

SEDR109-7

J. Lee

project mercury

NASA

**CAPSULE
FLIGHT
OPERATIONS
MANUAL**

CAPSULE 7

**MCDONNELL
AIRCRAFT**

15 AUGUST 1960

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INTRODUCTION

The detailed preparation required in attempting a mission of the magnitude and scope of PROJECT MERCURY obviously cannot and need not be covered in a document of the handbook type. Prior to any actual attempt to launch a manned capsule, many weeks will be spent in an extensive training and familiarization program. The information contained in this manual, therefore, will pre-suppose a detailed knowledge of the capsule systems and will be confined, for the most part, to procedural data. Detailed descriptions and operation of the various capsule systems are contained in Service Engineering Department Report (SEDR) 104 "PROJECT MERCURY FAMILIARIZATION MANUAL".

SCOPE :

This handbook covers operation of Mercury capsule No. 7 (Redstone Ballistic). For handbooks covering other capsules, refer to SEDR 109 (capsules 18 and 19) or to SEDR 109-10 (capsules 10, 11, 15, 16, and 17).

ARRANGEMENT

The material contained in this manual has been divided as follows:

NORMAL OPERATING PROCEDURES - This section will cover a complete normal mission, with expanded checklist type instructions.

EMERGENCY OPERATING PROCEDURES - This section attempts to anticipate every emergency that might arise during the mission. Each emergency is discussed and instructions are provided in expanded checklist form.

TROUBLE SHOOTING - Simplified system schematics are contained in this section.



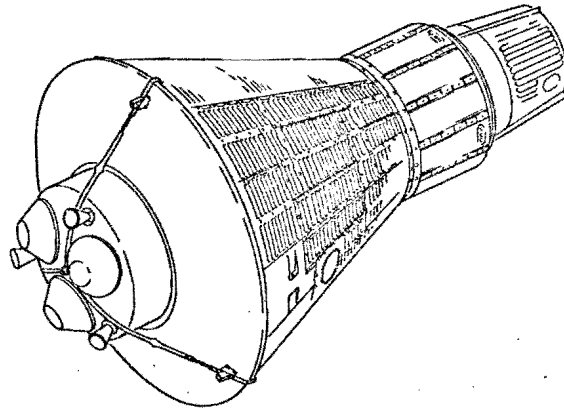
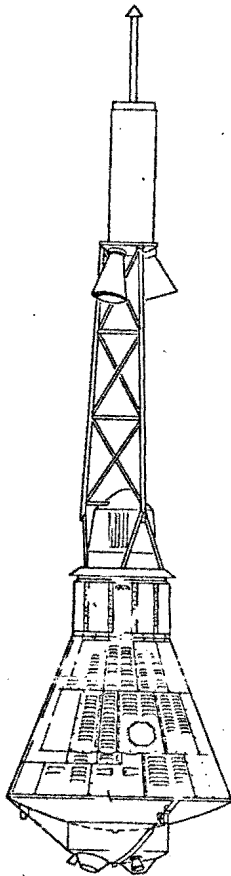
NORMAL PROCEDURES

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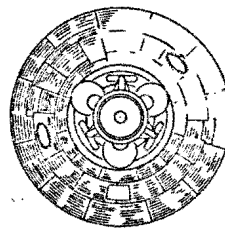
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MERCURY

SPACE CAPSULE



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PRE-LAUNCH

PRE-ENTRANCE

The Pre-Entrance Checks are completed just prior to entering the capsule. The Tower Jett, Capsule Sep, Main Deploy, and Reserve Deploy sequence override rings actuate squibs when pulled and have ground safety pins installed when the squibs are installed.

ENTRANCE

As soon as the intercom is checked, confirm all Pre-Entrance checks. When all suit connections are completed, the ground crew performs a suit circuit leakage check, purges the suit system, and disconnects the external oxygen supply. Remove the ground safety pins and give them to the ground crew just prior to hatch installation.

INTERIOR INSPECTION

During hatch installation, complete the interior inspection.

WARNING

Do not operate hand controller to prevent possible injury to personnel or damage to equipment by the control jets.

ENTRANCE

PRE-ENTRANCE

1. Sequence override ring ground safety pins -
INSTALLED
2. Hand controller - LOCKED
3. Transmit switch - OFF
4. Abort handle - LOCKED
5. Squib switch - OFF

ENTRANCE

1. All suit connections - CONNECTED
2. Visor seal oxygen supply - ON
3. Visor seal oxygen supply pressure - 1800
4. Intercom - CHECK
5. Restraint harness - FASTENED
6. Suit Fan switch - NO. 1
7. Remove safety pins and give to ground crew.

INTERIOR INSPECTION

1. Hand controller - LOCKED
2. Six Battery switches - ON
3. Abort handle - LOCKED
4. Survival kit - SECURED
5. Flashlight - STOWED
6. Shoulder harness reel handle - UNLOCKED
7. Window shutters - AS DESIRED
8. All fuse switches - NO. 1 POSITION
9. Cabin Lites switch - ON
10. Gyro switch - NORMAL
11. ASCS Mode Sel. switch - NORMAL

LEFT AND RIGHT CONSOLES

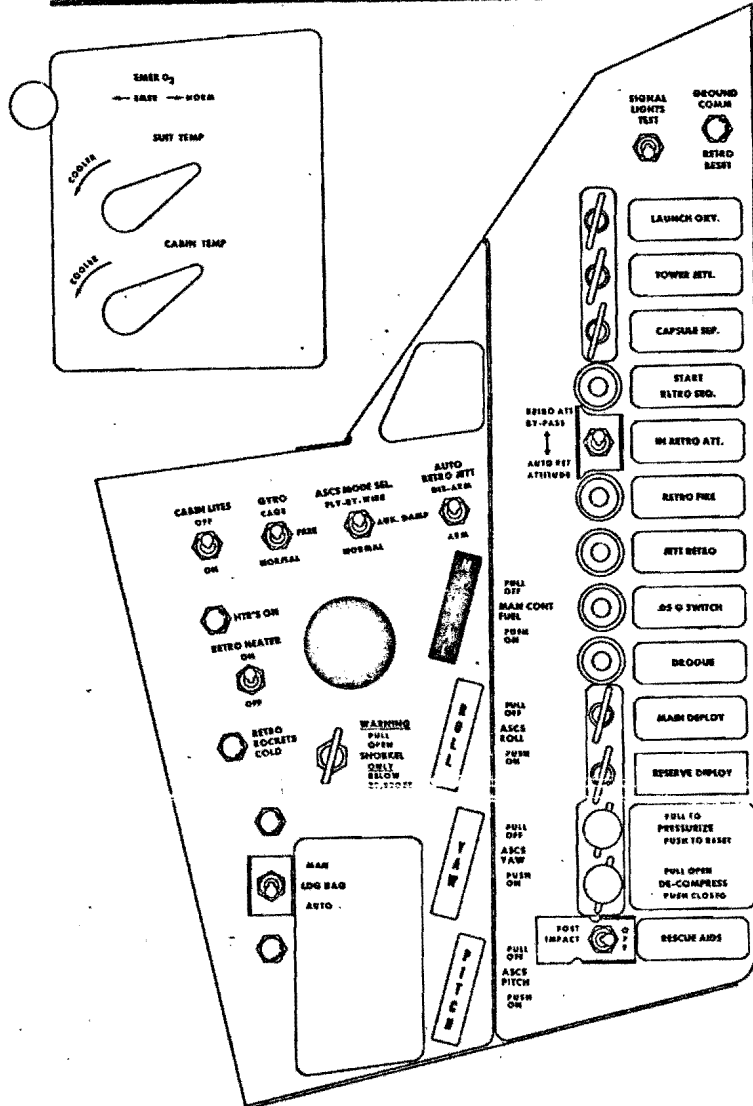


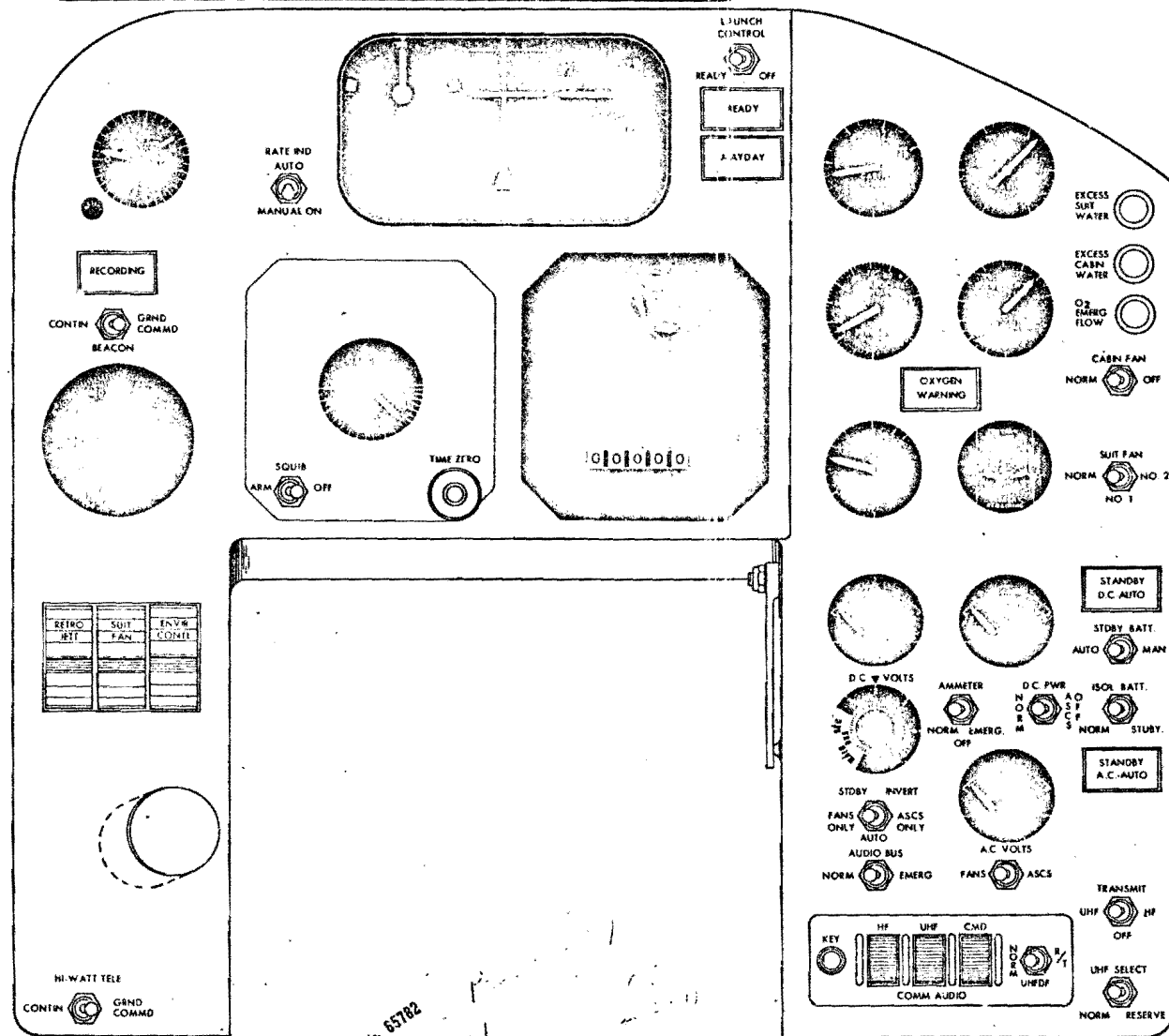
Figure 1-1

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MAIN INSTRUMENT PANEL

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Figure 1-2

INTERIOR INSPECTION

12. Auto Retro Jett switch - DIS-ARM
13. Control fuel handles - IN
 - a. Man Cont Fuel handle - PUSH ON
 - b. ASCS Roll handle - PUSH ON
 - c. ASCS Yaw handle - PUSH ON
 - d. ASCS Pitch handle - PUSH ON
14. Retro Heater switch - OFF
15. Control fuel quantity gages - CHECK
 - a. Auto fuel - 100%
 - b. Manual fuel - 100%
16. Snorkel ring - IN
17. Ldg. Bag switch - AUTO
18. Rescue Aids switch - OFF
19. De-Compress ring - PUSH CLOSED
20. Pressurize ring - PUSH TO RESET
21. All sequence override rings - IN
22. In Retro Att switch - AUTO RET ATTITUDE
23. Signal Lights Test switch - ON

Actuate the Signal Lights Test switch and check that all warning lights, indicator lights, and teletlights except "Launch Oxy" illuminate.
24. Accelerometer - SET
25. Beacon switch - GRND COMMD
26. Altimeter - CHECK

The altimeter should indicate the pressure altitude at launch pad.
27. Main panel fuse switches - NO. 1
28. Hi-Watt Tele switch - GRND COMMD
29. Map Case - SECURED
30. Periscope - CHECK
 - a. Set anticipated retrograde altitude on altitude scale.
 - b. Rotate sun-moon index through 360° and check that index rotates smoothly.
 - c. Check that drift knob smoothly rotates drift grid throughout range.

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NOTES

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INTERIOR INSPECTION

- d. Rotate filter selector knob through all four positions return to CLEAR.
- e. Check operation of magnification control and set to low magnification.
- f. Manual extension-retraction handle - STOWED
- g. Manual engage lever - DISENGAGED
- 31. Squib switch - OFF
- 32. Rate of descent indicator - 0
- 33. Satellite clock - CHECK
 - a. Wind knob - FULLY WOUND
 - b. Check time of day with ground control.
 - c. Elapsed time counter - ZERO
- 34. Rate Ind switch - AUTO
- 35. Attitude-Rate indicators - CHECK
 - a. Rate indicators - 0°/sec.
 - b. Attitude indicators - To be specified for each flight
- 36. Launch Control switch - OFF
- 37. Cabin pressure indicator - CHECK
- 38. Cabin temperature - CHECK
- 39. Coolant Quantity indicator - 100%
- 40. Humidity indicator - CHECK
- 41. CO₂ Partial pressure indicator - LESS THAN .04 PSI
- 42. Oxygen Quantity indicator - CHECK
- 43. Cabin Fan switch - NORM
- 44. Suit Fan switch - NORM
- 45. Stby Batt switch - AUTO
- 46. Isol Batt switch - NORM
- 47. DC Pwr switch - NORM
- 48. Ammeter switch - NORM
- 49. Ammeter - LESS THAN 21 AMPS
- 50. DC voltmeter - CHECK
 - DC Volts meter should read 28 volts with the volt-meter selector knob in all positions.
- 51. DC Volts knob - MAIN BUS
- 52. Stby Invert switch - AUTO

COUNTDOWN

These checks will be read out by the test director. Call out the action as it is accomplished. The Escape System Check is accomplished as soon as the gantry is clear while the Pre-Launch Check is accomplished after T-7 minutes.

Note

There will be some checks which require response to interrogation concerning various indicators or operation of controls and switches as directed to prove the integrity of capsule systems. The specific checks will be determined by the test director and are not listed here.

WARNING

The Squib switch must be in the ARM position before the escape system can receive power.

WARNING

Placing the Squib switch to the ARM position arms the Retro Fire button, Jett Retro button, Drogue button, Main Deploy ring and Reserve Deploy ring, allowing these override controls to operate WHENEVER they are actuated REGARDLESS of the capsule condition or the phase of the mission. The escape rocket will also fire if the Sep Capsule ring is pulled after capsule umbilical disconnect.

COUNTDOWN

53. Audio Bus switch - NORM
54. AC voltmeter - 115 volts
AC voltmeter should read 115 volts with the AC volts switch in the FANS or ASCS position.
55. AC Volts switch - FANS
56. Transmit switch - OFF
57. Comm Audio volume wheels - AS DESIRED
58. UHF DF switch - NORM
59. UHF Select switch - NORM
60. Emerg O₂ lever - NORM (PULL INTO DETENT)
61. Suit Temp. selector - AS DESIRED
62. Cabin Temp selector - AS DESIRED
63. Knife - STOWED
64. Food and water containers - SECURED
65. Waste container - SECURED

COUNTDOWN

Escape System Check

1. Squib switch - ARM
2. Auto Retro Jett switch - ARM
3. Isolated battery voltage - CHECK
Place the Voltmeter Selector knob to ISOL and check the voltage of the isolated battery. An immediate hold will be required if the isolated battery is below 28 volts.
4. "Mayday" light - MONITOR
5. When cleared by ground command, check the communication systems.
 - a. Transmit switch - UHF
 - b. UHF Select switch - NORM
 - c. Contact ground control over the normal UHF set.
 - d. UHF Selector switch - RESERVE



LAUNCH

During launch, the operation of the capsule is completely automatic. Therefore, the only action required will be to monitor all instruments and warning lights to guard against a malfunction of some component. Closely monitor the "Mayday" warning light and actuate the abort handle if it illuminates. If the elapsed time counter fails to start at launch, depress the Time Zero button. Check that the "Tower Jett" telelight illuminates green when the booster engines shut off and the "Capsule Sep" telelight illuminates green 10 seconds after the booster engine shuts off.



SEPARATION

The separation check list should be completed as soon as possible after the capsule separates from the booster. Do not open faceplate except in an emergency.

WARNING

The cabin pressure must be 5.0 ± 1.0 psi and "Launch Oxy" telelight not illuminated before opening the helmet faceplate.

