 326.4 |
| 03:09:58.5 | LOX Tank Repressurization Control Valve Open Off | 0110 0001 | S-IVB | 4 | $T_6$ + 326.8 |
| 03:09:58.7 | S-IVB Engine Start On | 0001 0011 | S-IVB | 9 | $T_6$ + 327.0 |
| 03:09:59.5 | S-IVB Engine Out Indication "A" Enable | 0001 0011 | IU | 9 | $T_6$ + 327.8 |
| 03:09:59.7 | S-IVB Engine Out Indication "B" Enable | 0111 0011 | IU | 11 | $T_6$ + 328.0 |
| 03:10:01.7 | S-IVB Ullage Engine #1 Off | 0111 1110 | S-IVB | 43 | $T_6$ + 330.0 |
| 03:10:01.8 | S-IVB Ullage Engine #2 Off | 0010 0110 | S-IVB | 102 | $T_6$ + 330.1 |
| 03:10:02.0 | S-IVB Ullage Thrust Present Indication Off | 0100 0010 | IU | 46 | $T_6$ + 330.3 |
| 03:10:06.3 | Flight Control Computer S-IVB Burn Mode On "A" | 0010 0011 | IU | 31 | $T_6$ + 334.6 |
| 03:10:06.5 | Flight Control Computer S-IVB Burn Mode On "B" | 0000 0100 | IU | 74 | $T_6$ + 334.8 |
| 03:10:06.7 | Fuel Injection Temperature OK Bypass | 0111 0011 | S-IVB | 11 | $T_6$ + 335.0 |
| 03:10:06.9 | LOX Tank Flight Pressure System On | 0111 1001 | S-IVB | 103 | $T_6$ + 335.2 |
| 03:10:07.1 | Coast Period Off | 0111 1010 | S-IVB | 80 | $T_6$ + 335.4 |
| 03:10:07.3 | S-IVB Engine Start Off | 0101 1101 | S-IVB | 27 | $T_6$ + 335.6 |
| 03:10:09.3 | Second Burn Relay On | 0100 0011 | S-IVB | 32 | $T_6$ + 337.6 |
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| NOMINAL FLT. TIME HR: MIN: SEC | COMMAND | SWITCH SELECTOR | | | TIME FROM BASE SECONDS |
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| | | CODE | STAGE | CHAN | |
| 03:10:11.5 | P.U. Activate On | 0000 0010 | S-IVB | 5 | $T_6$ + 339.8 |
| 03:10:11.7 | P.U. Valve Hardover Position Off | 0011 0011 | S-IVB | 18 | $T_6$ + 340.0 |
| 03:10:16.7 | Fuel Injection Temperature OK Bypass Reset | 0001 0001 | S-IVB | 16 | $T_6$ + 345.0 |
| 03:14:28.7 | Flight Control Computer Switch Point No. 5 | 0011 0010 | IU | 44 | $T_6$ + 597.0 |
| 03:15:54.9 | Point Level Sensor Arming | 0000 0110 | S-IVB | 97 | $T_6$ + 683.2 |
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| NOMINAL FLT. TIME HR. MIN. SEC | COMMAND | SWITCH SELECTOR | | | TIME FROM BASE SECONDS |
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| | | CODE | STAGE | CHAN | |
| 03:15:09.7 | Cutoff S-IVB Engine - Start of Time Base #7 ($T_7$) | 0100 1101 | S-IVB | 12 | $T_7$ + 0.0 |
| | | | | | |
| 03:15:09.9 | LOX Tank Vent Valve Open | 0010 0101 | S-IVB | 93 | $T_7$ + 0.2 |
| 03:15:10.0 | Point Level Sensors Disarming | 0100 0100 | S-IVB | 98 | $T_7$ + 0.3 |
| 03:15:10.1 | $LH_2$ Tank Vent Valve Open | 0011 0001 | S-IVB | 38 | $T_7$ + 0.4 |
| 03:15:10.5 | Second Burn Relay Off | 0001 1100 | S-IVB | 33 | $T_7$ + 0.8 |
| 03:15:10.7 | LOX Tank Flight Pressure System Off | 0111 0111 | S-IVB | 104 | $T_7$ + 1.0 |
| 03:15:10.9 | Coast Period On | 0110 1010 | S-IVB | 79 | $T_7$ + 1.2 |
| 03:15:11.1 | P.U. Activate Off | 0010 1101 | S-IVB | 6 | $T_7$ + 1.4 |
| 03:15:11.2 | P.U. Inverter and D.C. Power Off | 0011 1111 | S-IVB | 8 | $T_7$ + 1.5 |
| 03:15:11.3 | LOX Chilldown Pump Purge Control Valve Open Off | 0100 0001 | S-IVB | 21 | $T_7$ + 1.6 |
