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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

NASA PROGRAM APOLLO WORKING PAPER NO. 1213

CREW EGRESS PROCEDURES FOR APOLLO
BLOCK I COMMAND MODULE AT SEA



MANNED SPACECRAFT CENTER

HOUSTON, TEXAS

December 7, 1966

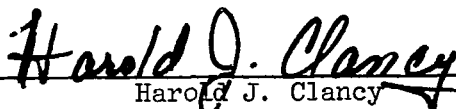
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BLOCK I COMMAND MODULE AT SEA

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CREW EGRESS PROCEDURES FOR APOLLO

BLOCK I COMMAND MODULE AT SEA

By Harold J. Clancy and Reed M. Darley

SUMMARY

All four possible modes of egress were investigated - the main crew hatch and forward hatch in Stable I and both of these again in Stable II. Check list procedures were developed for all cases. Stable II egresses were considered only as being contingent. Egress through the forward hatch and main crew access hatch in Stable II was found to be feasible. In the case of the main crew hatch egress in Stable II, the present proposed center of gravity ($X = 37$ in., $Y = 0.5$ in., and $Z = 4.5$ in.), and concomitant flotation attitude could result in the loss of the spacecraft. The forward hatch egress in Stable II would not result in the loss of the spacecraft as long as the crew compartment air pocket is maintained.

The Stable II tunnel hatch egress is accomplished by first flooding the tunnel area through the postlanding vents, equalizing pressure on both sides of the hatch. The hatch is then removed and egress is performed in a feet-first attitude using the hands to push down and away from the spacecraft. The buoyant force of the pressure garment assembly or life preserver may be utilized to indicate the direction of the surface. To avoid injury or entanglement, the crewman must make sure he has pushed himself clear of the spacecraft before he surfaces. He should also exhale as he surfaces to prevent aeroembolism.

Active and exact crew coordination is required during egress. This is particularly true in the deployment of the survival equipment which, with its several lanyards, can become tangled quite easily.

INTRODUCTION

The Apollo Postlanding Suitability Program includes a development program to investigate facility and safeness of egress from the Apollo command module, to develop test crewmen egress procedures, and to qualify

test crewmen in egress procedures in preparation for Spacecraft 007 at-sea tests. See Appendix A for egress procedure development chart.

The total development program consists of three test series:

1. Development of water egress procedures both Stable I and Stable II in a test tank.
2. Qualification of procedures at sea.
3. Verification of nominal egress procedures utilizing Spacecraft 007.

The development program took into account all pertinent details including stowage of loose equipment, acquisition and deployment of survival gear, and proper handling of spacecraft hatches.

The Flight Crew Support Division, Astronaut Activity Office, and Crew Systems Division are integrally involved in the egress development program. Completion of the test program will result in an astronaut egress training program with Boilerplate 1102 as the training vehicle.

DESCRIPTION OF TEST VEHICLE AND FACILITIES

Boilerplate 1102 (Figure 1)

Boilerplate 1102 has the basic exterior and pressure cabin dimensions of the Block I Apollo spacecraft. Its equipment bays are equivalent to an Apollo spacecraft in dimensions but contain dummy equipment which approximates equipment displacement of Apollo Spacecraft 012. The crew compartment is mocked up and includes actual flight item crew couches borrowed from Spacecraft 007, instrument panels which contain dummy switches, switch guards and other protrusions which could hinder egress, and dummy umbilicals for connection to the pressure garment assembly. Scuba breathing equipment is located below the crew couches with masks and regulators located on each couch.

Boilerplate 1102 hatches are similar in size, weight, and operating mechanism to flight articles. The outer main crew access hatch has no dummy heat shield material making it somewhat thinner than the flight article. The forward hatch was borrowed from Spacecraft 007 and includes S/C vent valves and fan. A special switch was added to the PLVC circuitry in order to assure that the fan would not operate when the vent valves were opened in the Stable II attitude.

The boilerplate contains an uprighting system similar in operation to the flight article but utilizing tanks of compressed air rather than a compressor.

At the time of testing the following figures were provided by North American Aviation as the postlanding weight and center of gravity of Spacecraft 012:

Without crew - X = 36.7 inches
 Y = 0.4 inches
 Z = 5.6 inches
 Weight = 10 028 pounds

Boilerplate 1102 was configured to this data. See Appendix B for flotation attitude of 1102.

NASA Water Tank Facility

A fresh water tank is located in building 260 at the Manned Spacecraft Center. The tank is 16-feet deep and 24 feet in diameter.

NASA Motor Vessel "Retriever"

The "Retriever" is a converted LCU modified for use as an open sea test facility. It includes a boom capable of placing test vehicles into the water and retrieving them.

DESCRIPTION OF TESTS AND RESULTS

The major portion of results are written in the form of check list procedures and appear in Appendix C. These check lists were developed and used to verify that the Apollo command module permitted safe and rapid egress for both the Stable I and Stable II attitudes.

Test 1 - Tank Facility

Stable I testing. - Prior to egress development water testing, preliminary techniques were established while the boilerplate was static. This also served to acquaint the test subjects with the interior of the spacecraft.

After the boilerplate was placed in the test tank, the test subjects entered and all hatches were locked. During these initial tests, the subjects wore flight suits which closely approximate the Apollo constant-wear garment. The test subjects went through several egresses using both the main crew access hatch and the forward hatch. Survival equipment was deployed in each case. Various procedures were tried, alternating duties among the three test subjects. Following these tests, detailed check lists were written for each crewman using both the observations of the subjects and those of cognizant personnel.

The initial difficulties in removing the forward hatch on the Block I spacecraft have been remedied by the addition of a screwjack mechanism on the hatch. However, several other factors should influence consideration of a forward hatch egress: the possibility of inflated uprighting bags restricting maneuverability, pyro charges on the upper deck could present a danger factor, motion of the spacecraft in water causes difficulty in standing on the upper deck, and entering life rafts from the upper deck is difficult.

The inner main crew access hatch will have to be stowed to the left or right of the hatch opening to facilitate egress. At present neither side appears preferential, but the addition of a stowage box for experiment S-15 beneath the hatch opening could hinder movement of the hatch after its removal. The addition of an airlock on Spacecraft 014 will increase the weight of the inner hatch by about 25 pounds and add further bulkiness. This will compound handling problems and at least two crewmen will be required for removal and storage.