LAUNCH - SEPARATION

- e. Contact ground control over the reserve UHF set.
- f. UHF Selector switch - NORM
- g. Check HF Receiver.
- h. Key button - CHECK
- 6. Hi-Watt Tele switch - CONTIN
- 7. Beacon switch - CONTIN

Pre-Launch Check

- 1. Check time with blockhouse.
- 2. Transmit switch - UHF
- 3. Squib switch - ARM
- 4. Auto Retro Jett switch - ARM
- 5. Restraint harness - LOCKED & SECURE
- 6. Periscope - RETRACTED
- 7. "Retract" light - OFF
- 8. Launch Control switch - READY
- 9. Arms and hands - POSITIONED

LAUNCH

During launch, check that the elapsed time counter starts and monitor the "Mayday" warning light, "Tower Jett" telelight, and the "Capsule Sep" telelight.

SEPARATION

- 1. All instruments - CHECK
- 2. Attitude Indicator - CHECK
 - Capsule should be in orbit attitude (14 1/2° small end down).

CAPSULE STABILIZATION

Automatic Mode

During all phases of normal operation, proper capsule attitude is maintained by the automatic stabilization control system (ASCS).

Note

If ASCS a-c power has been interrupted, cage the gyros, level the capsule, blunt end forward, and then uncage the gyros before returning to the automatic mode.

Note

If the normal control system fails, the attitude indicating system may be unreliable since it is slaved to the ASCS attitude gyros.

Fly-By-Wire Mode

The fly-by-wire mode generally would not be used unless manual control is required and the manual mode is inoperative or manual fuel is low. The fly-by-wire mode is used with the manual mode if manual control is required during retrograde.

Manual Mode

The manual mode is normally used when manual control of the capsule is desired. It is also used during retrograde if the auto mode is inoperative. The manual mode can be used in conjunction with the fly-by-wire mode to provide additional control torque during retrograde. The use of manual plus fly-by-wire for retrograde should consume less fuel per system.

STABILIZATION

CAPSULE STABILIZATION

Fly-By-Wire Mode

To use the fly-by-wire control system, perform the following:

1. ASCS Mode Sel switch - FLY-BY-WIRE
2. Manual fuel handle - PULL OFF
3. Use hand controller to maintain desired attitude.

To return to the normal control system:

4. ASCS Mode Sel switch - NORMAL
5. Manual fuel handle - PUSH ON

Manual Mode

To use the manual control system with ASCS damping, perform the following:

1. Manual fuel handle - PUSH ON
2. ASCS Mode Sel switch - AUX DAMP
3. Use hand controller to maintain desired attitude.

To return to normal control system:

4. ASCS Mode Sel switch - NORMAL

ENVIRONMENTAL CONTROL SYSTEM

Separate control knobs for controlling suit and cabin temperatures are located on the right console. Adjust the suit and cabin temperature for maximum comfort. Cabin pressure is normally maintained at 5.1 psia. If it becomes necessary to open the faceplate, check that cabin pressure is normal and "Launch Oxy" telelight is not illuminated. Closely monitor the cabin pressure and "Launch Oxy" telelight whenever the faceplate is open and be prepared to close the faceplate immediately if the "Launch Oxy" telelight illuminates or at any sign of dropping cabin pressure.

WARNING

In the event of sudden cabin depressurization, the faceplate must be closed and sealed immediately.

ELECTRICAL POWER SUPPLY SYSTEM

AC and DC electrical power is automatically controlled and distributed to the capsule systems. Refer to Figures 3-1 and 3-2. Monitor the power supply system indicators in order to become immediately aware of any impending failure. Such failures will normally be indicated by a low reading on the AC or DC voltmeter, an abnormal reading on the DC ammeter, or illumination of the "Sby AC Auto" or "Sby DC Auto" warning lights.

COMMUNICATIONS SYSTEM

UHF voice communication is available throughout the mission with either the main or reserve UHF communications set. To use the UHF transmitter, place the Transmit switch to UHF and select the main or reserve transmitter with the UHF Select switch. The PTT button on the abort handle must be depressed to transmit until after capsule separation as the VOX is disabled until this time. Either the main or reserve UHF receiver, depending upon the position of the UHF Select switch, is operative at all times. The HF transmitter can be used at any time until antenna fairing jettison by placing the Transmit switch to HF.

WARNING

Do not use the HF transmitter until after capsule separation to prevent possible damage to the Bicone antenna system and/or the HF transmitter.

The HF receiver operates continuously until antenna fairing separation. The HF Rescue set may be used after impact, if the HF Rescue antenna is deployed. The command receiver is operative throughout the mission and may be used for receiving voice communications in the event the UHF and HF receivers fail. The low power (high frequency) telemetry transmitter may be used for transmitting code with the Key button on the main console if all voice transmitters fail.



RETROGRADE

The retrograde sequence is normally initiated by the retrograde clock; however, it can be initiated by depressing the Retro Seq button or by ground command. The "Start Retro Seq" telelight illuminates green at retro event time. The capsule should start rotating to retrograde attitude and the "In Retro Att" telelight should illuminate green within 10 seconds after the "Start RetroSeq" telelight illuminates green.

WARNING

If there has been a malfunction of the attitude indicating system, the ASCS may energize the attitude permission relay and permit the retrograde rockets to fire even though the capsule is not in the retrograde attitude.

WARNING

If the Auto Retro Jett switch is in the ARM position, the retrograde package will jettison 60 seconds after the retrograde fire command even if no retrograde rockets have fired.

Be prepared to manually orientate capsule if the "Retro Att" telelight does not illuminate green or if the capsule is not in the retrograde attitude. The "Retro Fire" telelight illuminates green when the No. 3 retrograde rocket fires.

RETROGRADE

1. Auto Retro Jett switch - DISARM
2. "Start Retro Seq" telelight - GREEN
3. "In Retro Att" telelight - GREEN
4. Crosscheck attitude indicator and periscope.
5. "Retro Fire" telelight - GREEN
6. After "Retro Fire" telelight illuminates green, Auto Retro Jett switch - ARM

NOTES

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RE-ENTRY

60 seconds after the retro fire signal, the retrograde package is jettisoned and the ASCS positions the capsule in the re-entry attitude. As soon as the capsule is in the re-entry attitude, cross check the periscope and attitude indicator to be sure that the capsule is in the correct attitude. The periscope is retracted 30 seconds after the retrograde package is jettisoned.

WARNING

Be sure the periscope has fully retracted. If the periscope does not completely retract, the periscope door will not close causing the cabin to overheat during re-entry.

When the capsule enters the atmosphere and deceleration reaches .05g the .05g relay will shut off attitude hold, engage rate damping, and initiate a constant $10^\circ/\text{sec}$. slow roll to minimize touchdown dispersion. Pitch and yaw rates should not exceed $2^\circ/\text{sec}$.

Note

Capsule 7 has no two-speed roll rate circuit, therefore the roll rate indicator will not show roll rates above $6^\circ/\text{sec}$. If desired, the roll rate may be controlled manually, to maintain a roll rate below $6^\circ/\text{sec}$.

RE-ENTRY**RE-ENTRY**

1. "Jett Retro" telelight illuminates green 60 seconds after retro fire signal.
2. ASCS positions the capsule in the re-entry attitude (40° heat shield down).
3. Check periscope and attitude indicator.
4. Check periscope fully retracted.
5. Monitor attitude indicator until .05G.
6. ".05G Switch" telelight illuminates green approximately 140 seconds after retrograde.
7. Rate indicator shows 6°/sec roll rate.
8. If desired, manually control roll rate.
 - a. Manual fuel handle - PUSH ON
 - b. Roll fuel handle - PULL OFF
 - c. Manually reduce roll rate to 5°/sec.

NOTES



LANDING

When the capsule descends to 42,000 feet, "Drogue" telelight illuminates green if the drogue chute is deployed. At 20,000 feet, the cabin fan goes off, the Emerg O₂ handle moves to EMERG and the "O₂ Emerg Flow" light illuminates, indicating that the cabin inlet valve has opened, thereby providing cooler suit ventilation. Pull the Snorkel ring at 20,000 feet to ensure that both the inlet and outlet valves open. At 10,000 feet, a set of dual barostats initiates the antenna fairing ejector to jettison the antenna fairing and extend the periscope. Separation of the antenna fairing will deploy the main chute, turn on UHF rescue beacon, switch communications to descent antenna, and fire cabin inlet and outlet valve squibs. All remaining hydrogen peroxide is also jettisoned at this time through the high thrust pitch and yaw reaction jets. When the antenna fairing separates from the capsule, the "Main Deploy" telelight will illuminate green. Main chute deployment can be detected by the opening shock, rate of descent, and by observing the chute through the periscope. The reserve chute may be deployed in the event the main chute does not deploy properly or is damaged. 12 seconds after chute deployment, the heat shield is released to deploy the landing bag. The Ldg Bag green light will illuminate green as soon as the heat shield is actuated. At impact, the inertia switch and pressure switch (in parallel) releases the main chute, illuminates the "Rescue Aids" telelight red, and energizes the recovery light. Place the Rescue Aids switch to POST IMPACT to disconnect the reserve chute, fire the reserve chute ejector, illuminate the "Rescue Aids" telelight green, and deploy the HF recovery antenna.

LANDING**LANDING**

1. "Drogue" telelight illuminates green at 42,000 feet.
2. At 20,000 ft., Snorkel ring - PULL
3. "O₂ Emerg Flow" warning light - ILLUMINATED
4. "Launch Oxy" telelight - ILLUMINATED
5. "Main Deploy" telelight illuminates green at 10,000 ft.
6. Check main chute deployment.
 - a. Opening shock should be approximately 3-1/2 g's.
 - b. Rate of descent indicator shows approximately 32 ft./sec.
 - c. Check chute for proper deployment or damage through periscope.
7. Ldg Bag green light - ILLUMINATED
8. After impact, Rescue Aids switch - POST IMPACT

NOTES

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RECOVERY AIDS

Radar reflective chaff is ejected when the drogue chute is deployed to aid radar stations in tracking the capsule. A SOFAR bomb is also ejected when the main chute is deployed. The UHF recovery beacon will operate during descent and after landing until capsule recovery. The UHF transmitter is switched to CW mode at antenna fairing separation. A dye marker and shark repellent are ejected when the reserve chute is ejected. The impact switch actuates the recovery flashing light and HF recovery beacon, and switches the HF radio to the recovery transceiver. In the D-F mode the UHF transmitter will transmit cw continuously for DF homing if the UHF DF switch is in the NORM position. The Transmitter switch must be in the UHF position before the UHF transmitter can be used for communications. To receive on the UHF set, place the UHF DF switch in the R/T position. After impact, the HF recovery receiver operates continuously and the HF recovery beacon transmits continuously for DF homing. A low-powered, hand-held UHF transceiver is also available in the survival kit for DF transmission and voice communications.

EGRESS

Except in an emergency, remain in the capsule in order to have the protection of the capsule and to have access to the recovery aids.

SECTION III EMERGENCY PROCEDURES

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ASTRONAUTS CHECK LIST

MERCURY SPACE CAPSULE 7

The procedures contained in
this check list are condensed
from SEDR109, Capsule Flight
Operations Manual

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This check list consists of two parts, normal procedures and emergency procedures. The numbered items (line items) correspond to identically numbered items in the amplified procedures in Sections II and III of the Capsule Flight Operations Manual. Emergency procedures are identified by a red and black diagonally striped border.

This check list does not replace the amplified version in the Capsule Flight Operations Manual. To operate the capsule safely and efficiently, you must thoroughly understand why each step is performed and why it occurs in a certain sequence.

A

NORMAL PROCEDURES

PRE-ENTRANCE

1. Safety pins - INSTALLED
2. Hand controller - LOCKED
3. Transmit switch - OFF
4. Abort Handle - LOCKED
5. Squib switch - OFF

ENTRANCE

1. Suit connections - CONNECTED
2. Visor Seal O₂ Supply - ON
3. Visor Seal O₂ Press - 1800 PSI
4. Intercom - CHECK
5. Harness - FASTENED
6. Suit Fan switch - NO. 1
7. Safety pins - REMOVED

INTERIOR INSPECTION

1. Hand controller - LOCKED
2. Battery switches - ON
3. Abort handle - LOCKED
4. Survival kit - SECURED
5. Flashlight - STOWED
6. Shoulder harness - UNLOCKED

7. Window shutters - AS DESIRED
8. All fuse switches - NO. 1
9. Cabin Lites switch - ON
10. Gyro switch - NORMAL
11. ASCS Mode Sel sw. - NORMAL
12. Auto Retro Jett. sw. - DIS ARM
13. Control fuel handles - IN
14. Retro Heater switch - OFF
15. Fuel gages - CHECK
16. Snorkel ring - IN
17. Ldg. Bag switch - AUTO
18. Rescue Aids switch - OFF
19. De-Compress ring - IN
20. Pressurize ring - IN
21. Seq. over-ride rings - IN
22. In Retro Att. sw. - AUTO RET
ATTITUDE
23. Signal Lights Test sw. - ON
24. Accelerometer - SET
25. Beacon switch - GRND COMMD
26. Altimeter - CHECK
27. Fuse switches - NO. 1
28. Hi-Watt Tele. sw. - GRND COMMD
29. Map case - SECURED
30. Periscope - CHECK
31. Squib switch - OFF
32. Rate of descent indicator - 0
33. Satellite clock - CHECK
34. Rate Ind switch - AUTO
35. Attitude-Rate ind. - CHECK

36. Launch Control switch - OFF
37. Cabin press. ind. - CHECK
38. Cabin temp. ind. - CHECK
39. Coolant quantity ind. - 100%
40. Humidity ind. - CHECK
41. CO₂ press ind. - BELOW .04 PSI
42. Oxygen quan. ind. - CHECK
43. Cabin Fan switch - NORM
44. Suit Fan switch - NORM
45. Stby Batt switch - AUTO
46. Isol Batt switch - NORM
47. DC Pwr switch - NORM
48. Ammeter switch - NORM
49. Ammeter - LESS THAN 21 AMPS
50. DC voltmeter - CHECK
51. DC Volts knob - MAIN BUS
52. Stby Invert switch - AUTO
53. Audio Bus switch - NORM
54. AC Voltmeter - 115 VOLTS
55. AC Volts switch - FANS
56. Transmit switch - OFF
57. Audio volume - AS DESIRED
58. UHF DF switch - NORM
59. UHF Select switch - NORM
60. Emerg O₂ lever - NORM
61. Suit Temp - AS DESIRED
62. Cabin Temp - AS DESIRED
63. Knife - STOWED
64. Food & water - SECURED
65. Waste container - SECURED

COUNTDOWN

Escape System Check

1. Squib switch - ARM
2. Auto Retro Jett switch - ARM
3. Isol Btry voltage - CHECK
4. Mayday light - MONITOR
5. Communications - CHECK
6. Hi-Watt Tele. switch - ON
7. Beacon switch - CONTIN

Pre-Launch Check

1. Check Time
2. Transmit switch - UHF
3. Squib switch - ARM
4. Auto Retro Jett switch - ARM
5. Harness - LOCKED & SECURE
6. Periscope - RETRACTED
7. "Retract" light - OFF
8. Launch Control switch - READY
9. Arms and hands - POSITIONED

SEPARATION

1. All instruments - CHECK
2. Attitude Indicator - CHECK

CAPSULE STABILIZATION

Fly-By-Wire Mode

1. ASCS switch - FLY-BY-WIRE
2. Man. fuel handle - PUSH ON
3. Use hand cont. to maintain att.

To return to normal:

4. ASCS switch - NORMAL

Manual Mode

1. Man. fuel handle - PUSH ON
2. ASCS switch - AUX DAMP
3. Use hand cont. to maintain att.

To return to normal:

4. ASCS switch - NORMAL

RETROGRADE

1. Auto Retro Jett sw. - DIS-ARM
2. "Start Retro Seq" light - GREEN
3. "In Retro Att" light - GREEN
4. Check att. ind. and periscope.
5. "Retro Fire" light - GREEN
6. Auto Retro Jett sw. - ARM

RE-ENTRY

1. "Jett. Retro" telelight - GREEN
2. Check capsule in re-entry att.
3. Check periscope and att. ind.
4. Periscope - RETRACTED
5. Monitor attitude indicator.
6. Monitor ".05G switch" telelight
7. Rate indicator - 6° /sec roll.
8. To manually control roll:
 - a. Roll handle - PULL
 - b. Manual handle - PULL
 - c. Reduce roll to 5° /sec.

LANDING

1. At 42,000 ft. "Drogue" lt. - GREEN
2. At 20,000 ft. Snorkel ring - PULL
3. "O₂ Emer Flow" lt. - ON
4. "Launch Oxy" lt. - ON
5. "Main Deploy" telelight - GREEN
6. Check main chute deployment
7. "Ldg Bag" green light - ON
8. Rescue Aids sw. - POST IMPACT

EMERGENCY PROCEDURES**ABORT**

1. Actuate abort handle
2. "Capsule Sep" telelight - GREEN
3. Monitor "Tower Jett" light.
4. Monitor "Main Deploy" light.
5. If req. Reserve Deploy ring - PULL
6. Snorkel ring - PULL
7. Complete normal recovery proc.