| 03:15:13.2 | Flight Control Computer S-IVB Burn Mode Off "A" | 0100 1101 | IU | 12 | $T_7$ + 3.5 |
| 03:15:13.4 | Flight Control Computer S-IVB Burn Mode Off "B" | 0001 0100 | IU | 75 | $T_7$ + 3.7 |
| 03:15:13.6 | Aux. Hydraulic Pump Flight Mode Off | 0011 1100 | S-IVB | 29 | $T_7$ + 3.9 |
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| NOMINAL FLT. TIME HR: MIN: SEC | COMMAND | SWITCH SELECTOR | | | TIME FROM BASE SECONDS |
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| | | CODE | STAGE | CHAN | |
| 03:15:13.8 | Telemetry Calibrator In-Flight Calibrate On | 0010 0010 | IU | 23 | $T_7$ + 4.1 |
| 03:15:14.0 | Regular Calibrate Relays On | 0011 1010 | S-IVB | 64 | $T_7$ + 4.3 |
| 03:15:18.8 | Telemetry Calibrator In-Flight Calibrate Off | 0001 0010 | IU | 24 | $T_7$ + 9.1 |
| 03:15:19.0 | Regular Calibrate Relays Off | 0010 1010 | S-IVB | 65 | $T_7$ + 9.3 |
| 03:15:19.2 | SS/FM Transmitter Off | 0010 0001 | S-IVB | 53 | $T_7$ + 9.5 |
| 03:15:19.4 | SS/FM Group Off | 0100 1110 | S-IVB | 41 | $T_7$ + 9.7 |
| 03:15:19.7 | LOX Tank Vent Valve Close | 0000 1011 | S-IVB | 94 | $T_7$ + 10.0 |
| 03:15:22.7 | LOX Tank Vent Valve Boost Close On | 0011 1011 | S-IVB | 95 | $T_7$ + 13.0 |
| 03:15:24.7 | LOX Tank Vent Valve Boost Close Off | 0001 1011 | S-IVB | 96 | $T_7$ + 15.0 |
| 03:17:09.7 | $LH_2$ Tank Vent Valve Close | 0100 0110 | S-IVB | 76 | $T_7$ + 120.0 |
| 03:17:12.7 | $LH_2$ Tank Vent Valve Boost Close On | 0110 0110 | S-IVB | 77 | $T_7$ + 123.0 |
| 03:17:14.7 | $LH_2$ Tank Vent Valve Boost Close Off | 0111 0110 | S-IVB | 78 | $T_7$ + 125.0 |
| 03:18:09.7 | LV/SC Separation Sequence Start | 0000 0001 | IU | 37 | $T_7$ + 180.0 |
| 03:35:09.7 | Switch PCM to Low Gain Antenna (Fail Safe) | 0101 1011 | IU | 60 | $T_7$ + 1200.0 |
| 03:35:09.9 | Switch CCS to Low Gain Antenna | 0010 1010 | IU | 65 | $T_7$ + 1200.2 |
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| NOMINAL FLT. TIME HR. MIN. SEC | COMMAND | SWITCH SELECTOR | | | TIME FROM BASE SECONDS |
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| | | CODE | STAGE | CHAN | |
| 03:35:10.1 | $LH_2$ Tank Continuous Vent Valve Open On | 0000 1010 | S-IVB | 111 | $T_7$ + 1200.4 |
| 03:35:12.1 | $LH_2$ Tank Continuous Vent Valve Open Off | 0100 1011 | S-IVB | 112 | $T_7$ + 1202.4 |
| 03:37:00.0 | Telemetry Calibrator In-Flight Calibrate On | 0010 0010 | IU | 23 | $T_7$ + 1310.3 |
| 03:37:00.2 | Regular Calibrate Relays On | 0011 1010 | S-IVB | 64 | $T_7$ + 1310.5 |
| 03:37:05.0 | Telemetry Calibrator In-Flight Calibrate Off | 0001 0010 | IU | 24 | $T_7$ + 1315.3 |
| 03:37:05.2 | Regular Calibrate Relays Off | 0010 1010 | S-IVB | 65 | $T_7$ + 1315.5 |
| 04:45:09.7 | Switch PCM to High Gain Antenna | 0100 1010 | IU | 62 | $T_7$ + 5400.0 |
| 04:45:09.9 | Switch CCS to High Gain Antenna (Fail Safe) | 0000 0111 | IU | 63 | $T_7$ + 5400.2 |
| 04:47:00.0 | Telemetry Calibrator In-Flight Calibrate On | 0010 0010 | IU | 23 | $T_7$ + 5510.3 |
| 04:47:00.2 | Regular Calibrate Relays On | 0011 1010 | S-IVB | 64 | $T_7$ + 5510.5 |
| 04:47:05.0 | Telemetry Calibrate In-Flight Calibrate Off | 0001 0010 | IU | 24 | $T_7$ + 5515.3 |