If the outer main crew access hatch is excessively tight, it was found that the crewman could get excellent leverage by grasping the two X-X head struts and using his feet to push out the hatch. This is possible in both Stable I and Stable II.

Stable II testing. - All Stable II egress development work was done in the test tank facility for reasons of ease in handling and safety. Although initially the removal of the forward hatch by the crewmen was arduous if not impossible, this exit was investigated. The later development of the screwjack mechanism alleviated the problem.

The boilerplate was placed in the Stable II position with three test subjects strapped inside. The two postlanding vents were opened by activating the PLVC switch in conjunction with the fan blower switch on MDC 25. This procedure was necessary to equalize pressure on both sides of the forward hatch. It was found that the hatch should be unlocked and partially screwed open by the senior pilot prior to the command pilot's activating the postlanding vent valves. Excessive difficulty occurred when attempting to insert the unlocking and ratcheting device underwater. The water rose in the boilerplate until it approximately filled the tunnel area. The decrease of interior atmosphere

volume caused an increase in the interior pressure approximately equal to the water pressure at the depth of the test vehicle in the water. Since this increase in pressure is rather sudden, the crewmen should be prepared to clear their ears. After egress through the forward hatch, the crewmen should exhale as they rise to the surface to prevent aero-embolism.

The main crew hatch egress in Stable II was found to be feasible but would probably result in the loss of the spacecraft. The present proposed center of gravity (X = 37 in., Y = 0.5 in., and Z = 4.5 in.) puts the water line just above the main crew hatch opening in Stable II. After the main crew hatch is kicked off and the first crewman exits, the water line moves down several inches below the hatch. However, it is likely that the spacecraft would ship water.

Test II - Sea Tests

Sea tests were conducted in the Gulf of Mexico in relatively calm sea conditions (1 to 2 foot swells) and will be repeated in rougher seas (4 to 6 foot waves).

The flotation collar attached to the test vehicle presented an excellent platform for the swimmers to work from in aiding the crewmen during egress. The outer main crew access hatch can be positioned on the collar off to the side of the hatch. Care should be exercised since any sharp edge of the hatch could puncture the collar.

The check list procedures were closely followed for both the main crew hatch and forward hatch Stable I egresses. Minor problems arose in deploying the survival gear but these appeared to be remedied by reefing of the various lanyards when the survival kits are packed.

CONCLUSIONS

The most favorable Stable I egress exit appears to be the main crew access hatch with the flotation collar attached to the spacecraft. The difficulties in standing on the forward bulkhead in an active sea, plus several other factors, indicate that a Stable I forward hatch egress is not advisable.

In an emergency, Stable II egresses are feasible but could result in the loss of the spacecraft. Crewmen should be aware of the possible pressure changes and how to compensate for these changes. Tools used in operating the forward hatch should be in place on the hatch before the postlanding vent valves are opened.

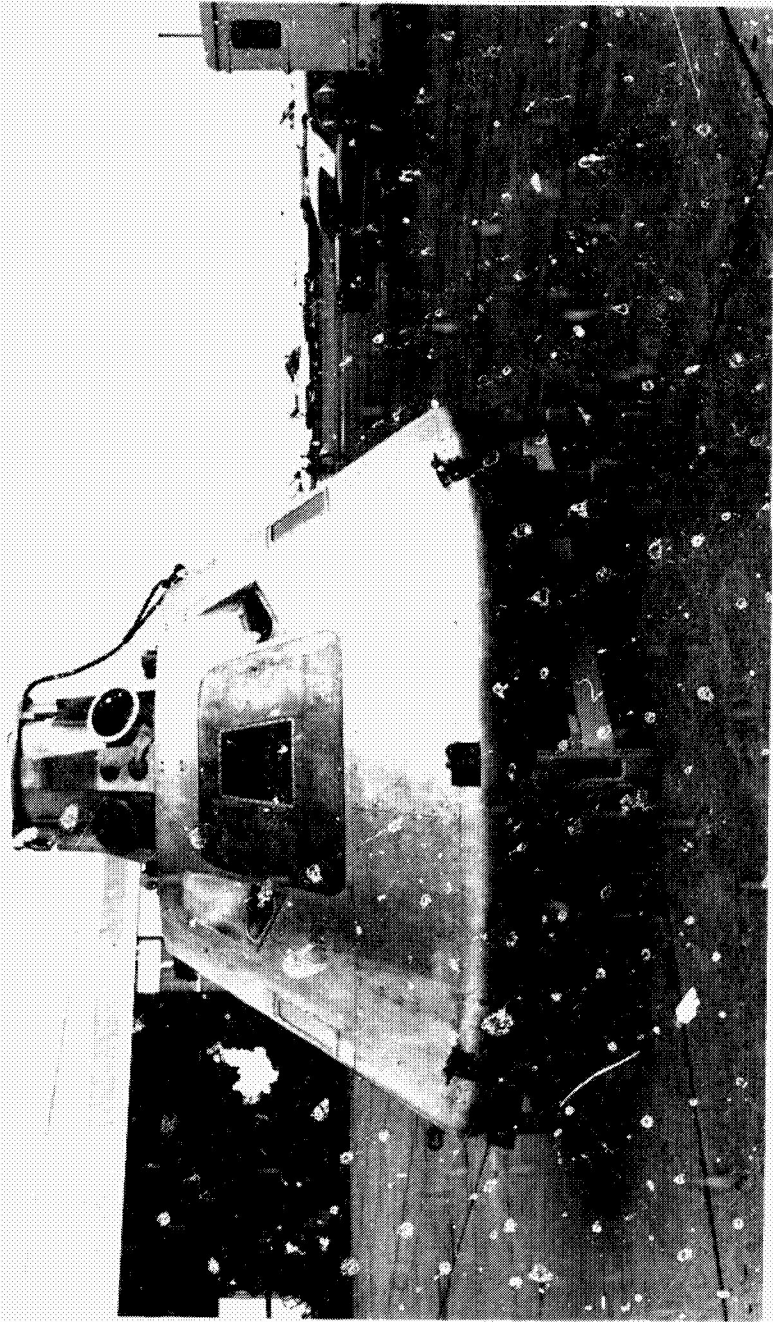


Figure 1. - Boilerplate 1102.