TOWER FAILS TO JETTISON

1. Tower Jett ring - PULL
2. If tower fails to jettison:
 - a. Twr Sep Cont. fuse - NO. 2
 - b. Emer Twr Sep fuse - NO. 2
 - c. Emer Twr Jett fuse - NO. 2
 - d. For norm. sep, Emer Escape Rkt fuse sw. - NO. 2

CAPSULE FAILS TO SEPARATE

1. Capsule Sep ring - PULL
2. If capsule fails to separate:
 - a. Emer Cap Sep Control Fuse - NO. 2

- b. On Aborts - Emer Escape Rckt fuse - NO. 2
- c. Emer Posigrade fuse - NO. 2

FAILURE OF ASCS AUTOMATIC MODE

- 1. Switch to manual mode.
- 2. Auto fuel gage - CHECK

If automatic mode failed in one axis:

- 3. Applicable ASCS handle - PULL
- 4. ASCS switch - NORMAL
- 5. Use hand controller.

FAILURE OF FLY-BY-WIRE MODE

- 1. Auto fuel gage - CHECK
- 2. ASCS switch - NORMAL
- 3. If auto mode fails, manual fuel handle - PUSH ON
- 4. ASCS switch - AUX DAMP
- 5. Use hand controller.

ATTITUDE GYRO SLAVING FAILURE

- 1. Manual fuel handle - PUSH ON
- 2. ASCS Switch - AUX DAMP

3. Gyro switch - CAGE
4. Place the capsule horizontal.
5. Gyro switch - NORMAL
6. ASCS switch - NORMAL
7. Check that ASCS returns capsule to orbit att.

CABIN DEPRESSURIZATION

1. Faceplate - CLOSED
2. All suit connections - CHECK
3. De-compress ring - PULL

CABIN RE-PRESSURIZATION

1. De-compress ring - PUSH
2. Pressurize ring - PULL
3. At 5 psi, Pressurize ring - IN
4. Emerg O₂ lever - NORM
5. Suit Fan switch - NO. 1
6. Suit Fan switch - NORM

EXCESSIVE CO₂ PARTIAL PRESSURE

1. Cabin pressure - CHECK
2. Launch Oxy light - CHECK
3. If all ind. norm, Open Faceplate.
4. If any indicator not norm, Emerg O₂ lever - EMERG

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EMERGENCY OXYGEN

1. Emerg O₂ lever - EMERG
2. To return to normal:
 - a. Emerg O₂ lever - NORM
 - b. Suit Fan switch - NO. 1
 - c. Suit Fan sw. - NORM

ALTERNATE SUIT FAN

1. Suit Fan switch - NO. 1
2. Suit Fan sw. - NO. 2
3. Emerg O₂ lever - EMERG

MAIN BATTERY FAILURE

1. Turn off batt. below 18 volts or 3 volts below bus voltage.
2. If standby DC Auto light illum.:
 - a. Check bus and batt. voltage.
 - b. Turn off low prior, equip.

STANDBY BATTERY FAILURE

1. Standby Battery - OFF
2. Check main & isol. batt.
3. If main batt. low, reduce power

If main batteries also fail:

4. Audio Bus switch - EMERG
5. If main bus power is needed, Isol Btry switch - STBY

ISOLATED BATTERY FAILURE

1. Isolated Battery - OFF
2. Check all battery voltages.
3. Isol Btry switch - STDBY

COMPLETE ELECTRICAL FAILURE

1. Ammeter switch - EMERG

INVERTER FAILURE

1. Determine which inv. failed.

COMMUNICATIONS SYSTEM FAILURE

1. Check mike button
2. Check other two comm. sets.
3. Audio Bus switch - EMERG
4. Use key button & comd. rec.

FIRE OR FUMES

1. Faceplate - CLOSED

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2. If fire or fumes are severe, Decomp handle - PULL
3. Determine source
4. Turn off affected equip.
5. If equip. turned off, repress.

PERISCOPE FAILURE

1. Periscope fuse switch - NO. 2
2. Periscope Fuse switch - OFF
3. Man engage lever - ENGAGED
4. Ratchet - AS REQUIRED
5. Manually operate periscope.

FAILURE TO START RETRO SEQUENCE

1. Retro Seq button - DEPRESS
2. If "Start Retro Seq" light is out:
 - a. Emer Retro Seq fuse - NO. 2
 - b. Retro Seq button - DEPRESS
3. Retro Fire button - DEPRESS
4. If capsule is not in retro att.:
 - a. Man fuel handle - PUSH ON
 - b. ASCS Switch - FLY-BY-WIRE
 - c. Position capsule to retro att.
 - d. In RetroAtt switch - RETROATT BYPASS
 - e. Retro Fire button - DEPRESS

FAILURE TO ATTAIN RETRO ATTITUDE

1. Check att. ind. and periscope.
2. If capsule is in retro attitude:
 - a. In Retro Att switch - RETRO ATT BYPASS
 - b. Retro Fire button - DEPRESS
3. If capsule is not in retro att.:
 - a. Man fuel handle - PUSH ON
 - b. ASCS switch - FLY-BY-WIRE
 - c. Position capsule to retro att.
 - d. If att permis. circuit is operating, retro rockets fire.
 - e. If rockets do not fire In Retro Att switch - RETRO ATT BYPASS
 - f. Retro Fire button - DEPRESS

RETRO ROCKETS FAIL TO FIRE

1. Check "In Retro Att" light green.
2. Retro Fire button - DEPRESS
3. If "Retro Fire" telelight is red:
 - a. No. 1, No. 2 and No. 3 Retro Rckt fuses - NO. 2
 - b. Retro Man. Contrl fuse - NO. 2
 - c. Retro Fire button - DEPRESS
4. "Retro Fire" green if No. 3 fires.

FAILURE TO MAINTAIN RETRO ATTITUDE

1. Squib switch - OFF
2. Reposition capsule to retro att.
3. In Retro Att sw. - RETRO ATT
BYPASS
4. Squib switch - ARM
5. Retro Fire button - DEPRESS

RETRO PACKAGE FAILS TO JETTISON

1. Jett Retro button - DEPRESS
2. If Retro package does not jett:
 - a. Retro Jett fuse - No. 2
 - b. Emer Retro Jett fuse - No. 2
3. Jett Retro button - DEPRESS

ASCS CANNOT MAINTAIN RE-ENTRY ATTITUDE

1. Manual fuel handle - PUSH ON
2. ASCS switch - AUX DAMP
3. Periscope Fuse - OFF
4. Position capsule to re-entry att.
5. ASCS switch - NORMAL
6. Use periscope to see if ASCS maintains re-entry attitude.
7. If ASCS maintains attitude, Periscope Fuse - NO. 1

8. If ASCS will not maintain att.:
 - a. ASCS switch - AUX DAMP
 - b. Maintain re-entry attitude.
 - c. At .05g, Periscope Fuse - NO. 1
 - d. ASCS starts 7°/sec roll.

.05G SWITCH FAILURE

1. .05G button - DEPRESS
2. ASCS .05G and Emer .05G fuse switches - NO. 2
3. .05G button - DEPRESS

DROGUE CHUTE FAILURE

1. Drogue button - DEPRESS
2. If drogue chute does not deploy:
 - a. Emer Drogue Deploy fuse - NO. 2
 - b. Drogue button - DEPRESS

ANTENNA FAIRING FAILS TO JETTISON

1. Check for chute deployment
2. Main Deploy ring - PULL
3. Check for chute deployment
4. Emer. Main Sys A fuse - NO. 2

MAIN CHUTE FAILURE

1. Reserve Depl. ring - PULL

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RESERVE CHUTE FAILURE

1. Reserve Depl. Sys A fuse - NO. 2

LANDING BAG FAILS TO DEPLOY

1. Landing Bag switch - MAN

CHUTE FAILS TO RELEASE

1. Reserve Depl. ring - PULL
2. If capsule is tumbling, stay in seat.
3. If capsule is not bouncing or tumbling:
 - a. Remove right side of instrument panel and escape hatch.
 - b. Push out parachute container.
 - c. Cut shroud lines with knife.

RESERVE CHUTE FAILS TO EJECT

1. Reserve chute can be pushed out with parachute container.

CAPSULE LANDS IN ROUGH SEAS

1. Remain in seat with harness fastened.
2. If forced to leave capsule, use extreme caution.

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COOLING SYSTEM FAILS

1. Remove escape hatch and open suit.
2. If capsule overheats, evacuate capsule.

CAPSULE LEAKS AFTER LANDING

1. If leak is large, leave capsule.
2. If leak is small, check conditions outside before deciding to leave capsule.

EGRESS

1. Remove harness and disconnect leads.
2. Remove survival kit cover, insert knife and flashlight in kit pockets.
3. Remove right side of instrument panel and stow under main panel.
4. Sit on right side of capsule and release escape hatch.
5. Stow hatch on leg couch, step into seat, and climb into hatch opening.
6. Check survival kit secured to the suit.

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7. Disconnect electrical leads, and remove pip pins from parachute container.
8. Push parachute container and survival kit out of capsule.
9. Maneuver through the housing until shoulders are out of capsule.
10. Retrieve survival kit, inflate raft, and tie raft to capsule.
11. Get into raft.
12. Secure raft & start rescue procedures.

EMERGENCY EGRESS

1. Remove harness & personal leads.
2. Detach survival kit.
3. Handle lock release button - DEPRESS
4. Pull release handle down
5. Push hatch out of capsule

If Capsule Is In Water:

6. Remain in couch, push out survival kit, and inflate raft.
7. Use raft for support while leaving.

E-12



LAUNCH

ABORT

Prior to capsule umbilical separation, the abort can be initiated from the blockhouse through the booster or capsule umbilical. After capsule umbilical separation and before lift-off, the abort can be initiated from the blockhouse through the booster umbilical or command receiver and by the abort handle. After liftoff, the abort can be initiated by ground command through the command receiver, failure sensing system of the booster, and by the abort handle.

An abort signal from any source will shut down the booster engine, illuminate the "Mayday" light, fire the capsule-adapter ring bolts and, after the capsule-adapter ring separates, fire the escape rocket and jettison the retrograde package. At maximum altitude, the escape tower is jettisoned and the ASCS is energized to provide rate damping. For aborts below 10,000 feet, the drogue chute is deployed 2 seconds after tower jettison. Two seconds later, the antenna fairing is jettisoned and the main chute is deployed. On aborts between 10,000 feet and 42,000 feet, the drogue chute is deployed 2 seconds after tower jettison and the main chute is deployed at 10,000 feet. If the abort is initiated above 42,000 feet, the normal recovery sequence is initiated. If the capsule does not rise above 20,000 feet, the inlet and outlet snorkel valves will be opened by the squibs upon antenna fairing separation. To ensure that these valves operate, pull the snorkel override ring after antenna fairing separation.

ABORT**ABORT**

1. Actuate the abort handle if the "Mayday" light illuminates or upon command from the ground.
2. Check "Capsule Sep" telelight green.
3. Monitor "Tower Jett" telelight until it illuminates green.
4. Monitor "Main Deploy" telelight until it illuminates green. If light is red, pull Main Deploy ring.
5. If main chute fails to deploy properly, pull Reserve Deploy ring.
6. Snorkel ring - PULL
7. Complete normal recovery procedures.

NOTES

TOWER FAILS TO JETTISON

On a normal launch, the tower is jettisoned by firing the escape and tower jettison rockets at staging. On aborts, the tower is jettisoned by firing the tower jettison rocket at maximum altitude. If the tower fails to jettison at the proper time, the "Tower Jett" telelight will illuminate red. Pulling the Tower Jett ring will electrically fire the tower ring bolts through an alternate circuit and fire one of the bolts through a gas initiator. If the telelight remains red on a normal jettison, the tower jettison rocket and the escape rocket have not fired and the escape system fuse switches should be reset. If the telelight remains red on an abort, the tower jettison rocket has not fired and the tower separation fuses should be reset.

CAPSULE FAILS TO SEPARATE

If the capsule fails to separate from the adapter at the proper time, the "Capsule Sep" telelight will illuminate red. Pulling the Capsule Sep ring will electrically fire two capsule-adapter ring retaining bolts and fire the third bolt through a gas initiator. On aborts, the "Capsule Sep" telelight will remain red if the escape rocket fails to fire. In this event, place the Emer Escape Rckt fuse switch to the NO. 2 position. After tower jettison the "Capsule Sep" telelight will remain red after the Capsule Sep ring is pulled if all posigrade rockets fail to fire. If this occurs, reset the Emerg Posigrade fuse switch to the NO. 2 position to fire the posigrade rockets. Any two of the three posigrade rockets will provide sufficient capsule-booster separation to permit retrograde firing.

TOWER & CAPSULE SEP

TOWER FAILS TO JETTISON

1. Tower Jett ring - PULL
2. If tower fails to jettison
 - a. Tower Sep Cont fuse switch - NO. 2
 - b. Emerg Tower Sep fuse switch - NO. 2
 - c. Emerg Tower Jett fuse switch - NO. 2
 - d. For normal jettison, Emerg Escape Rckt fuse switch - NO. 2

CAPSULE FAILS TO SEPARATE

1. Capsule Sep ring - PULL
2. If capsule fails to separate:
 - a. Emerg Cap Sep Contrl fuse - NO. 2
 - b. On aborts, Emerg Escape Rckt fuse switch - NO. 2
 - c. For normal separation, Emer Posigrade fuse switch - NO. 2



SEPARATION

STABILIZATION SYSTEM EMERGENCY OPERATION

Failure of Automatic Mode

If the automatic mode fails, switch to manual mode. ASCS rate damping is normally used with the manual mode to aid in maintaining smooth control, however, it may be turned off to conserve fuel if desired. Roll, pitch or yaw axis controls can be shut off in the event the ASCS has failed in one axis only. If ASCS has failed or is too unreliable to use during retrograde, check that the manual mode is operating properly and use manual and fly-by-wire during retrograde.

Note

ASCS rate damping will not be available with the ASCS fuel handles pulled.

WARNING

If ASCS malfunction was caused by a malfunction of the attitude gyros or the horizon scanner, the attitude indicator will give incorrect indications.

Failure of Fly-By-Wire

Failure of fly-by-wire may occur in conjunction with failure of the automatic mode. If it occurs without failure of the automatic mode, there is probably an electrical malfunction in the control system fly-by-wire switches, ASCS Mode Sel switch, or associated circuits. Return to the automatic mode, unless it has also failed, or switch to the manual mode.

STABILIZATION

STABILIZATION SYSTEM EMERGENCY OPERATION

Failure of Automatic Mode

1. Switch to manual mode.
 - a. Manual fuel handle - PUSH ON
 - b. ASCS Mode Sel switch - AUX DAMP
2. Auto control fuel gage - CHECK

If ASCS failed in only one axis, the automatic mode may be used in the other axes.

3. Applicable ASCS fuel handle - PULL OFF
4. ASCS Mode Sel switch - NORMAL
5. Use hand controller in failed axis.

Failure of Fly-By-Wire

1. Auto control fuel gage - CHECK
2. ASCS Mode Sel switch - NORMAL
3. If the automatic mode has also failed, manual fuel handle - PUSH ON
4. ASCS Mode Sel switch - AUX DAMP
5. Use hand controller as necessary to maintain proper attitude.

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Attitude Gyro Slaving Failure

If the horizon scanner fails, the attitude indicating system will have no horizon reference for slaving. The only indication that the horizon scanner has failed will be a difference in the indications of the attitude indicator and the periscope.

WARNING

Be sure the ASCS Mode Sel switch is in the AUX DAMP or FLY-BY-WIRE position before caging the attitude gyros. If the attitude gyros are caged and the ASCS Mode Sel switch is in the NORMAL position, the capsule will tumble.

ENVIRONMENTAL CONTROL SYSTEM EMERGENCY OPERATION

Cabin Pressurization

In the event the cabin becomes depressurized, it is only necessary to have the faceplate closed. The cabin may be depressurized to eliminate smoke, fumes, or fire. The cabin can be depressurized at any time as long as the faceplate is closed.

WARNING

If the faceplate is open and cabin pressure is suddenly lost, it must be closed and sealed within approximately 10 to 12 seconds.

ENVIRONMENT

Attitude Gyro Slaving Failure

1. Manual fuel handle - PUSH ON
2. ASCS Mode Sel switch - AUX DAMP
3. Gyro switch - CAGE
4. Use the hand controller to position the capsule in a horizontal position.
Align the earth image with the 14°30' pitch indices and the roll indices on the periscope.
5. Gyro switch - NORMAL
6. ASCS Mode Sel switch - NORMAL
7. Check that ASCS returns capsule to orbit attitude.

ENVIRONMENTAL CONTROL SYSTEM EMERGENCY OPERATION

Cabin Depressurization

1. Faceplate - CLOSED
2. All suit connections - CHECK
3. De-Compress ring - PULL

Cabin Re-Pressurization

1. De-Compress ring - PUSH IN
2. Pressurize ring - PULL
3. At 5 psi cabin pressure, pressurize ring - PUSH IN
4. Emerg O₂ lever - NORM
5. Suit Fan switch - NO. 1
6. After 30 seconds, Suit Fan switch - NORM

In the event of cabin depressurization, the cabin pressure regulator will automatically shut off oxygen flow when cabin pressure drops to 4.1 psia. The remaining oxygen is then reserved for the suit environmental circuit. If the cabin was depressurized by pulling the De-Compress ring, the cabin can be pressurized by pushing the ring IN and pulling Pressurize ring. This will pressurize the cabin in approximately 5 minutes. When the cabin pressure reaches 5 psi, push Pressurize ring IN and return the Emerg O₂ lever to NORM. If on Emerg O₂ rate, place the Suit Fan switch to NO. 1 for 30 seconds and then to NORM to restore the suit fans to automatic operation.