| 04:47:05.2 | Regular Calibrate Relays Off | 0010 1010 | S-IVB | 65 | $T_7$ + 5515.5 |
| 06:05:09.7 | $LH_2$ Tank Continuous Vent Valve Close On | 0101 1001 | S-IVB | 84 | $T_7$ + 10200.0 |
| 06:05:11.7 | $LH_2$ Tank Continuous Vent Valve Close Off | 0000 1001 | S-IVB | 87 | $T_7$ + 10202.0 |
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| NOMINAL FLT. TIME HR: MIN: SEC | COMMAND | SWITCH SELECTOR | | | TIME FROM BASE SECONDS |
|---|---|---|---|---|---|
| | | CODE | STAGE | CHAN | |
| Variable | S-II Engines Cutoff - Start of Time Base #4a ($T_{4a}$) | 0011 0011 | S-II | 18 | $T_{4a}$ + 0.0 |
| | | | | | |
| Variable | Charge Ullage Ignition On | 0111 0100 | S-IVB | 54 | $T_{4a}$ + 0.1 |
| Variable | S-II/S-IVB Separation Ordnance Arm | 0011 1111 | S-II | 8 | $T_{4a}$ + 0.2 |
| Variable | Start Recorders | 0001 0111 | S-II | 71 | $T_{4a}$ + 0.3 |
| Variable | S-IVB Engine Cutoff Off | 0111 0010 | S-IVB | 13 | $T_{4a}$ + 0.4 |
| Variable | S-IVB Engine Ready Bypass | 0110 0011 | S-IVB | 10 | $T_{4a}$ + 0.5 |
| Variable | Tape Recorder Record On | 0000 1111 | IU | 39 | $T_{4a}$ + 0.7 |
| Variable | Fast Record On | 0100 1100 | S-IVB | 105 | $T_{4a}$ + 0.9 |
| Variable | Start Recorder Timers | 0100 1001 | S-II | 66 | $T_{4a}$ + 1.1 |
| Variable | Prevalves Open | 0110 1001 | S-IVB | 83 | $T_{4a}$ + 1.4 |
| Variable | Fire Ullage Ignition On | 0101 0100 | S-IVB | 56 | $T_{4a}$ + 1.6 |
| Variable | S-II/S-IVB Separation | 0000 0010 | S-II | 5 | $T_{4a}$ + 1.7 |
| Variable | S-IVB Engine Start Interlock Bypass On | 0000 0100 | S-IVB | 74 | $T_{4a}$ + 1.9 |
| Variable | LOX Chilldown Pump Off | 0010 0010 | S-IVB | 23 | $T_{4a}$ + 5.2 |
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| NOMINAL FLT. TIME HR. MIN. SEC | COMMAND | SWITCH SELECTOR | | | TIME FROM BASE SECONDS |
|---|---|---|---|---|---|
| | | CODE | STAGE | CHAN | |
| Variable | S-IVB Engine Start On | 0001 0011 | S-IVB | 9 | $T_{4a}$ + 5.7 |
| Variable | Flight Control Computer S-IVB Burn Mode On "A" | 0010 0011 | IU | 31 | $T_{4a}$ + 6.1 |
| Variable | Flight Control Computer S-IVB Burn Mode On "B" | 0000 0100 | IU | 74 | $T_{4a}$ + 6.3 |
| Variable | S-IVB Engine Out Indication "A" Enable | 0001 0011 | IU | 9 | $T_{4a}$ + 6.5 |
| Variable | S-IVB Engine Out Indication "B" Enable | 0111 0011 | IU | 11 | $T_{4a}$ + 6.7 |
| Variable | Fuel Chilldown Pump Off | 0110 1011 | S-IVB | 59 | $T_{4a}$ + 6.9 |
| Variable | LOX Tank Flight Pressure System On | 0111 1001 | S-IVB | 103 | $T_{4a}$ + 8.5 |
| Variable | Fuel Injection Temperature OK Bypass | 0111 0011 | S-IVB | 11 | $T_{4a}$ + 8.7 |
| Variable | S-IVB Engine Start Off | 0101 1101 | S-IVB | 27 | $T_{4a}$ + 8.9 |
| Variable | Fast Record Off | 0111 0101 | S-IVB | 106 | $T_{4a}$ + 9.3 |
| Variable | First Burn Relay On | 0001 1001 | S-IVB | 68 | $T_{4a}$ + 10.5 |
| Variable | Charge Ullage Jettison On | 0110 0100 | S-IVB | 55 | $T_{4a}$ + 11.4 |
| Variable | Emergency Playback Enable On | 0110 0101 | S-IVB | 107 | $T_{4a}$ + 11.7 |
| Variable | Launch Escape Tower Jettison "A" On | 0010 1110 | IU | 52 | $T_{4a}$ + 12.7 |