NASA
SP-69-31421

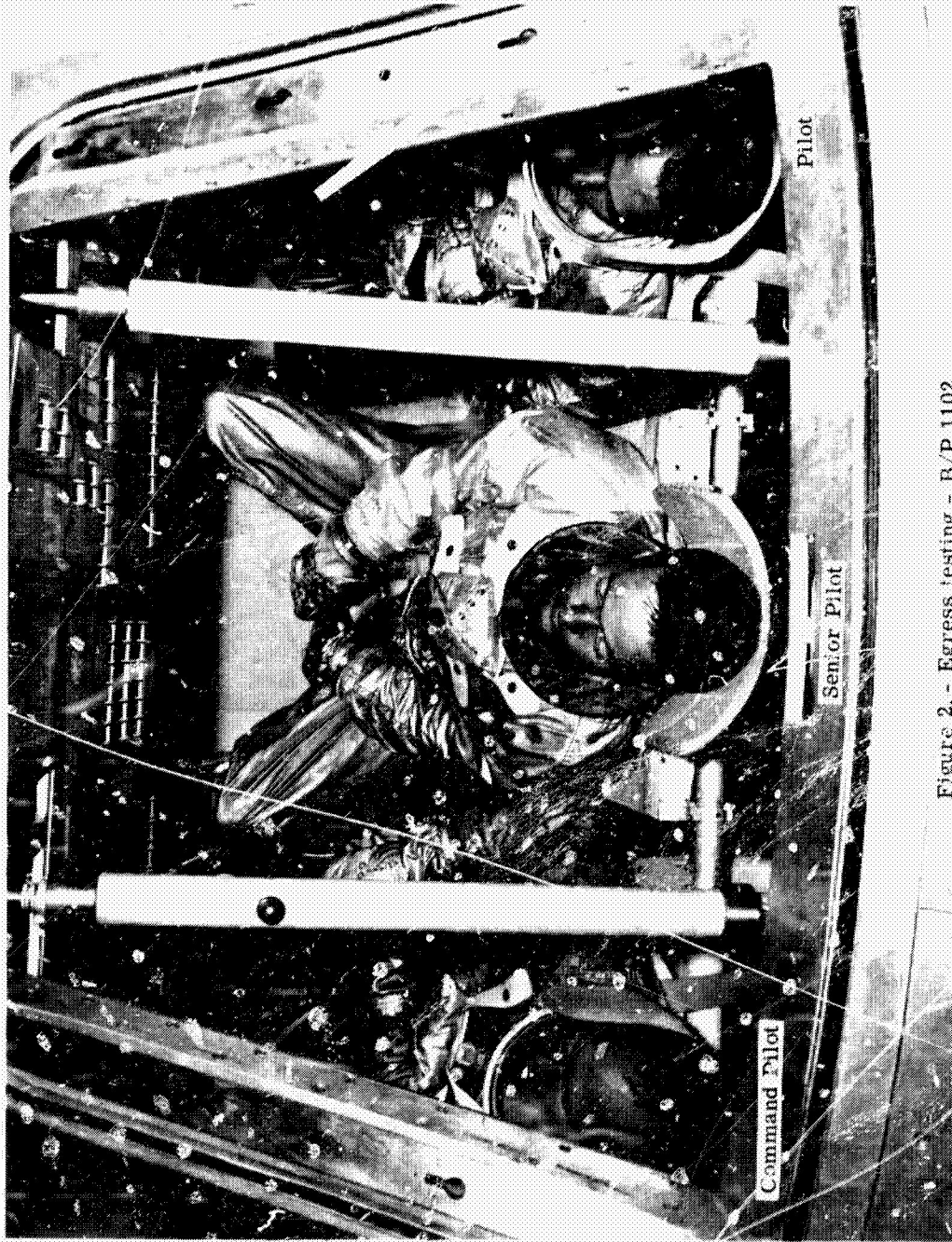


Figure 2. - Egress testing - B/P 1102

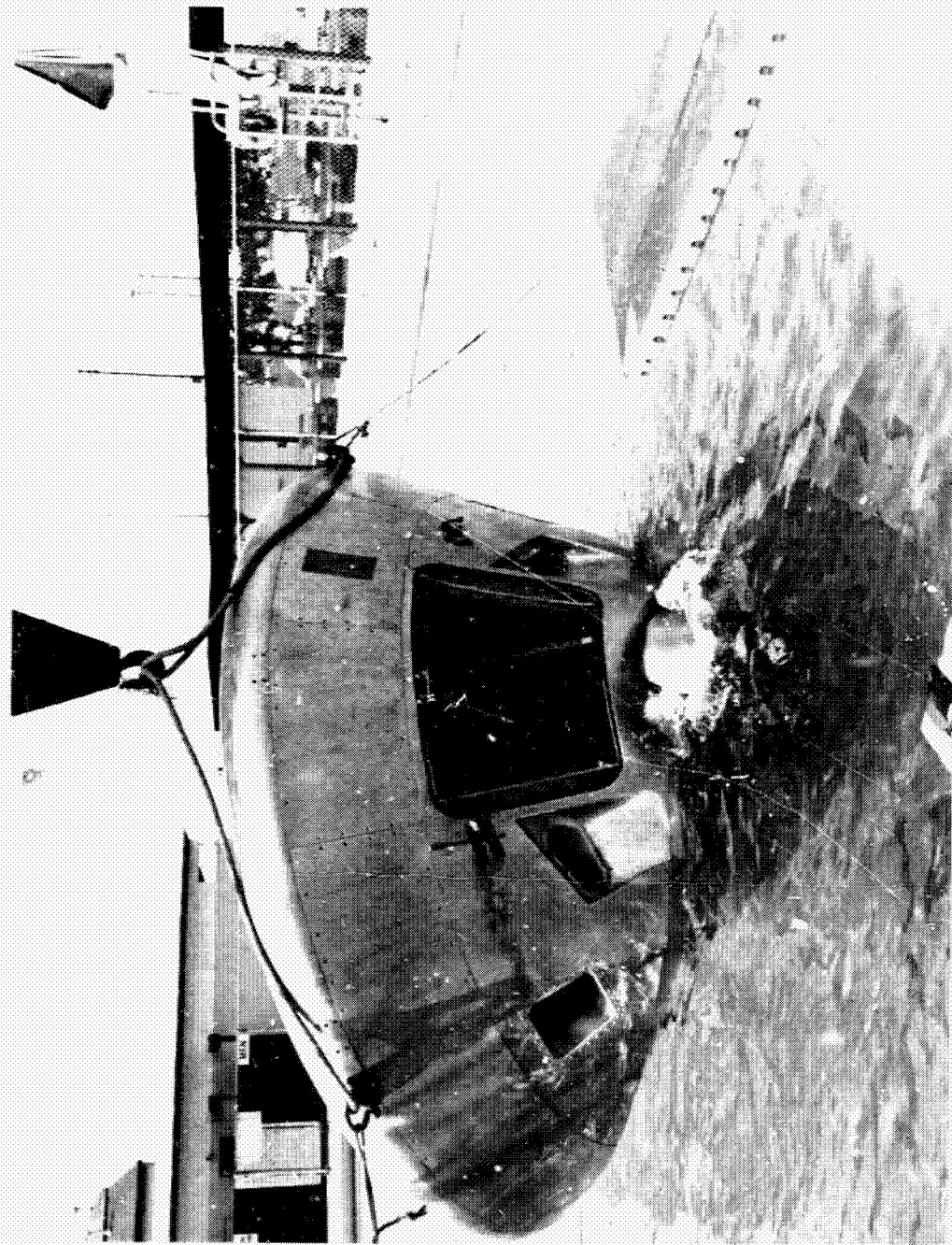


Figure 3. - Egress testing Stable II - Main crew access hatch.

NASA
S-69-46386

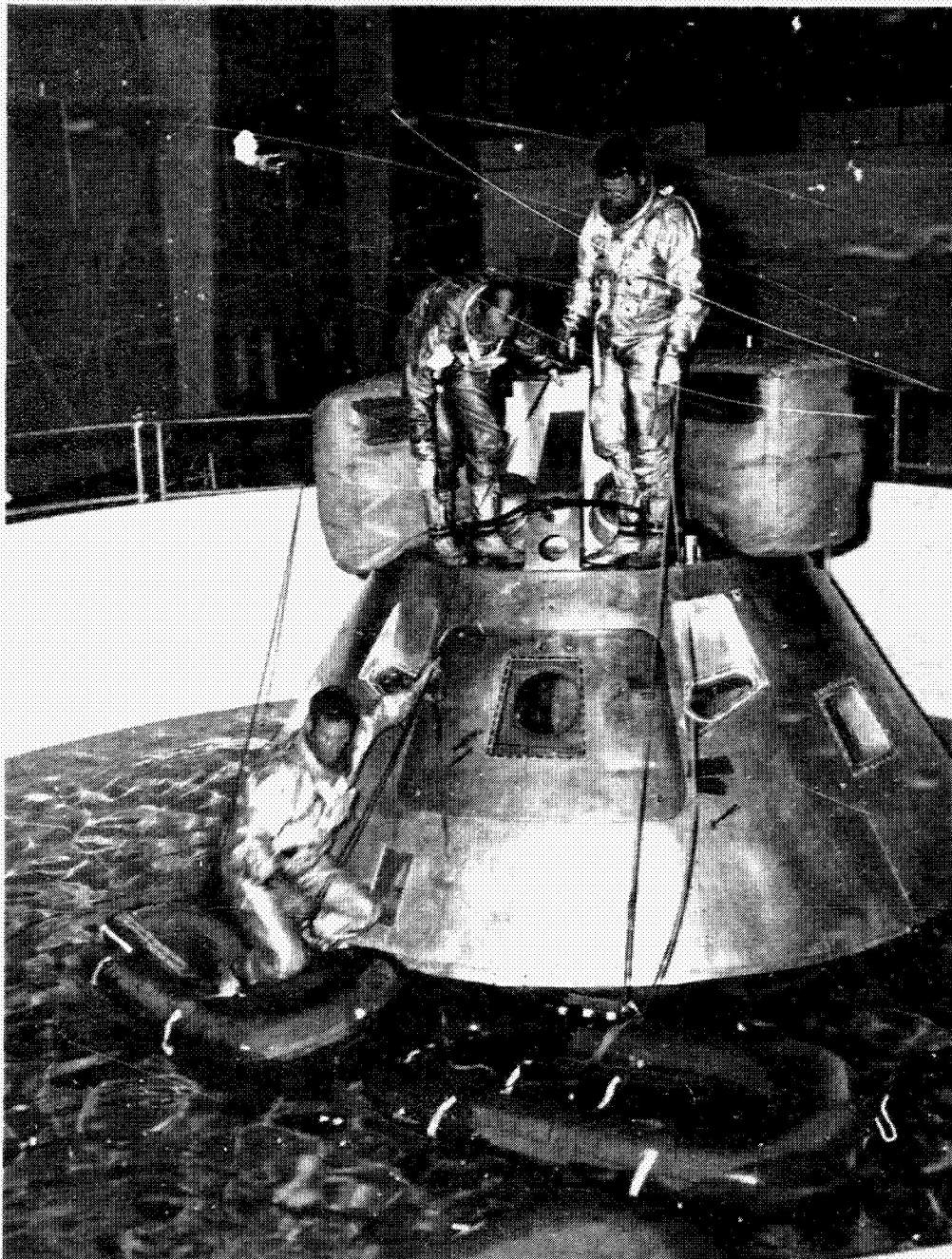


Figure 4. - Forward hatch egress.

NASA
60-1608B



Figure 5. - Stable II forward hatch egress.



NASA
LSC-100-100

Figure 6. - Egress testing Stable I - Test tank facility.



Figure 7. - Egress testing - Main crew hatch test tank facility.