Excessive CO₂ Partial Pressure

If the Suit CO₂ partial pressure exceeds the red line (.154 psi or 8 mm mercury), check the cabin pressure, and "Launch Oxy" telelight. If the cabin pressure is approximately 5 psi and the "Launch Oxy" telelight is not illuminated, open the helmet faceplate and prepare to initiate retrograde. If the cabin pressure is below 5 psi, or the "Launch Oxy" telelight is illuminated, place the Emerg O₂ lever to EMERG.

Emergency Oxygen

In the event the suit pressure drops below $4 \pm .1$ psi, the emergency oxygen rate valve automatically opens and the suit circuit shutoff valve closes to prevent oxygen flow through the impurity removers, temperature control units, and the suit fans. The emergency oxygen rate valve may be opened at any time by actuating the Emerg O₂ lever on the right console. This action supplies oxygen for cooling and pressurizing the suit as well as supplying oxygen for breathing. The "Oxygen Warning" light will illuminate whenever the emergency oxygen rate valve or suit circuit shutoff valve operates manually or automatically. During emergency rate operation, the oxygen supply duration is greatly reduced because oxygen is exhausted overboard.

ENVIRONMENT

Excessive CO₂ Partial Pressure

1. Cabin pressure - CHECK
Cabin pressure should be approximately 5 psi.
2. "Launch Oxy" telelight - NOT ILLUMINATED
3. If cabin pressure and "Launch Oxy" telelight are normal - OPEN FACEPLATE
4. If any indicator is not normal, Emerg O₂ handle - EMERG

Emergency Oxygen

1. To transfer to emergency oxygen, Emerg O₂ lever - EMERG
2. To return to normal operation:
 - a. Emerg O₂ lever - NORM
 - b. Suit Fan switch - No. 1
 - c. After 30 seconds, Suit Fan switch - NORM

Alternate Suit Fan

If the No. 1 suit fan fails with the Suit Fan switch in the NORM position, the No. 2 fan will automatically cut in to provide suit ventilation. Either fan may also be selected by placing the Suit Fan switch in the No. 1 or No. 2 position. In the event both suit fans fail, actuate the Emerg O₂ lever on the right console to provide ventilation.

Launch Oxy Telelight

The "Launch Oxy" telelight will illuminate whenever the cabin O₂ partial pressure drops below 3 psi. Do not open the faceplate if the "Launch Oxy" telelight is illuminated.

ELECTRICAL SYSTEM EMERGENCY OPERATION

Main Battery Failure

If the Standby Batt switch is in the AUTO position and main bus voltage drops below 18 volts, the standby battery will be connected to the main bus, the secondary bus will be deprived of power, the 250 VA main inverter and the ASCS bus will be deprived of power, and the "Standby DC Auto" warning light will be illuminated.

Standby Battery Failure

The only indication of standby battery failure will be failure to automatically switch to the main DC bus when main bus voltage drops below 18 volts. If standby battery failure is detected, turn that battery off. If the main batteries also fail, place the Audio Bus switch to EMERG to permit the isolated battery to maintain communications. The isolated battery also supplies the isolated squib bus to assure sufficient power to fire all squibs as well as the retrograde rockets. The isolated

ELECTRICAL**Alternate Suit Fan**

If the No. 1 suit fan fails and No. 2 does not switch in automatically:

1. Suit Fan switch - NO. 1
2. If NO. 1 fan is inoperative, Suit Fan switch - NO. 2
3. If NO. 2 fan is inoperative, Emerg O₂ lever - EMERG

ELECTRICAL SYSTEM EMERGENCY OPERATION**Main Battery Failure**

1. If any battery is below 18 volts or more than 3 volts below bus voltage, turn that battery OFF.
2. If "Standby DC Auto" warning light illuminates:
 - a. Check all bus and battery voltages
 - b. Turn off all low priority equipment.

Standby Battery Failure

If standby battery failure is detected:

1. Standby Battery - OFF
2. Check voltage of main and isolated batteries.
3. If main batteries are low, shut off all non-essential equipment.

If main batteries also fail:

4. Audio Bus switch - EMERG
5. If main bus power is needed, Isol Btry switch - STBY

battery may also be connected to the main bus through the Stdby Batt switch if the Isol Batt switch is placed in the STBY position.

WARNING

The isolated battery should not be used to supply other busses unless absolutely necessary and then only for essential equipment since it supplies the alternate power source for firing retrograde rockets and the recovery system pyrotechnics.

Isolated Battery Failure

If the isolated battery fails, the isolated squib bus can be powered from the standby battery by placing the Isol Btry switch to STDBY.

Complete Electrical Failure

Failure of the ammeter shunt or Ammeter switch can cause complete electrical failure by removing the ground for all capsule batteries. If all capsule power is suddenly lost, place the Ammeter switch to EMERG to provide an alternate ground for the batteries.

Inverter Failure

If either main inverter fails with the Stby Invert switch in the AUTO position, the standby inverter will automatically supply power to the failed AC bus and illuminate the "Standby AC Auto" light. Determine which inverter failed by placing Stby Invert switch to FANS ONLY and checking the ASCS bus with the AC voltmeter. If the ASCS bus voltage is zero, the ASCS bus inverter has failed. Then return the Stby Invert switch to AUTO. If both main inverters fail with the Stby Invert switch in the AUTO position, the standby inverter will automatically switch to the fan bus.

ELECTRICAL

Isolated Battery Failure

If isolated battery failure is detected:

1. Isolated battery - OFF
2. Check all battery voltages.
3. Isol Btry switch - STDBY

Complete Electrical Failure

1. If all electrical power is suddenly lost, Ammeter switch - EMERG

Inverter Failure

If the "Standby AC Auto" warning light illuminates:

1. Determine which inverter failed.

Fuses

All fuses accessible in flight are contained in fuse switches on two fuse panels. One is located just to the left of the left console and the other is on the left side of the main panel. Each fuse switch has four positions, NO. 1, NO. 2, OFF and REPLACE, and contains two fuses. If the NO. 1 fuse fails, the switch may be repositioned to NO. 2.

COMMUNICATIONS SYSTEM FAILURE

Since the basic capsule concept relies heavily on the communications system, three separate transmitters and receivers are provided for voice communications. Two additional command receivers are also provided and may be used for receiving ground commands if all other receivers fail. An emergency key for the low power (high frequency) telemetry transmitter is also provided for use in the event all the voice transmitters become inoperative.

WARNING

Do not place Audio Bus switch to EMER unless it is absolutely necessary because of the excessive drain on the isolated battery.

FIRE OR FUMES

Any fire inside the capsule will probably be an electrical fire. Therefore, attempt to determine the cause of the fire and turn off the affected equipment. The cabin can be depressurized to extinguish any fire and eliminate fumes. If helium is leaking from the H₂O₂ pressurization system, the cabin O₂

COMM & FIRE

COMMUNICATIONS SYSTEM FAILURE

1. Check transmission using mike button.
If transmitter operates normally, only the voice controlled relay has failed.
2. Check operation of the two remaining communication sets.
3. Audio Bus switch - EMERG
4. Attempt to contact ground using the emergency key button and command receiver.

FIRE OR FUMES

1. Faceplate - CLOSED
2. If fire or fumes are severe, De-Compress ring - PULL
3. Attempt to determine source of fire or fumes.
4. If source of fire or fumes can be determined, turn off affected equipment.
5. If affected equipment can be turned off, repressurize cabin.



partial pressure may become too low. The capsule has no instruments for detecting helium; however, the "Launch Oxy" telelight will illuminate when cabin O₂ partial pressure drops below 3 psi. Therefore, do not open the faceplate if the "Launch Oxy" telelight illuminates.

WARNING

An electrical fire can damage recovery system.

PERISCOPE FAILURE

The periscope is electrically extended and retracted with a manual lever for emergency extension and retraction. The periscope is automatically extended as soon as the capsule is separated and retracts 30 seconds after the retrograde package is jettisoned.

WARNING

The periscope must be retracted prior to re-entering the atmosphere. The periscope door forms a part of the capsule side insulation when it is closed. If the periscope is not retracted during re-entry, the door will be open causing the capsule to overheat.

The periscope is again extended at 10,000 feet during descent to allow the chute to be checked for proper deployment or damage.



1. Periscope fuse switch - NO. 2
If fuse has failed, periscope should extend or retract automatically.
2. If periscope does not extend or retract, Periscope Fuse switch - OFF
3. Manual Engage lever - ENGAGED
4. Ratchet - AS REQUIRED
5. Manually extend or retract periscope.

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RETROGRADE

FAILURE TO START RETROGRADE SEQUENCE

If the "Start Retro Seq" telelight fails to illuminate at retrograde time, the retrograde sequence can be started by depressing the Start Retro Seq button or the Retro Fire button. Depressing the Start Retro Seq button will start the normal retrograde sequence while depressing the Retro Fire button will fire the retrograde rockets as soon as the capsule reaches retrograde attitude. If the Start Retro Seq and the Retro Fire buttons fail, switch to manual and Fly-By-Wire, position the capsule to retrograde attitude, and manually fire the retrograde rockets.

FAILURE TO ATTAIN RETROGRADE ATTITUDE

The "In-Retro Att" telelight will illuminate red if the ASCS fails to position the capsule in the retrograde attitude within 30 seconds after receiving a signal from the satellite clock or ground command, or when the Start Retro Seq button is depressed. It will also illuminate red if the attitude permission circuit fails even though the capsule is in the retrograde attitude. Therefore, if the "In-Retro Att" telelight fails to illuminate within 10 seconds, immediately check the attitude indicator and periscope to determine if the capsule is in the retrograde attitude. If the capsule is in the retrograde attitude, place the In-Retro Att switch to RETRO ATT BYPASS and depress the Retro Fire button to fire the retrograde rockets. If the capsule is not in the correct position, use manual and fly-by-wire to position the capsule in the retrograde position. If the attitude permission circuit of the ASCS has not failed, the retrograde rockets will fire automatically 30 seconds after the retro sequence is initiated or, if over 30 seconds, as soon as the capsule is in the proper attitude.

RETROGRADE

FAILURE TO START RETROGRADE SEQUENCE

1. Start Retro Seq button - DEPRESS
2. If "Start Retro Seq" telelight is still out:
 - a. Emerg Retro Seq fuse switch - NO. 2
 - b. Retro Seq button - DEPRESS
3. If "Retro Seq" telelight is still out, Retro Fire button - DEPRESS
4. If capsule is not in retro attitude:
 - a. Manual fuel handle - PUSH ON
 - b. ASCS Mode Sel switch - FLY-BY-WIRE
 - c. Position capsule to retro attitude.
 - d. In Retro Att switch - RETRO ATT BYPASS
 - e. Retro Fire button - DEPRESS

FAILURE TO ATTAIN RETROGRADE ATTITUDE

If the "In Retro Att" telelight fails to illuminate within 10 seconds:

1. Check attitude indicator and periscope to determine if capsule is in retrograde attitude.
2. If the capsule is in the retrograde attitude:
 - a. In Retro Att switch - RETRO ATT BYPASS
 - b. Retro Fire button - DEPRESS
3. If the capsule is not in the retrograde attitude:
 - a. Manual fuel handle - PUSH ON
 - b. ASCS Mode Sel switch - FLY-BY-WIRE
 - c. Use hand controller to position capsule in the retrograde attitude.
 - d. If attitude permission circuit is operating, the retrograde rockets will fire 30 seconds after initiating retro sequence or as soon as the capsule is in the retrograde attitude, if over 30 seconds.

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If the attitude permission circuit has failed, place the In-Retro Att switch to RETRO ATT BYPASS and push the Retro Fire button to fire the retrograde rockets.

RETROGRADE ROCKETS FAIL TO FIRE

Normally the retrograde rockets are fired at 5 second intervals. If the No. 3 rocket fails to fire within 20 seconds after receiving the fire signal, the "Retro Fire" telelight will illuminate red. If the "Retro Fire" telelight illuminates red, or fails to illuminate, recheck that the "In Retro Att" telelight is green and depress the Retro Fire button to fire all retrograde rockets sequentially through another circuit. If the retrograde rockets still do not fire, place the No. 1 Retro Rckt, No. 2 Retro Rckt, No. 3 Retro Rckt and Retro Man fuse switches to the NO. 2 position and depress the Retro Fire button again. The "Retro Fire" telelight remains red until the No. 3 rocket fires; however, the capsule will make a safe re-entry even if no retrograde rockets fire.

FAILURE TO MAINTAIN RETROGRADE ATTITUDE

If the capsule exceeds the retrograde firing limits during retrograde rocket firing, place the Squib switch to OFF to prevent remaining rockets from firing in an incorrect attitude. Reposition the capsule to the retrograde attitude employing the appropriate control mode, place the In-Retro Att switch to RETRO ATT BYPASS, place the Squib switch to ARM, and depress the Fire Retro button. The No. 2 and No. 3 retrograde rockets will fire 5 seconds and 10 seconds after depressing the retro fire button.

Note

If No. 1 retrograde rocket was fired with the Retro Att switch in the BYPASS position, it is only necessary to return the Squib switch to the ARM position.

RETROGRADE

- e. If attitude permission circuit is inoperative and retrograde rockets do not fire as soon as capsule is in retrograde attitude, place the In Retro Att switch to RETRO ATT BYPASS
- f. Retro Fire button - DEPRESS

RETROGRADE ROCKETS FAIL TO FIRE

1. Recheck that "In Retro Att" telelight is illuminated green.
2. Retro Fire button - DEPRESS
3. If "Retro Fire" telelight is still illuminated red:
 - a. No. 1, No. 2, and No. 3 Retro Rckt fuse switches - NO. 2
 - b. Retro Man Contrl fuse switch - NO. 2
 - c. Retro Fire button - DEPRESS
4. "Retro Fire" telelight will illuminate green when No. 3 retrograde rocket fires.

FAILURE TO MAINTAIN RETROGRADE ATTITUDE

If capsule exceeds retrograde firing limits:

1. Squib switch - OFF
2. Reposition capsule to retrograde attitude.
3. In Retro Att switch - RETRO ATT BYPASS
4. Squib switch - ARM
5. Retro Fire button - DEPRESS

⊕
RETROGRADE PACKAGE FAILS TO JETTISON

The retrograde package is jettisoned 60 seconds after retro fire is initiated. If the retrograde package has not jettisoned 2 seconds after jett retro signal, the "Jett Retro" teletight will illuminate red.

ASCS CANNOT MAINTAIN RE-ENTRY ATTITUDE

After the retro package separates, the ASCS normally repositions the capsule to re-entry attitude (40° heat shield down). The periscope should be used to check the attitude as soon as the ASCS repositions the capsule to re-entry attitude since the periscope will automatically retract 30 seconds after the retrograde package is jettisoned. If the capsule is not in the correct re-entry attitude, use the manual control system to position the capsule in the correct attitude. Place periscope fuse switch to OFF to prevent the periscope from retracting after the retrograde package is jettisoned. As soon as the capsule is in the re-entry attitude, return to normal control system and use periscope to see if ASCS will maintain re-entry attitude. If the ASCS maintains re-entry attitude, shut off manual control system and retract periscope. If ASCS will not maintain re-entry attitude, leave periscope extended and use manual controls to maintain re-entry attitude until ".05g" teletight illuminates. Then immediately retract periscope and check that the ASCS automatically initiates a 7°/sec slow roll. ⊕

RE-ENTRY

RETROGRADE PACKAGE FAILS TO JETTISON

1. Jett Retro button - DEPRESS
2. If Retrograde package does not jettison:
 - a. Retro Jett fuse switch - NO. 2
 - b. Emer Retro Jett fuse switch - NO. 2
3. Jett Retro button - DEPRESS

ASCS CANNOT MAINTAIN RE-ENTRY ATTITUDE

If ASCS does not reposition capsule to correct re-entry attitude after retro package separates:

1. Manual fuel handle - PUSH ON
2. ASCS Mode Sel switch - AUX DAMP
3. Periscope fuse switch - OFF
4. Use hand controller to position the capsule in the re-entry attitude.
5. ASCS Mode Sel switch - NORMAL
6. Use periscope to see if ASCS will maintain re-entry attitude.
7. If ASCS will maintain re-entry attitude, periscope fuse switch - NO. 1
8. If ASCS will not maintain re-entry attitude:
 - a. ASCS Mode Sel switch - AUX DAMP
 - b. Use hand controller to maintain re-entry attitude.
 - c. As soon as the ".05g Switch" telelight illuminates, Periscope fuse switch - NO. 1
 - d. Check that ASCS initiates a 7°/sec slow roll.

.05G SWITCH FAILURE

If the .05g switch has not closed by 0.25g (approximately 100 seconds after retrograde package is jettisoned) the ".05g" switch telelight will illuminate red. If the .05g switch button does not override the failure, the Emerg .05g fuse has probably failed.

LANDING

DROGUE CHUTE FAILURE

Drogue chute failure can be detected by the lack of opening shock. Failure of the Emerg Drogue Deploy fuse will fail the Drogue Override button.

ANTENNA FAIRING FAILS TO JETTISON

If the "Main Deploy" telelight illuminates red at 10,000 feet, the antenna fairing has failed to jettison or the telelight relay has failed. If the telelight fails to illuminate, there has probably been a failure of the 10,000 ft. barostat, or of the telelight. If the telelight or the telelight relay has failed, the antenna fairing will still jettison normally and no corrective action is required.