| Variable | Launch Escape Tower Jettison "B" On | 0011 1110 | IU | 36 | $T_{4a}$ + 12.9 |
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| NOMINAL FLT. TIME HR: MIN: SEC | COMMAND | SWITCH SELECTOR | | | TIME FROM BASE SECONDS |
|---|---|---|---|---|---|
| | | CODE | STAGE | CHAN | |
| Variable | P.U. Activate On | 0000 0010 | S-IVB | 5 | $T_{4a}$ + 13.7 |
| Variable | Fire Ullage Jettison On | 0001 1010 | S-IVB | 57 | $T_{4a}$ + 13.9 |
| Variable | Ullage Charging Reset | 0101 1100 | S-IVB | 88 | $T_{4a}$ + 17.1 |
| Variable | Ullage Firing Reset | 0010 1011 | S-IVB | 73 | $T_{4a}$ + 17.3 |
| Variable | Fuel Injection Temperature OK Bypass Reset | 0001 0001 | S-IVB | 16 | $T_{4a}$ + 18.7 |
| Variable | Tape Recorder Record Off | 0001 1111 | IU | 17 | $T_{4a}$ + 22.0 |
| Variable | Emergency Playback Enable Off | 0100 0101 | S-IVB | 108 | $T_{4a}$ + 23.0 |
| Variable | Telemetry Calibrator In-Flight Calibrate On | 0010 0010 | IU | 23 | $T_{4a}$ + 23.2 |
| Variable | Regular Calibrate Relays On | 0011 1010 | S-IVB | 64 | $T_{4a}$ + 23.4 |
| Variable | Regular Calibrate Relays Off | 0010 1010 | S-IVB | 65 | $T_{4a}$ + 28.0 |
| Variable | Telemetry Calibrator In-Flight Calibrate Off | 0001 0010 | IU | 24 | $T_{4a}$ + 28.2 |
| Variable | Telemetry Calibrator In-Flight Calibrate On | 0010 0010 | IU | 23 | $T_{4a}$ + 200.0 |
| Variable | Regular Calibrate Relays On | 0011 1010 | S-IVB | 64 | $T_{4a}$ + 200.2 |
| Variable | Regular Calibrate Relays Off | 0010 1010 | S-IVB | 65 | $T_{4a}$ + 204.8 |
| Variable | Telemetry Calibrator In-Flight Calibrate Off | 0001 0010 | IU | 24 | $T_{4a}$ + 205.0 |
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| NOMINAL FLT. TIME HR. MIN. SEC | COMMAND | SWITCH SELECTOR | | | TIME FROM BASE SECONDS |
|---|---|---|---|---|---|
| | | CODE | STAGE | CHAN | |
| Variable | First Burn Relay Off | 0010 1001 | S-IVB | 69 | $T_{4a}$ + 305.7 |
| Variable | Flight Control Computer Switch Point No. 5 | 0011 0010 | IU | 44 | $T_{4a}$ + 408.9 |
| Variable | Point Level Sensor Arming | 0000 0110 | S-IVB | 97 | $T_{4a}$ + 435.1 |
| Variable | Engine Pump Purge Control Valve Enable On | 0001 0010 | S-IVB | 24 | $T_5$ - 7.0 |
| Variable | Return to Primary Time Base #5 ($T_5$) - S-IVB Engine Cutoff | 0100 1101 | S-IVB | 12 | $T_5$ + 0.0 |
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| NOMINAL FLT. TIME HR. MIN. SEC | COMMAND | SWITCH SELECTOR | | | TIME FROM BASE SECONDS |
|---|---|---|---|---|---|
| | | CODE | STAGE | CHAN | |
| | C-BAND TRANSPONDER SWITCHING | | | | |
| | | | | | |
| Variable | C-Band Transponder No. 1 and No. 2 On | 0111 0100 | IU | 54 | Variable |
| Variable | C-Band Transponder No. 1 Off | 0110 0100 | IU | 55 | Variable |
| Variable | C-Band Transponder No. 2 Off | 0101 0100 | IU | 56 | Variable |
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| | WATER COOLANT VALVE SWITCHING | | | | |
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| Variable | Water Coolant Valve Open | 0110 0101 | IU | 107 | Variable |
| Variable | Water Coolant Valve Closed | 0100 0101 | IU | 108 | Variable |
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