NASA
S-06-35037

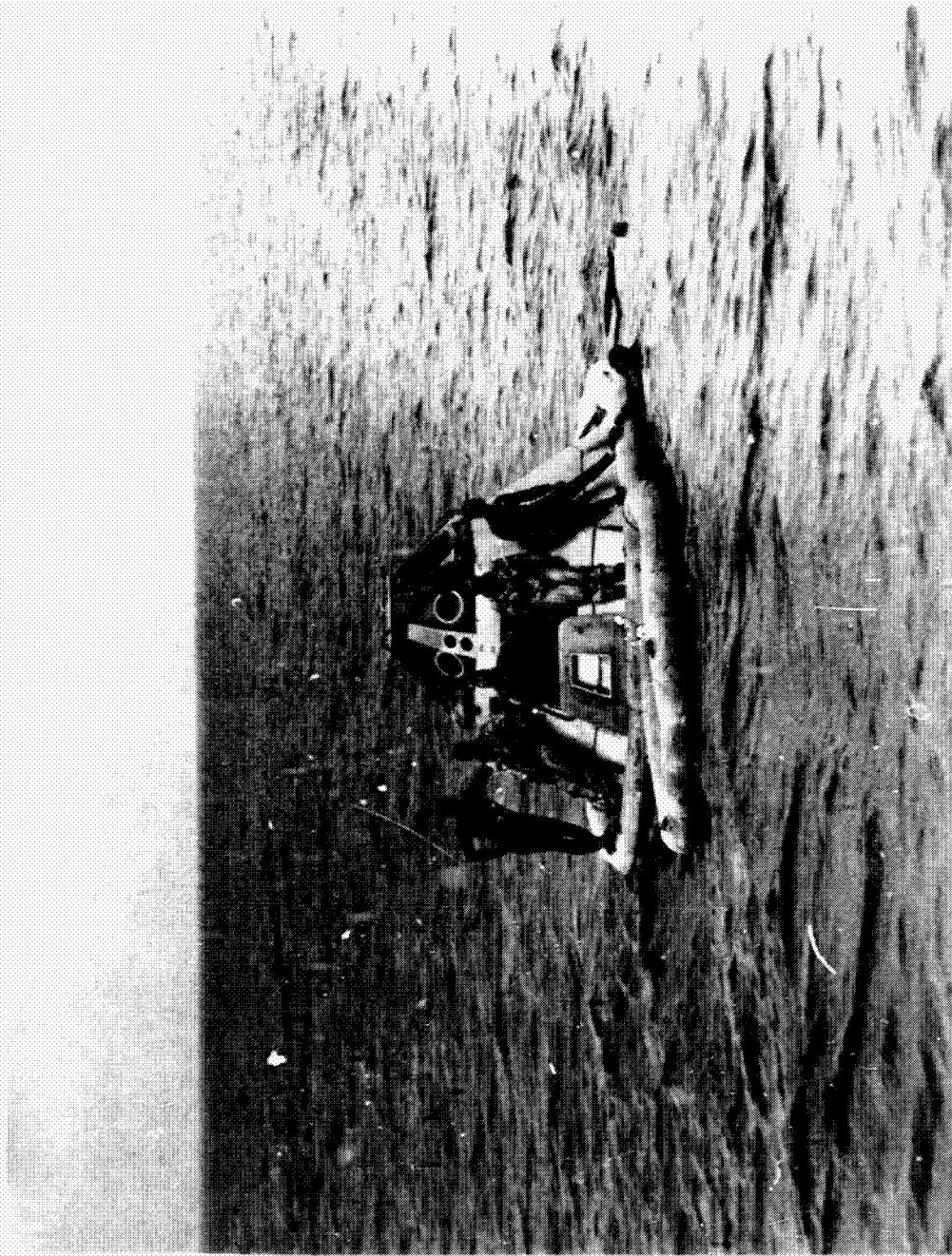


Figure 8. - Egress testing - Main crew access hatch - Gulf of Mexico.

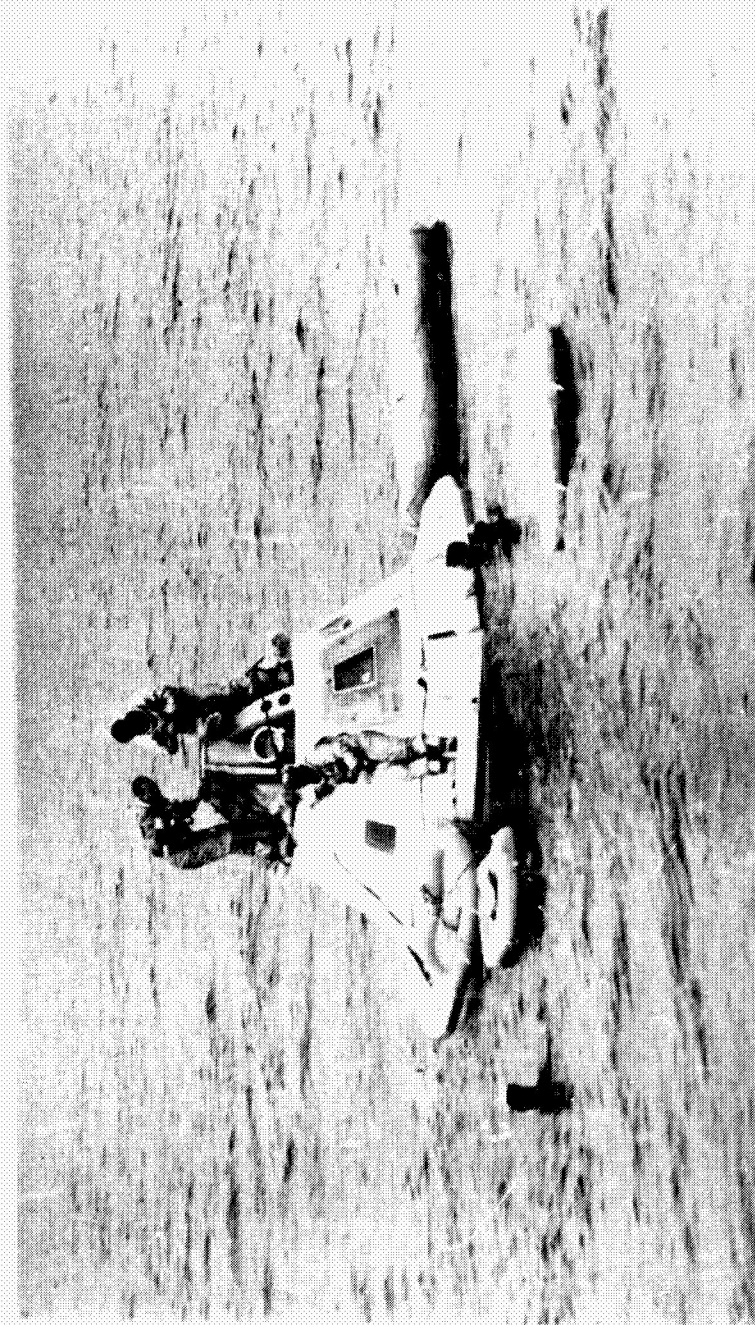


Figure 9. - Egress testing - Forward hatch - Gulf of Mexico.