MAIN CHUTE FAILURE

Main chute deployment failure can be detected by the lack of opening shock, accelerometer, a visual check through the periscope, and no decrease in the rate of descent. Chute damage can be detected by visual inspection and by a rate of descent above 32 feet per second.

LANDING

.05G SWITCH FAILURE

If the ".05g Switch" telelight illuminates red or fails to illuminate:

1. .05G switch button - DEPRESS
2. If .05G switch is still failed:
 - a. ASCS .05G fuse switch - NO. 2
 - b. Emerg .05G fuse switch - NO. 2
3. .05G switch button - DEPRESS

DROGUE CHUTE FAILURE

1. Drogue button - DEPRESS
2. If drogue chute does not deploy:
 - a. Emerg Drogue Deploy fuse switch - NO. 2
 - b. Drogue button - DEPRESS

ANTENNA FAIRING FAILS TO JETTISON

If the "Main Deploy" telelight illuminates red or fails to illuminate at 10,000 feet:

1. Check for chute deployment.
2. Main Deploy ring - PULL
3. Check for chute deployment.
4. If chute has not deployed, Emerg Main Sys A fuse switch - NO. 2

MAIN CHUTE FAILURE

If the main chute does not deploy properly or is damaged:

1. Reserve Depl ring - PULL

LANDING BAG FAILS TO DEPLOY

If the heat shield release is not actuated 12 seconds after chute deployment, the "Ldg Bag" light will illuminate.

POST-LANDING EMERGENCIES

Chute Fails to Release

If the main parachute fails to release upon impact, it may be released by pulling the Reserve Depl ring. If the Reserve Depl ring fails, the parachute may act as a sail and pull the capsule through the water. In this event, remain in the seat with the restraint system fastened to prevent injury from bouncing and tumbling. If the capsule is not bouncing or tumbling, release the escape hatch and cut shroud lines with a knife.

Reserve Chute Fails to Eject

In the event the reserve chute fails to eject when Rescue Aids switch is actuated, the chute container can be pushed out of the capsule after removing the escape hatch.

Capsule Lands in Rough Seas

In the event the capsule lands in rough seas, remain in the seat with the restraint harness fastened except in emergencies such as: fire, leaking capsule, etc. If an emergency prohibits remaining in the capsule, use extreme caution to prevent the raft from capsizing.

POST-LANDING

RESERVE CHUTE FAILS TO DEPLOY

If the reserve chute does not deploy when the Reserve deploy ring is pulled:

1. Reserve Deploy Sys A fuse switch - NO. 2

LANDING BAG FAILS TO DEPLOY

1. Landing Bag switch - MAN

POST-LANDING EMERGENCIES

Chute Fails to Release

1. Reserve Depl ring - PULL
2. If capsule is bouncing or tumbling, stay in seat.
3. If capsule is not bouncing or tumbling:
 - a. Remove right side of instrument panel and escape hatch.
 - b. Push out parachute container.
 - c. Cut shroud lines with knife.

Reserve Chute Fails to Eject

1. Reserve chute can be pushed out with parachute container.

Capsule Lands in Rough Seas

1. Remain in seat with harness fastened.
2. If forced to leave capsule, use extreme caution.

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Cooling System Fails

In the event the cooling system fails after impact, adequate ventilation may be received by removing the escape hatch and opening his suit. If the capsule overheats, use normal egress procedures.

Fire or Fumes

In the event of fire or fumes in the cabin, immediately evacuate the capsule using emergency egress procedures.

Capsule Leaks After Landing

If the leak is large, immediately leave capsule. If leak is small, check conditions outside before deciding whether or not to leave capsule immediately.

Capsule Strikes Land

In the event the capsule strikes land, use emergency egress procedures to leave capsule.

EGRESS

Except in an emergency, remain in the capsule in order to have the protection of the capsule and to have access to the recovery aids. If conditions prohibit remaining in the capsule, proceed as illustrated in Figure 2-1.

५

- 100

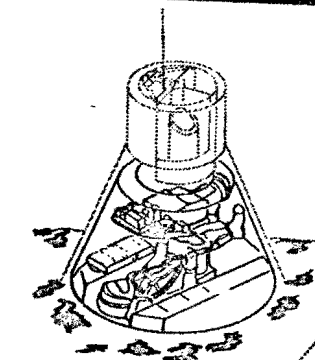
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-

10

10

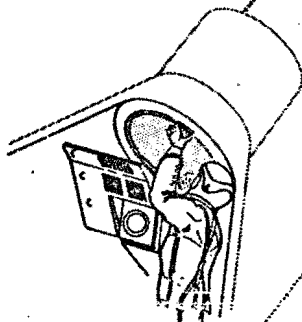
EGRESS



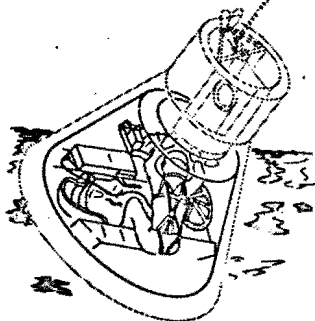
1 REMOVE HARNESS AND DISCONNECT PERSONAL LEADS. THE HELMET MAY BE REMOVED IF DESIRED.

2 REMOVE SURVIVAL KIT COVER AND INSERT KNIFE AND FLASHLIGHT IN SURVIVAL KIT.

3 REMOVE RIGHT SIDE OF INSTRUMENT PANEL AND STOW UNDER MAIN PANEL.



4 SIT ON RIGHT SIDE OF CAPSULE AND RELEASE ESCAPE HATCH. CAPSULE WILL START TIPPING WHEN ASTRONAUT SHIFTS WEIGHT.



5 STOW HATCH ON TOP OF LEG COUCH.

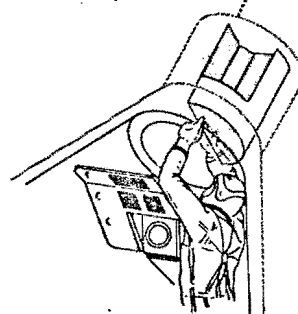
6 CHECK THAT SURVIVAL KIT LANYARD IS SECURED TO SUIT.

7

DISCONNECT TWO ELECTRICAL LEADS,
REMOVE THREE PIP PINS FROM THE PARA-
CHUTE CONTAINER.

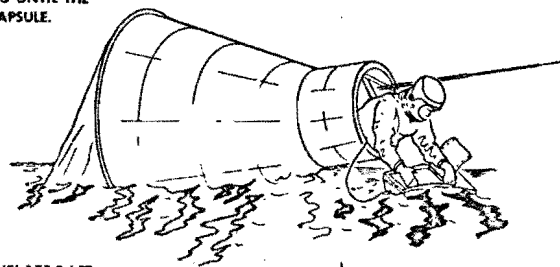
8

PUSH PARACHUTE CONTAINER AND SUR-
VIVAL KIT OUT OF CAPSULE.



9

MANEUVER THRU HOUSING UNTIL THE
SHOULDERS ARE OUT OF CAPSULE.



10

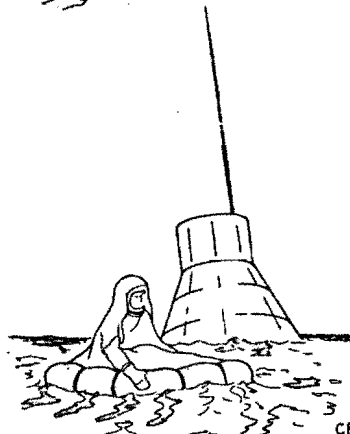
RETRIEVE SURVIVAL KIT, INFLATE RAFT
AND TIE RAFT TO CAPSULE.

11

GET INTO RAFT.

12

SECURE RAFT AND START RESCUE PRO-
CEDURES.



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EMERGENCY EGRESS

Removal of the side entrance hatch provides an alternate egress route. The hatch is held in place by locking cams which are connected to the release handle by a mechanical linkage. The hatch can also be removed from the outside with a release handle which is stowed under the hatch shingles.

WARNING

If the capsule is in the water, the emergency escape hatch should be used only in an emergency requiring immediate egress since the capsule can be swamped after the hatch is removed, especially in rough seas.

WARNING

When leaving capsule, use the raft for support. If the hatch sill is used for support, it will sink below the waterline.

POST EGRESS

The survival kit contains the following equipment:

1. PK2 raft
2. Desalting kit (for 8 pints)
3. Two shark repellent packages
4. Three dye markers
5. First aid kit

To use the emergency escape hatch, proceed as follows:

- If capsule is in the water:**

- ## NOTES

[illegible]

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6. Three distress signals
7. Signal mirror
8. AN/PRC-32 radio
9. Survival ration
10. Matches
11. Whistle
12. 10 feet of nylon cord

A knife and flashlight are also attached to the pressure suit. The suit assists flotation until it fills with water. After getting into the raft, it may be necessary to ventilate the suit by opening the zippers or by cutting open the suit with the knife.

WARNING

If the zippers have been opened or the suit cut for ventilation, the suit will not assist flotation in the event the raft capsizes.



TROUBLE SHOOTING

Table of Contents

Schematics

DC Electrical System	3-2
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Recovery Sequence (Pre-Impact)	3-18
Recovery Sequence (Post-Impact).	3-20

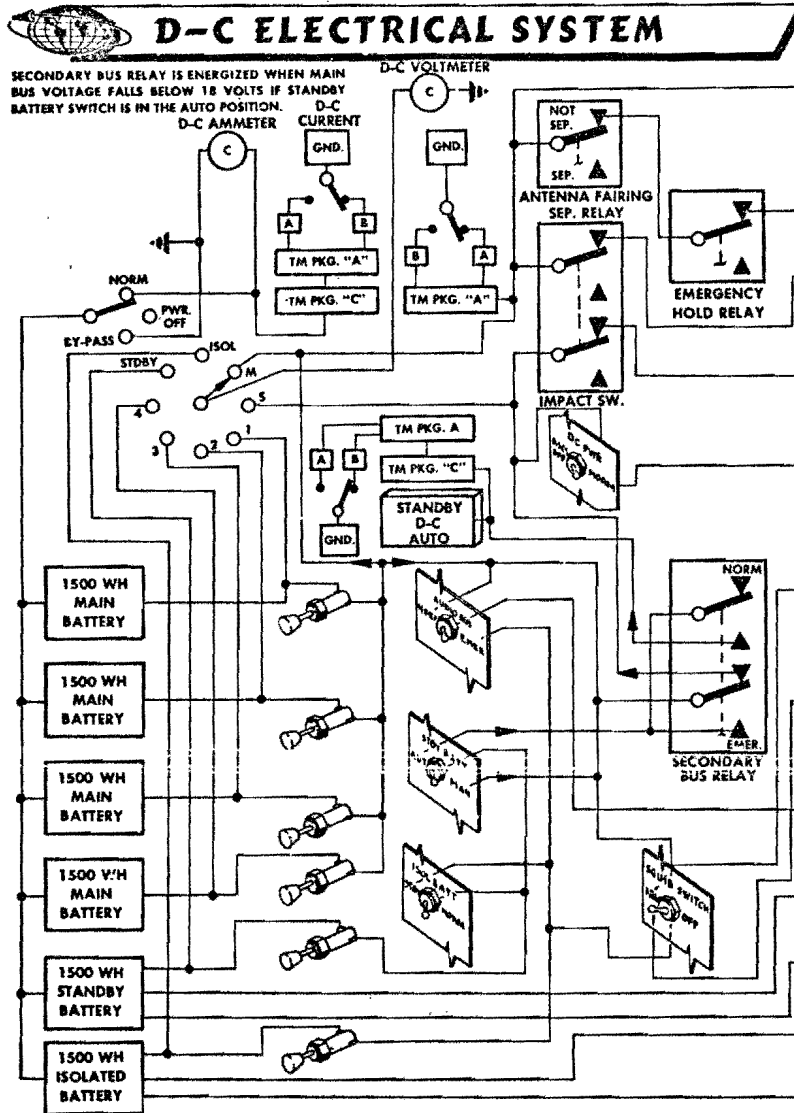


Figure 3-1

MAIN 24V DC BUS

AUTOMATIC $H_2 O_2$ JETTISON
AUTOMATIC SUIT FAN CONTROL
DC VOLTS MONITOR
EMERGENCY HOLD CONTROL
ENVIRONMENTAL CONTROL

INSTRUMENT DC NO. 6
MAIN INVERTER FANS
NO. 1 AUDIO
PERISCOPE CONTROL
PERISCOPE RETICLE
PROGRAMMER

RETRO-ROCKET BLANKET HEATER
SATELLITE CLOCK
WARNING LIGHTS TEST
TELELIGHTS
RETRO-ROCKETS TELELIGHTS
LAUNCH & ESCAPE TELELIGHTS
RECOVERY TELELIGHTS

MAIN 24V DC ASCS BUS

ASCS LOGIC
EMERGENCY LOGIC

FLY-BY-WIRE
RATE GYRO CONTROL

PRE-IMPACT MAIN 24V DC BUS

ANTENNA SWITCH
C BAND BEACON
COMMAND RECEIVER AUDIO
HF COMMUNICATION

HIGH WATT TELEMETRY TRANSMITTER
INSTRUMENT DC NO'S 2, 4 AND 7
INSTRUMENT POWER SUPPLY
TAPE RECORDER

TELEMETRY COMMAND

PRE-IMPACT SECONDARY 24V DC BUS

AUXILIARY COMMAND
INSTRUMENT DC NO'S 1, 3 AND 5

LOW WATT TELEMETRY TRANSMITTER
PILOT AND INSTRUMENT CAMERA

S BAND BEACON

SECONDARY 24V DC ASCS BUS

ASCS LOGIC

ATTITUDE GYRO CONTROL

MAIN INVERTER ASCS

MAIN 24V DC SQUIB BUS

AUTOMATIC LANDING SYSTEM A
CAPSULE ADAPTER UMBILICAL
CABIN VENT VALVE
CAPSULE SEPARATION BOLTS
CAPSULE SEPARATION CONTROL
CHUTE JETTISON - SYSTEM A
COVER SQUIB
EMERGENCY MAIN - SYSTEM A

HELIUM VALVES
MANUAL $H_2 O_2$ JETTISON
NOS. 1, 2, 3 RETRO-ROCKET FIRE
RETRO-ROCKETS ASSY. UMBILICAL
POST GRADE ROCKETS
RESCUE AIDS - SYSTEM A
RESERVE DEPLOY - SYSTEM A
RETRO GRADE SEQUENCE CONTROL

RETRO GRADE JETTISON
TETHER SQUIB
TOWER ESCAPE ROCKET
TOWER JETTISON ROCKET
TOWER SEP. BOLTS AND CONTROLS
VENT VALVES

ISOLATED 24V DC SQUIB BUS

ABORT CONTROL
AUTOMATIC LANDING - SYSTEM B
CAPSULE ADAPTER UMBILICAL
CABIN VENT VALVES
CHUTE JETTISON - SYSTEM B
EMERGENCY CAPSULE SEPARATION BOLTS
EMERGENCY CAPSULE SEPARATION CONTROLS

EMERGENCY RETRO JETT
EMERGENCY RETRO - ROCKET FIRE
EMERGENCY RETRO - ROCKET CONTROL
EMERGENCY POST GRADE ROCKET
EMERGENCY TOWER ESCAPE ROCKET
EMER. DROGUE DEPLOY
EMER. RETRO PKT. ASSY. JETT.

EMERGENCY TOWER JETTISON ROCKET
EMERGENCY TOWER SEPARATION BOLTS
EMERGENCY TOWER SEPARATION CONTROL
RESCUE AIDS - SYSTEM B
VENT VALVES
EMER. RETRO SEQUENCE

24V DC AUDIO BUS

ANTENNA SWITCH
HF RECOVERY

NO. 2 AUDIO
UHF BACK-UP

UHF COMMUNICATION

STANDBY 12V DC BUS

HF BEACON

STANDBY 18V DC BUS

AUXILIARY COMMAND DECODER B

COMMAND RECEIVER DECODER B

ISOLATED 6V DC BUS

UHF BEACON

TELEMETRED SEQUENCE

ISOLATED 18V DC BUS

AUXILIARY COMMAND DECODER A

COMMAND RECEIVER DECODER A

FUSE SWITCH

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A-C ELECTRICAL SYSTEM

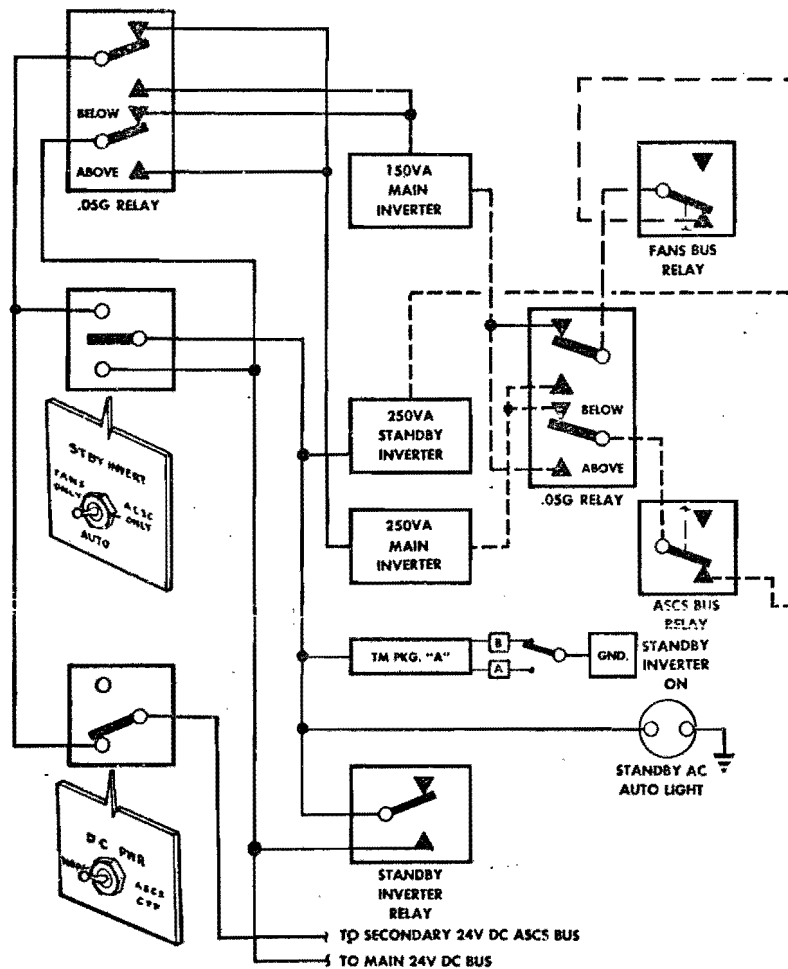
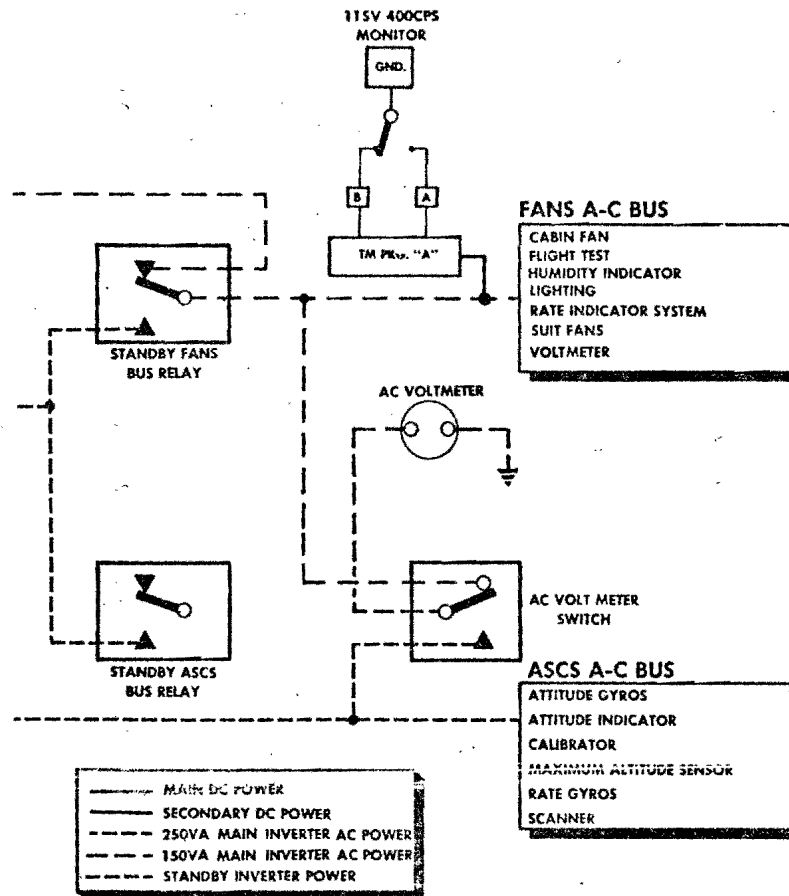


Figure 3-2



NOTES

- STANDBY INVERTER RELAY CLOSES IF EITHER MAIN INVERTER FAILS
- FANS BUS RELAY OPENS IF THE INVERTER SUPPLYING THE FANS BUS FAILS
- ASCS BUS RELAY OPENS IF THE INVERTER SUPPLYING THE ASCS BUS FAILS
- STANDBY FANS BUS RELAY CLOSES IF FANS BUS RELAY OPENS
OR IF STANDBY INVERTER SWITCH IS PLACED TO FANS ONLY
- STANDBY ASCS BUS RELAY CLOSES IF ASCS BUS RELAY OPENS
OR IF THE STANDBY INVERTER SWITCH IS PLACED TO ASCS ONLY
AND THE STANDBY FANS BUS RELAY IS OPEN

CFM7-6

STABILIZATION SYSTEM

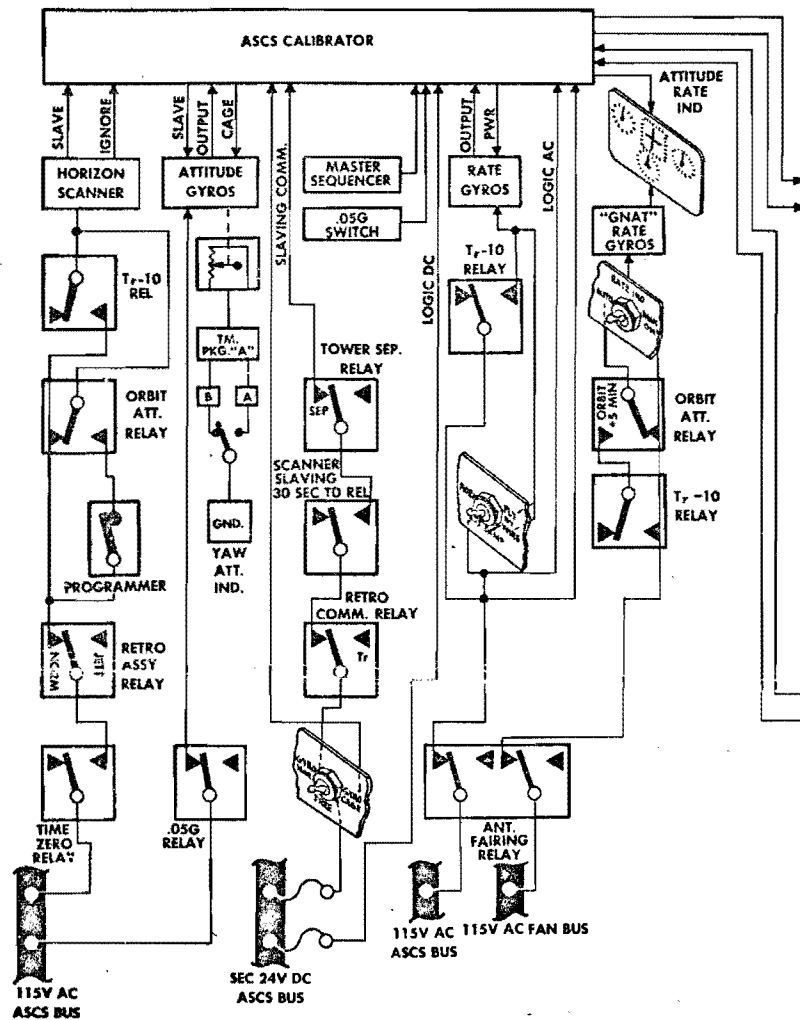
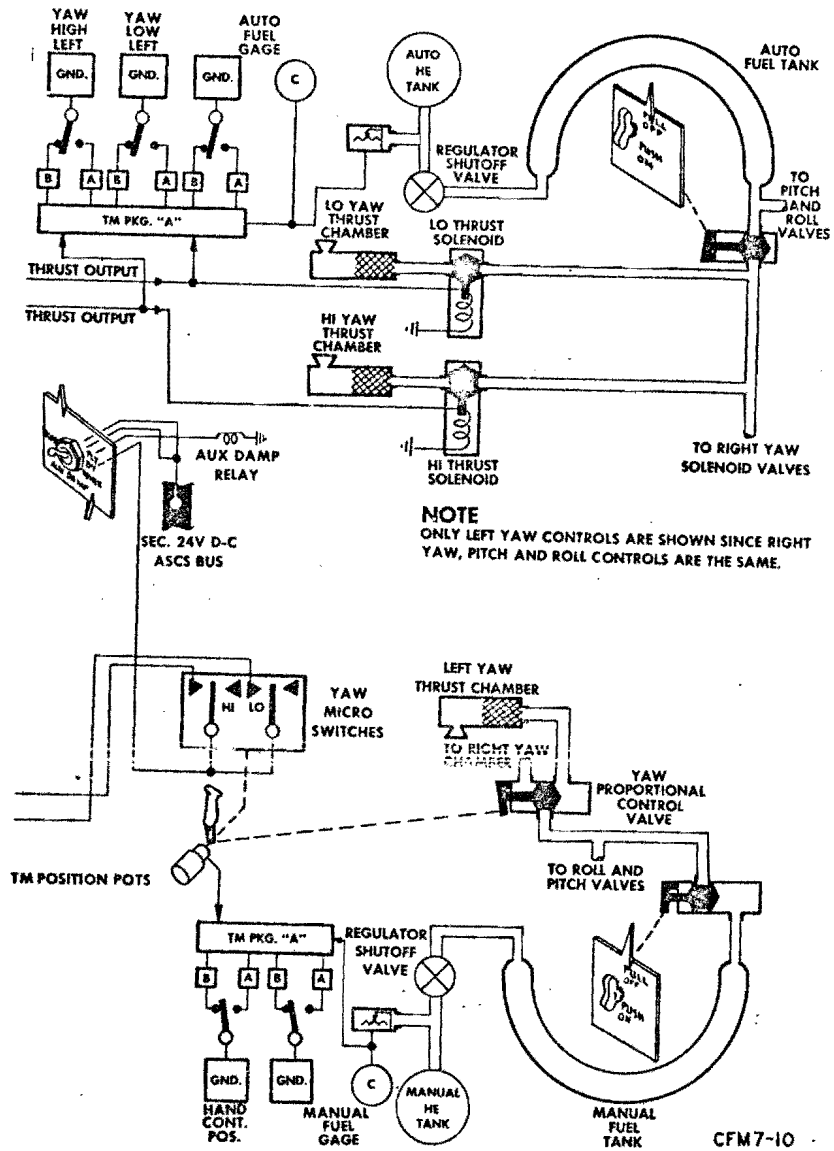


Figure 3-3



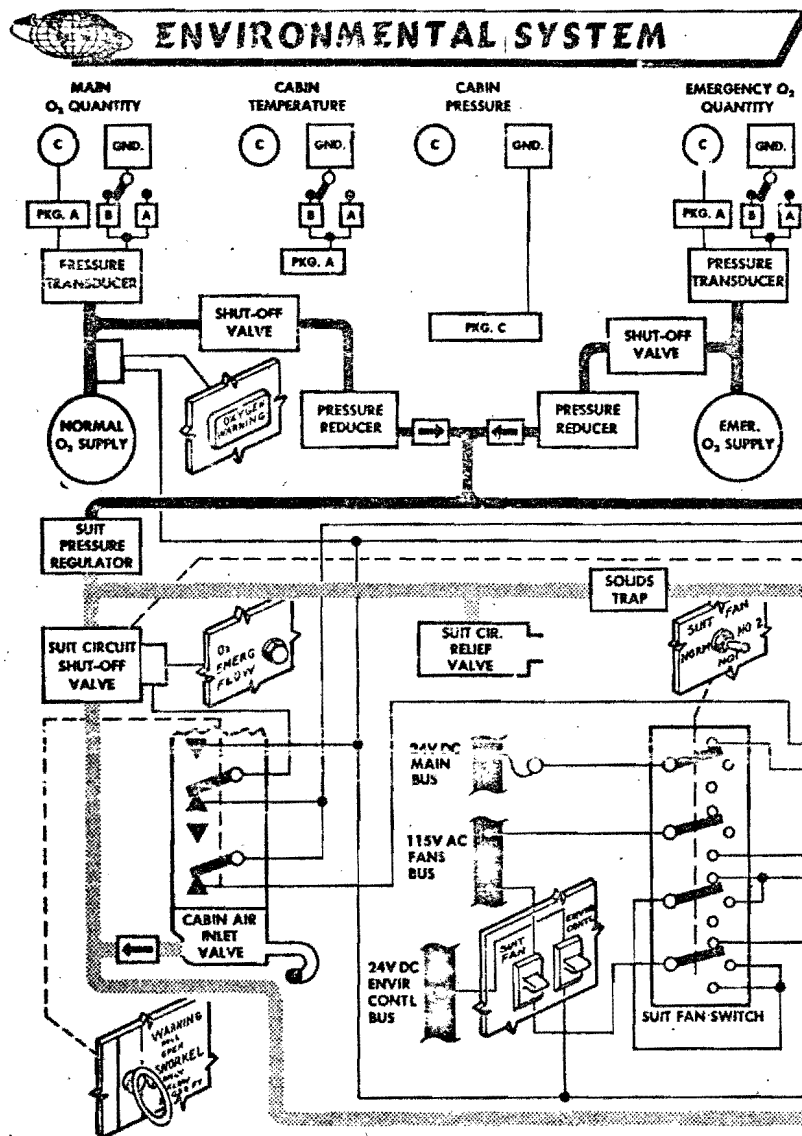
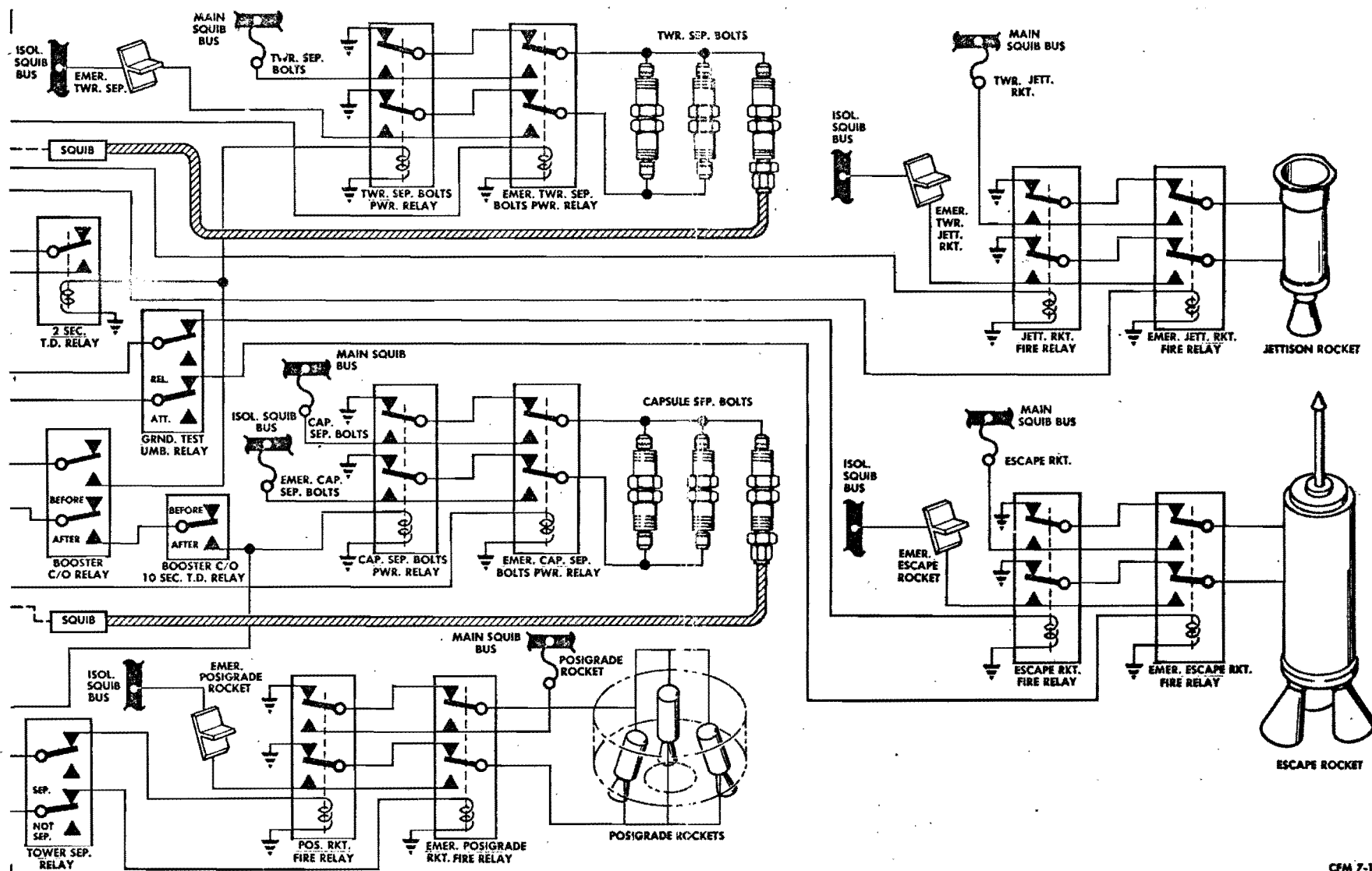
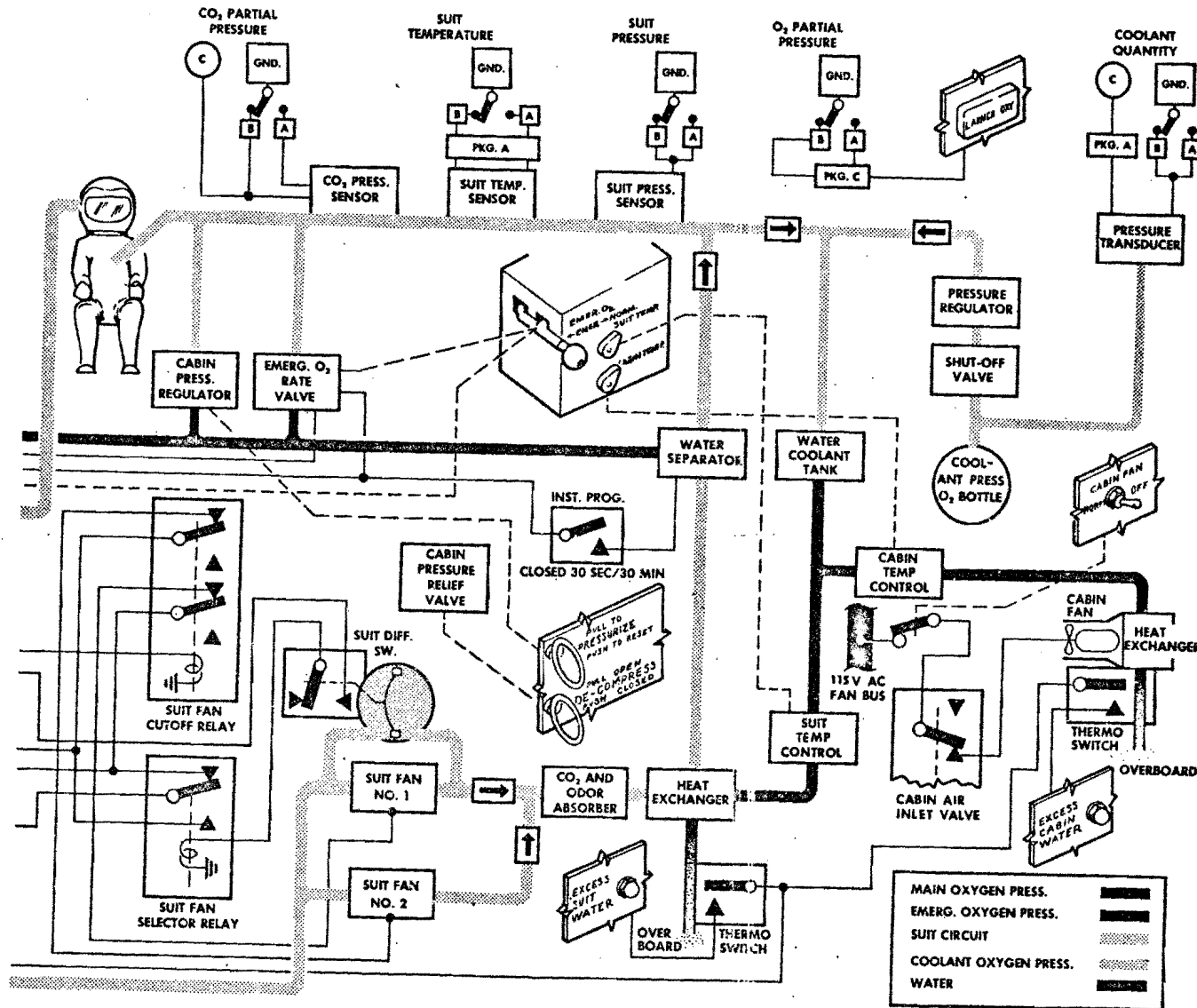