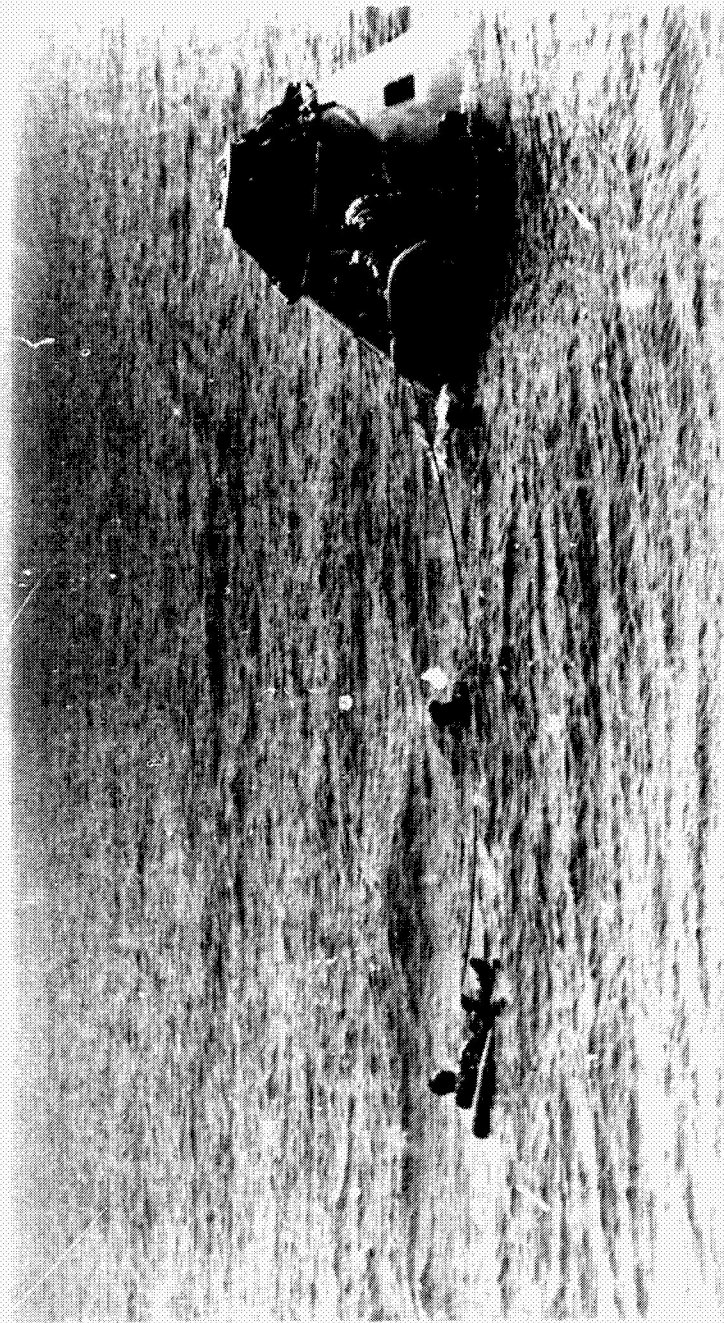


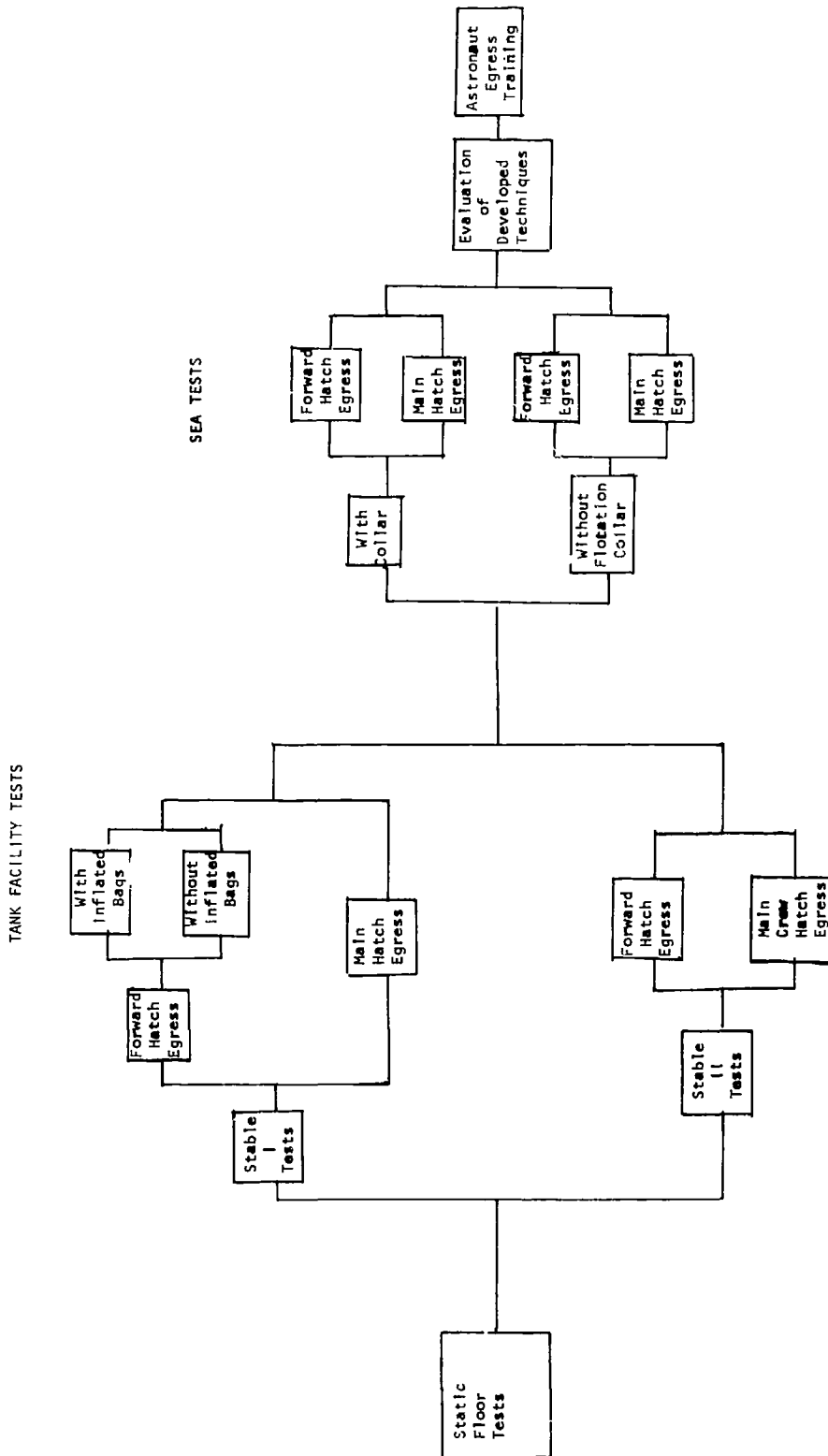
Figure 10. - Egress testing - Main crew access hatch - Gulf of Mexico.