Figure 3-4





CFM7-9.

LAUNCH ORBIT SEQUENCE

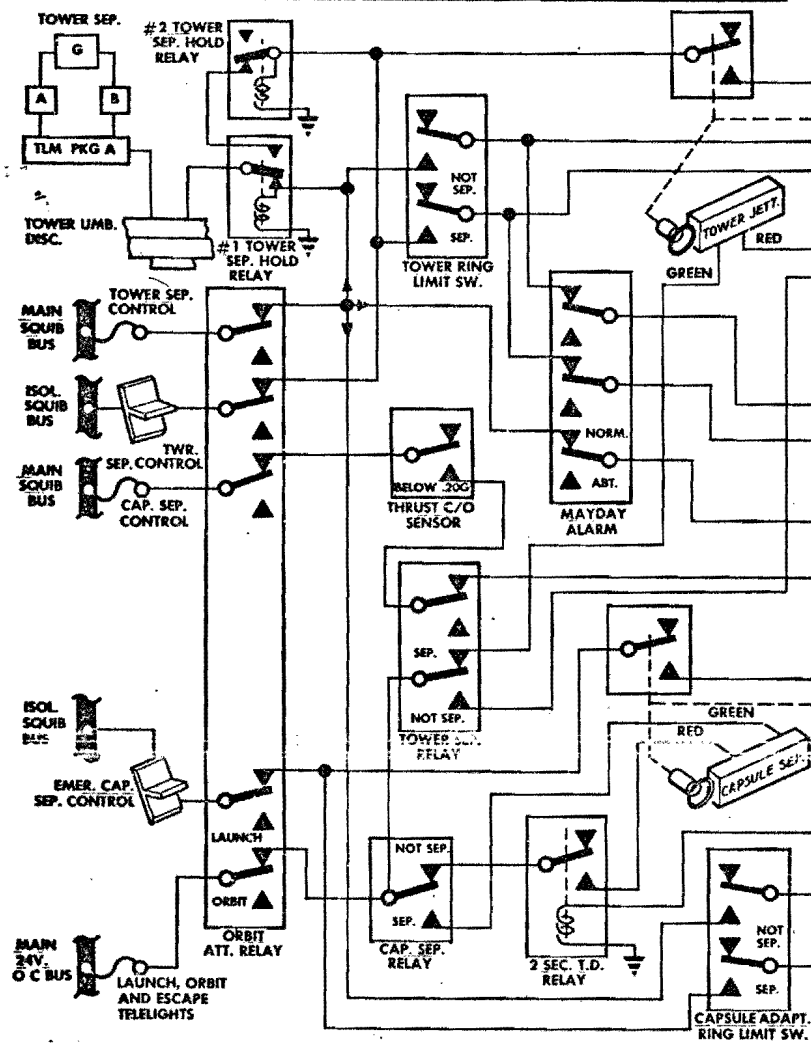


Figure 3-6

3-12

BASIC AUG 15 1980

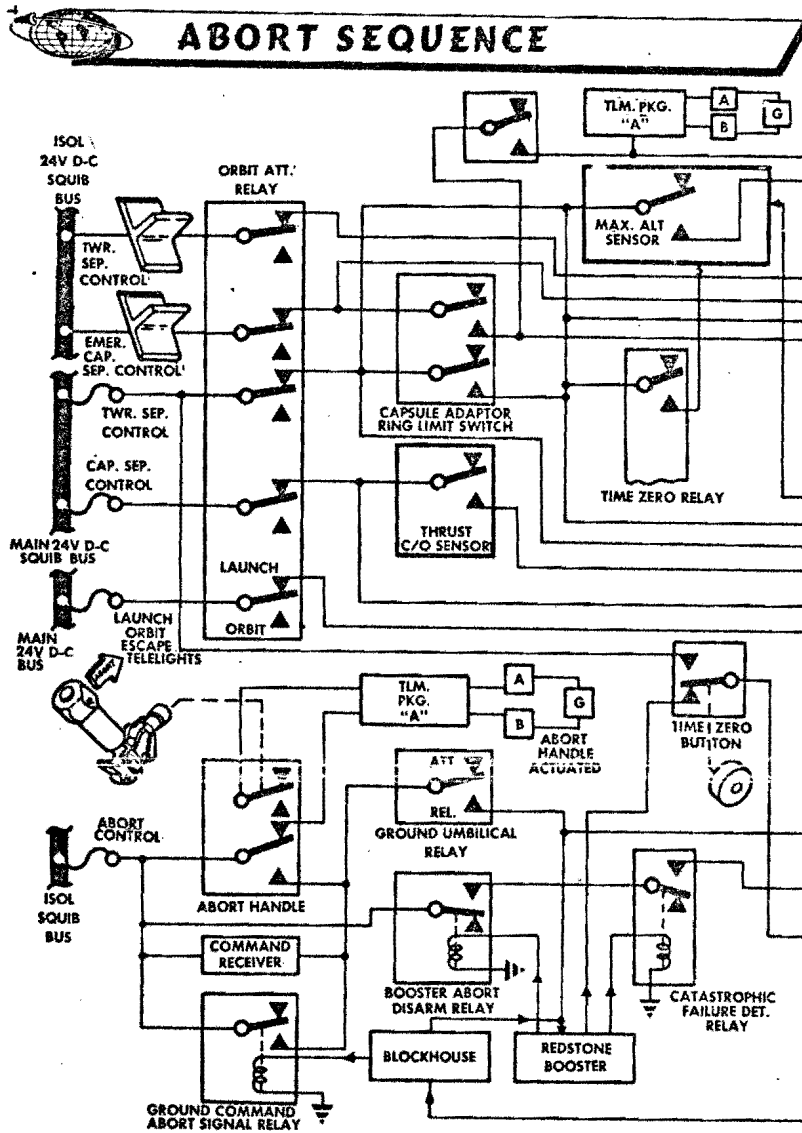


Figure 3-7

COMMUNICATIONS SYSTEM

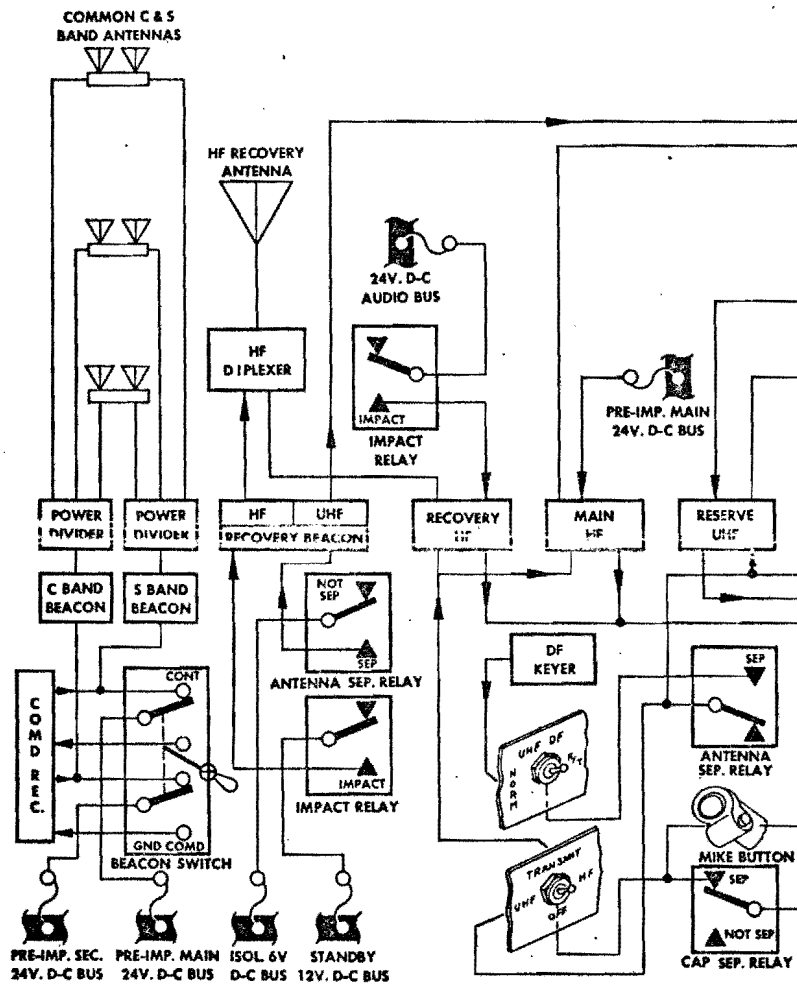


Figure 3-5

3-10

BASIC AUG 15 1960

COMMUNICATIONS SYSTEM

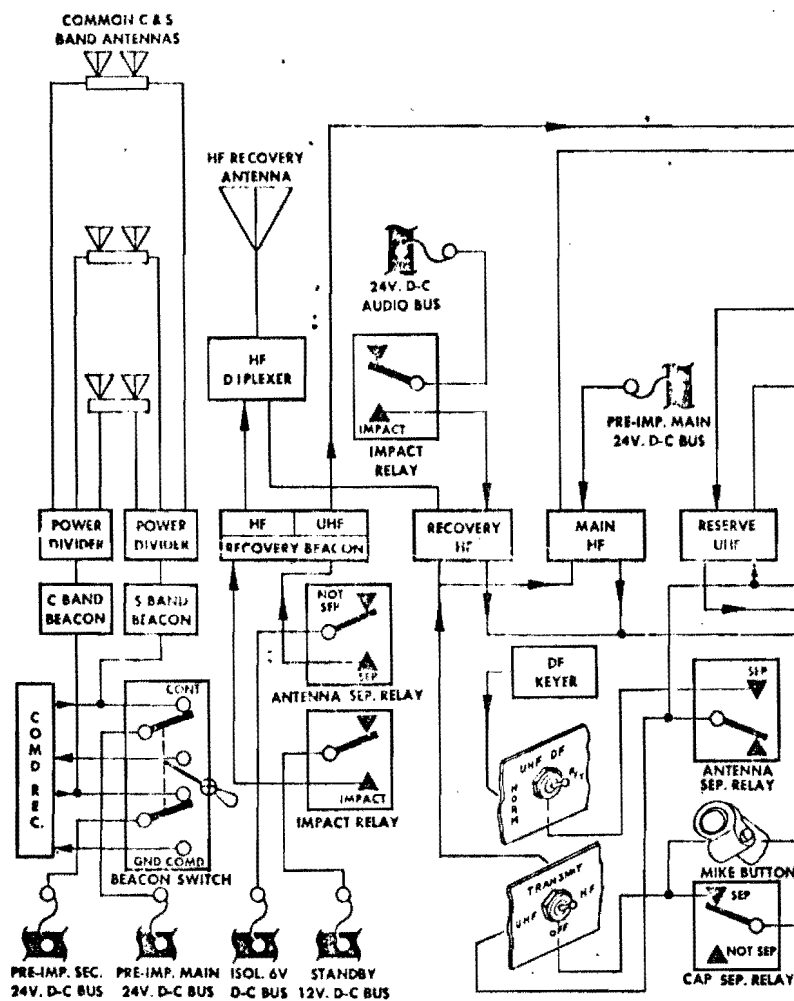
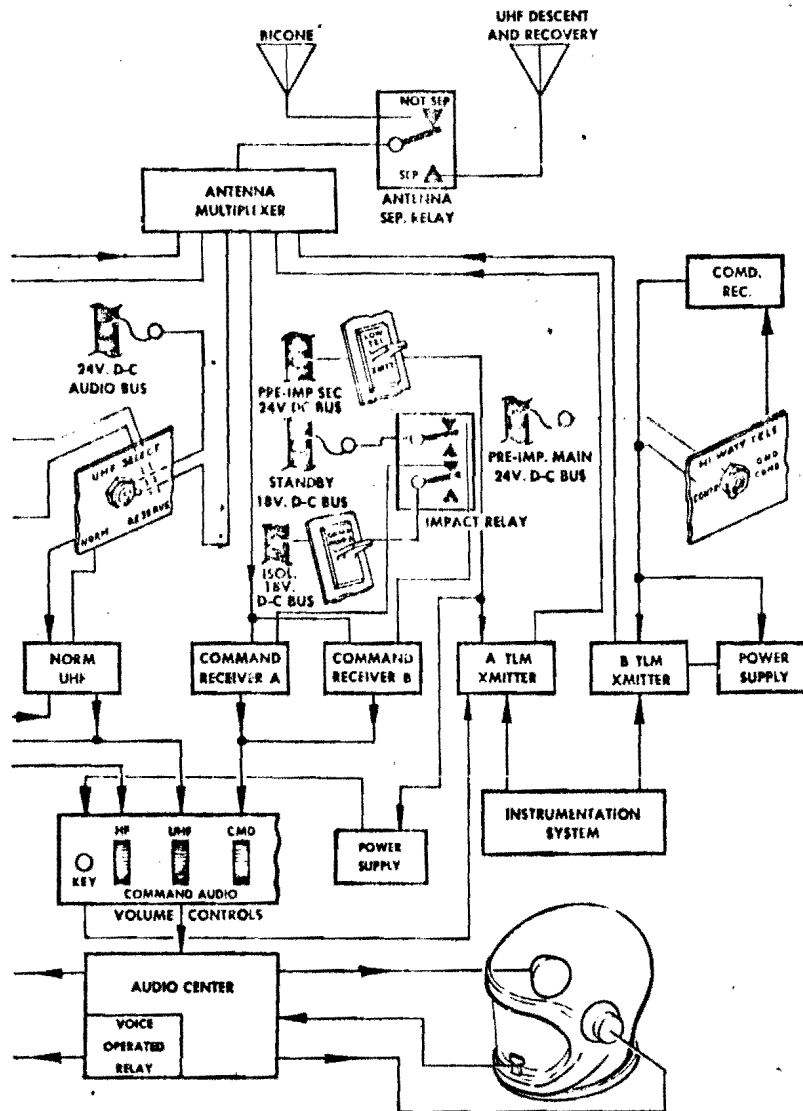
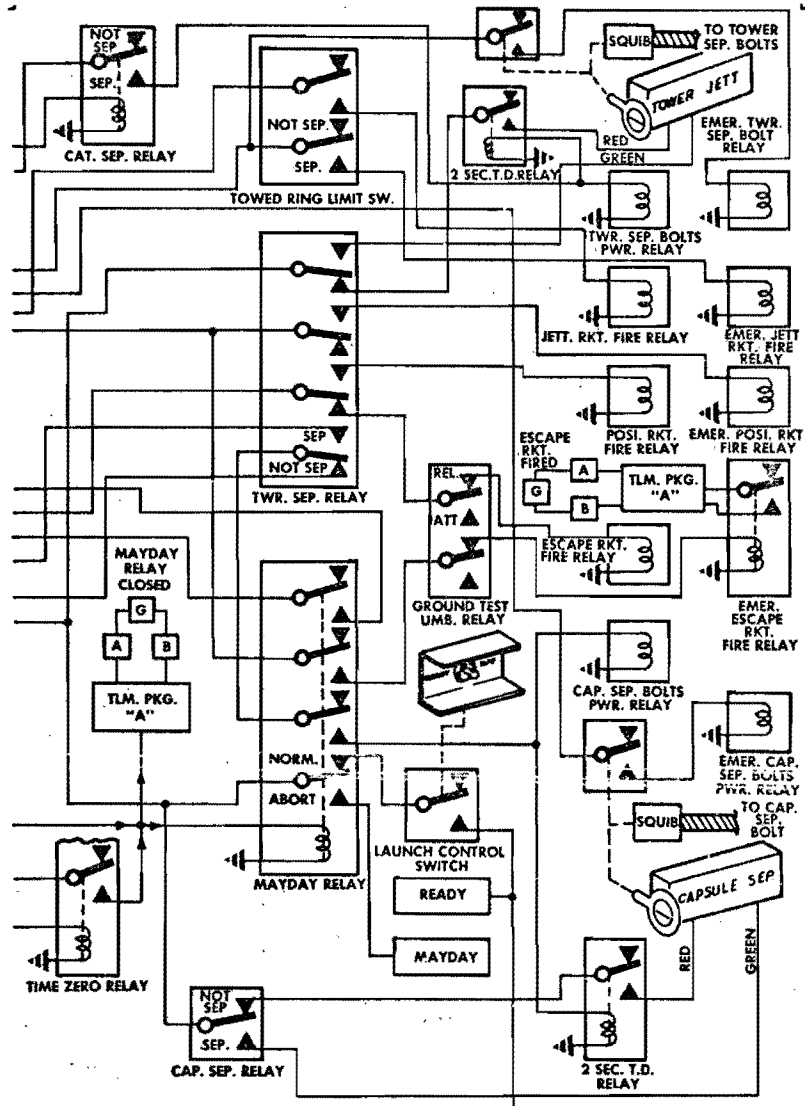