Appendix A

EGRESS PROCEDURE
DEVELOPMENT PROGRAM

— . —

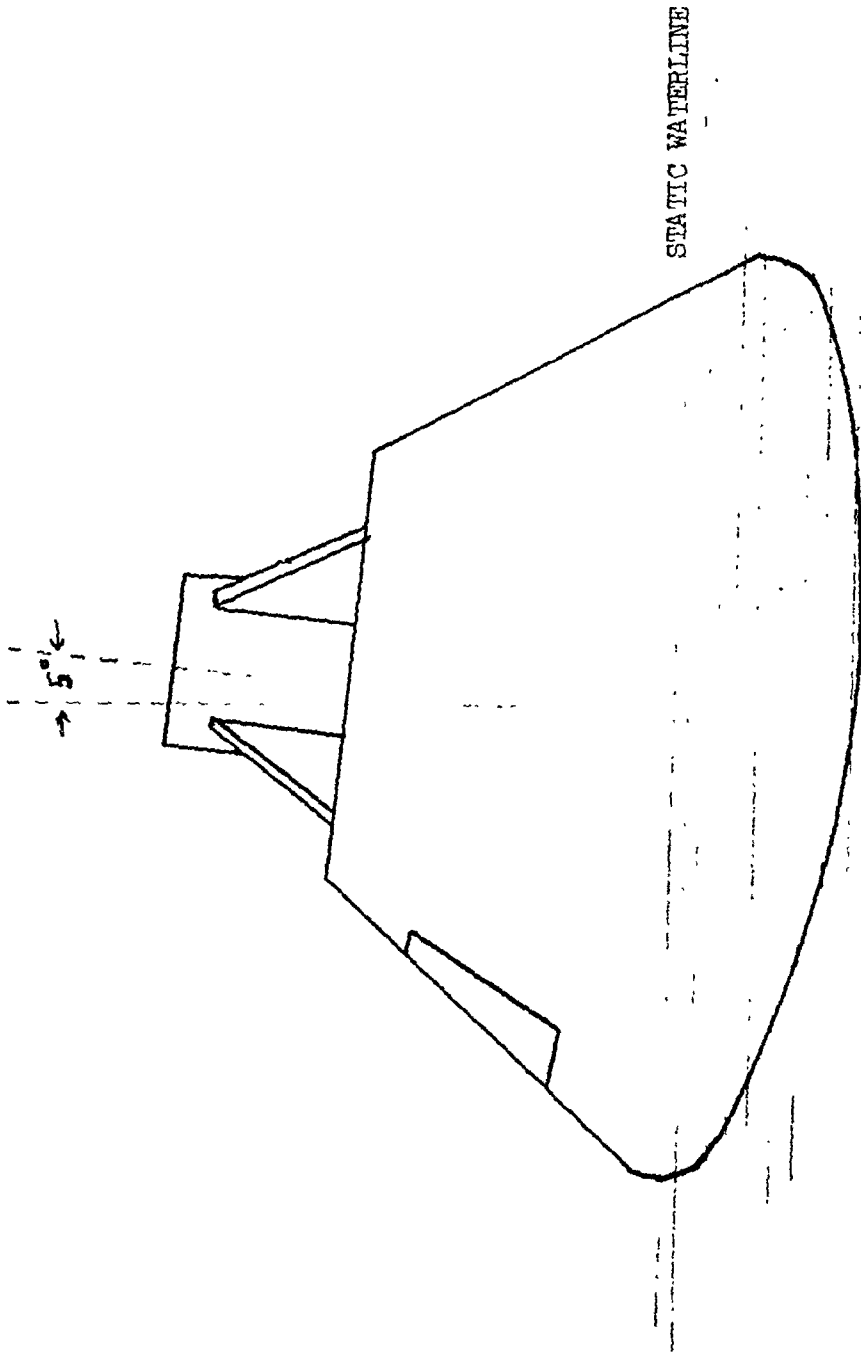
EGRESS PROCEDURE DEVELOPMENT



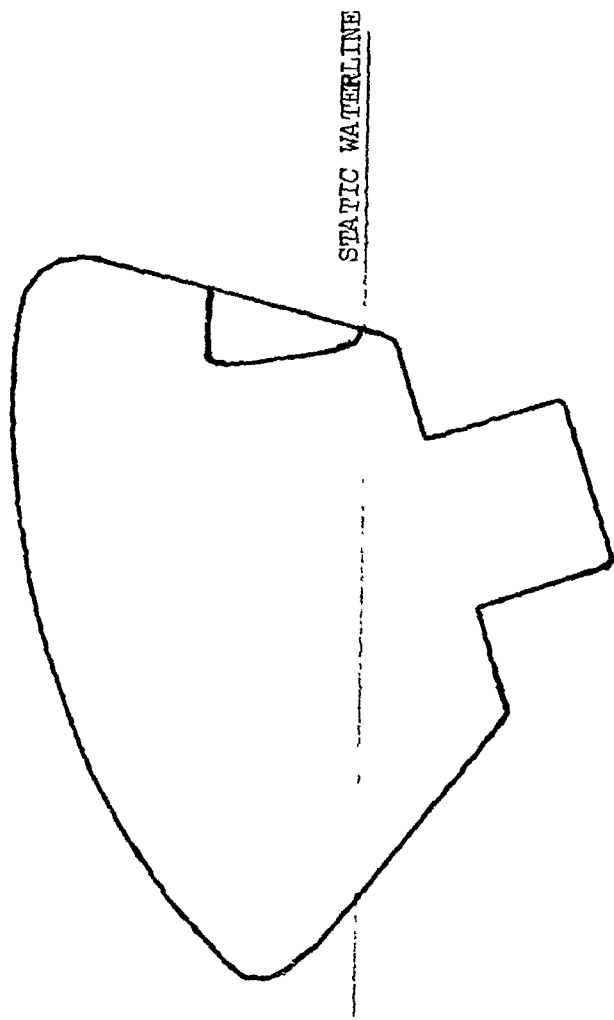
Appendix B

BOILERPLATE 1102 TEST FLOTATION

ATTITUDES



BOILERPLATE 1102 STABLE I ATTITUDE



B-3

BOILERPLATE 1102 STABLE II ATTITUDE

C-1

Appendix C

TEST CREW EGRESS

CHECK LISTS

The check lists were developed with test subjects wearing the Block I pressure garment assembly. If egress is performed while crewmen are in the constant wear garment, applicable deletions can be made on the check lists. Provisions has been made for attaching the life preserver pack to the crewman in the constant wear garment by using part of the raft lanyard as a harness to which the life preserver is attached.

On these check lists the following terminology is used. Facing the command module from the outside looking at the main crew access hatch,

1. The command pilot is seated on the left
2. The senior pilot is seated in the center
3. The pilot is seated on the right.

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STABLE I ATTITUDE

CREW ACCESS HATCH EGRESS

COMMAND PILOT'S CHECK LIST

- | | |
|--|--|
| 1. GLOVES | REMOVED |
| 2. RESTRAINT HARNESS | UNSTRAPPED |
| 3. HELMET | REMOVED AND STOWED |
| 4. UMBILICAL | DISCONNECTED |
| 5. HEADREST | LOWERED |
| 6. SEAT PAN | LOWERED INTO 170°
POSITION |
| 7. ARM RESTRAINT AND HAND CONTROLLER | REMOVED AND STOWED |
| 8. LIFE PRESERVER PACKS | OBTAINED FROM STOWAGE |
| 9. LIFE PRESERVER PACK | ATTACHED TO PRESSURE
GARMENT ASSEMBLY |

NOTE

COMMAND PILOT MOVES TO THE AREA OF THE CREW ACCESS HATCH, SITTING ON OR STANDING NEAR HIS COUCH.

NOTE

SENIOR PILOT AND PILOT AID IN REMOVAL OF INNER CREW ACCESS HATCH.

NOTE

INNER CREW ACCESS HATCH IS STOWED TO THE RIGHT OR LEFT OF THE COMMAND PILOT.

- 10. INNER HATCH REMOVED AND STOWED

NOTE

COMMAND PILOT AIDS SENIOR PILOT