Figure 3-5



CFM7-8



CFM 7-2

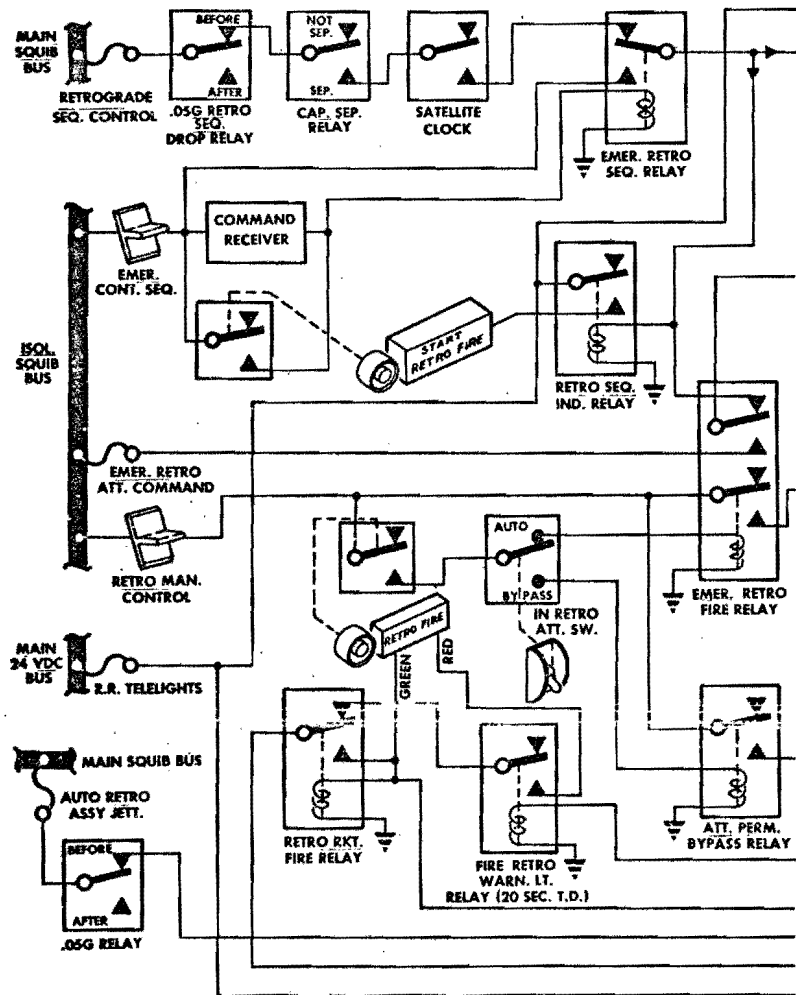
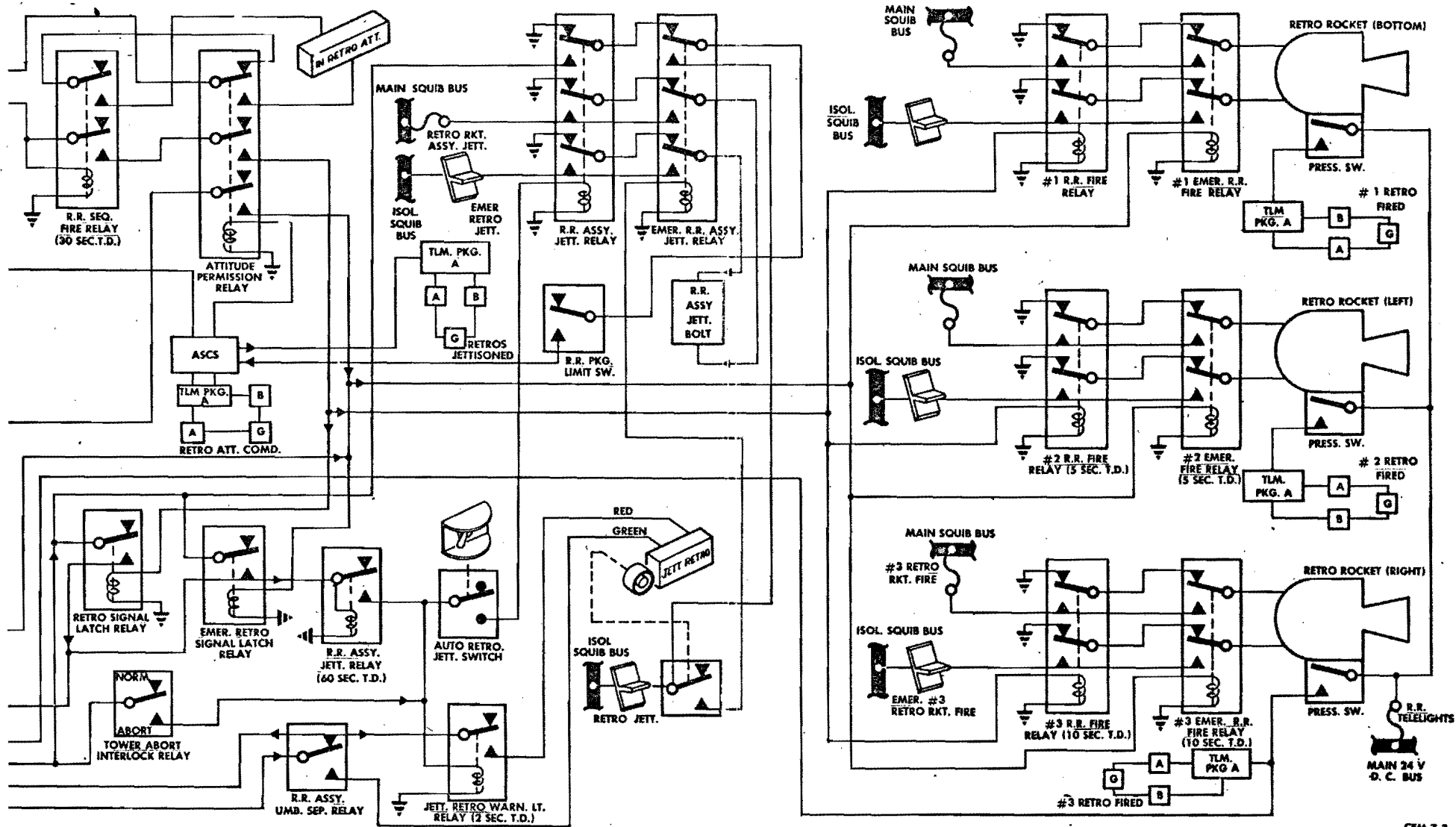


Figure 3-8



RECOVERY SEQUENCE (PRE-IMPACT)

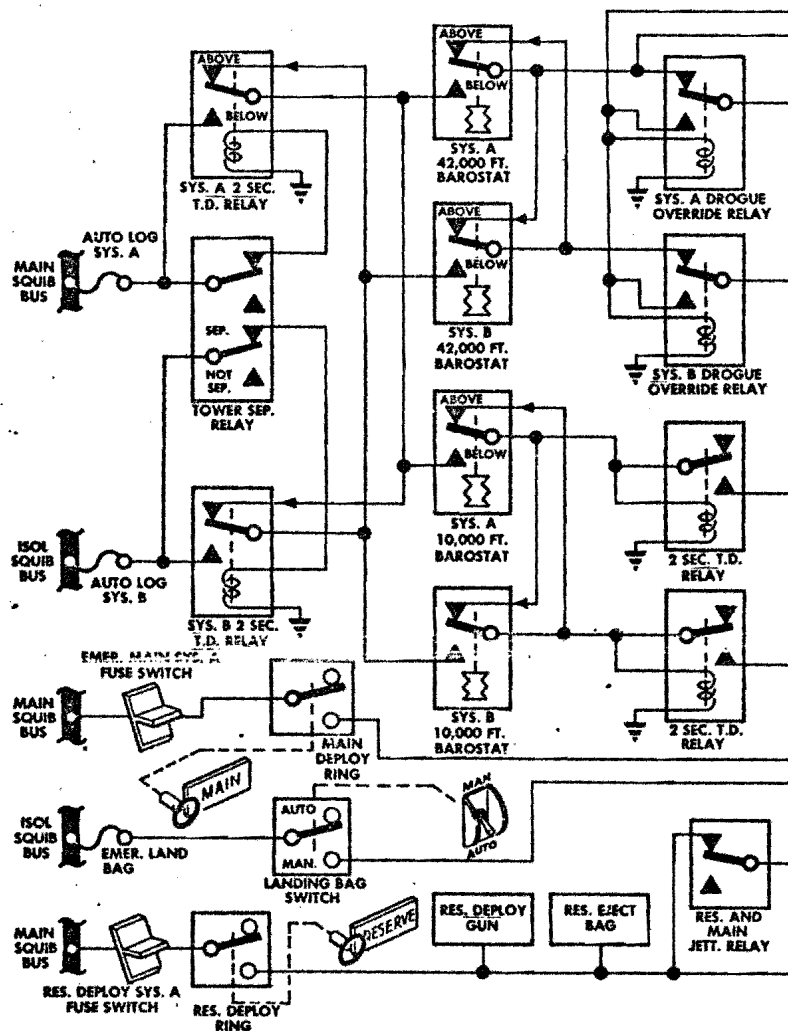
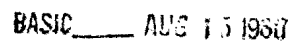


Figure 3-9



RECOVERY SEQUENCE (POST-IMPACT)

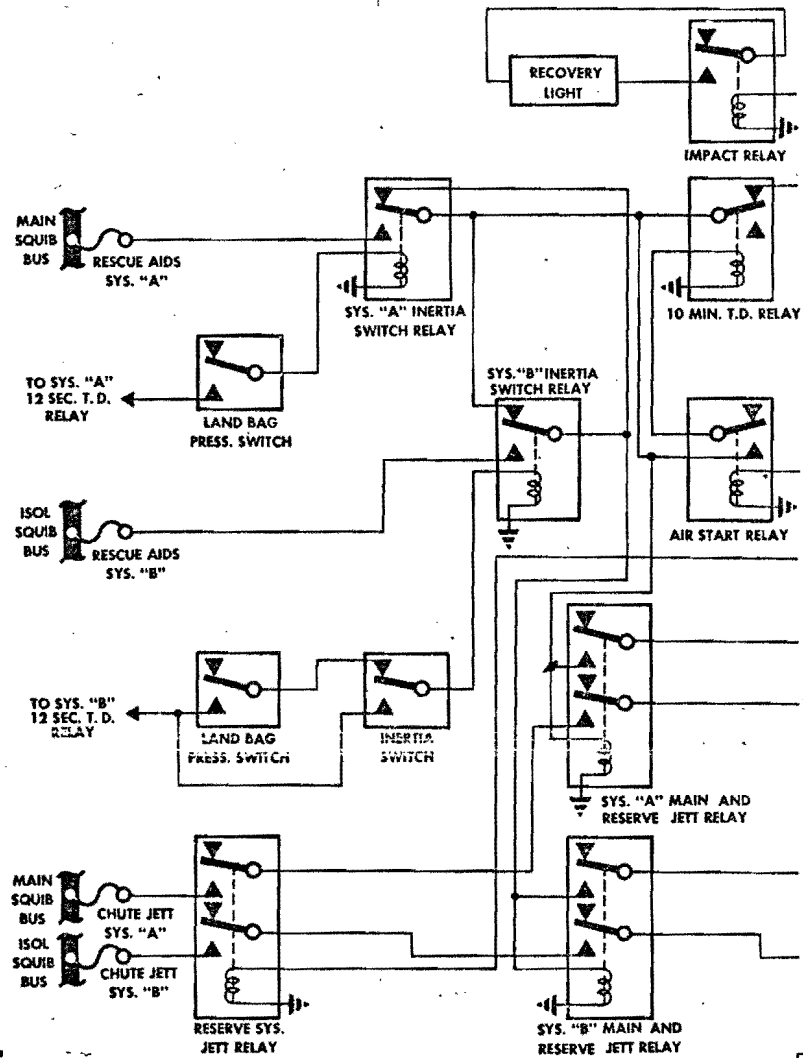
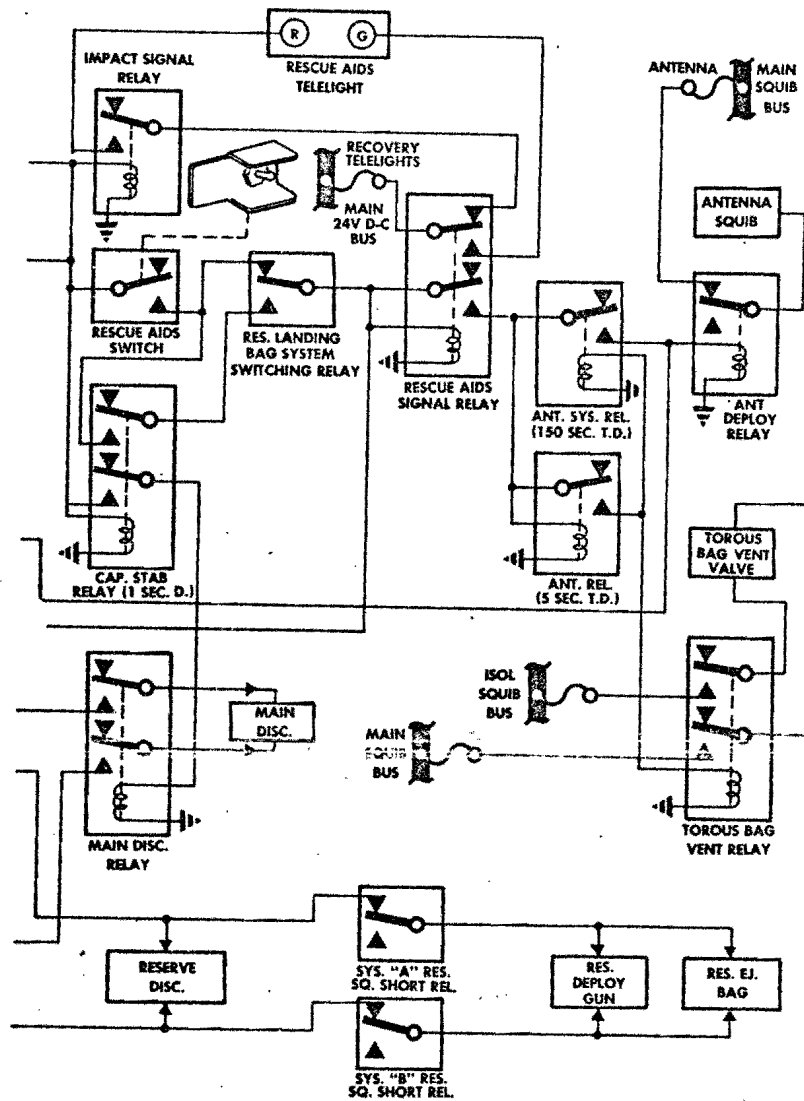


Figure 3-10

SEDR 109-7



CFM 7-5

SEDR 109-7

NOTES

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There is no text or other markings on the paper.

3-22