AND PILOT IN OUTER HATCH OPENING.

- 11. OUTER CREW ACCESS HATCH OPENED

- 12. PRESSURE GARMENT ASSEMBLY
NECK DAM DONNED

NOTE

SENIOR PILOT OPENS RAFT KIT AND
ASSISTS IN CONNECTING HARDWARE
AND WATER CONTAINER RUCKSACKS TO
LIFE RAFT.

- 13. HARDWARE KIT AND WATER KIT CONNECTED TO RAFT

NOTE

IF SURVIVAL RADIO HAS BEEN RE-
MOVED FROM RUCKSACK TO CHECK
COMMUNICATIONS, IT SHOULD BE
REPLACED IN RUCKSACK TO PREVENT
LOSS DURING EGRESS.

- 14. NO. 3 WHITE RAFT LANYARD CONNECTED TO D-RING
OF PRESSURE GARMENT
ASSEMBLY

NOTE

INFLATE LIFE VEST AND DEPART SPACE-
CRAFT MANEUVERING THE LIFE RAFT
USING ATTACHED LANYARD.

WARNING

SWIMMING TO RAFT IS NOT ADVISABLE.

- 15. COMMAND PILOT SEATED IN RAFT

STABLE I ATTITUDE

CREW ACCESS HATCH EGRESS

SENIOR PILOT'S CHECK LIST

- | | | |
|-----|--|---|
| 1. | GLOVES | REMOVED |
| 2. | RESTRAINT HARNESS | UNSTRAPPED |
| 3. | HELMET | REMOVED AND STOWED |
| 4. | UMBILICAL | DISCONNECTED |
| 5. | HEADREST | LOWERED |
| 6. | SEAT PAN | LOWERED INTO 170°
POSITION |
| 7. | ARM RESTRAINTS AND HAND CONTROLLER | STOWED BENEATH COUCHES |
| 8. | LIFE PRESERVER PACK | ATTACHED TO PRESSURE
GARMENT ASSEMBLY |
| 9. | HARDWARE KIT AND WATER KIT | HANDED TO COMMAND
PILOT |
| 10. | TORQUE WRENCH | REMOVED FROM WORKSHELF
DRAWER IF NECESSARY |

NOTE

SENIOR PILOT MOVES TO HEAD OF COUCH
STANDING DIRECTLY IN FRONT OF INNER
CREW HATCH. RATCHET IS SET FOR
COUNTER-CLOCKWISE OPERATION AND IN-
SERTED INTO INNER HATCH SEALED DRIVE.
WRENCH IS TURNED 220° CCW TO UNLATCH
INNER HATCH.

- | | | |
|-----|------------------------------|----------|
| 11. | INNER ACCESS HATCH | UNLOCKED |
|-----|------------------------------|----------|

NOTE

COMMAND PILOT AND PILOT AID IN HATCH REMOVAL AND STOWAGE.

NOTE

INNER CREW ACCESS HATCH IS STOWED TO THE RIGHT OR LEFT OF COMMAND PILOT.

- 12. INNER HATCH REMOVED AND STOWED

NOTE

SENIOR PILOT AIDS COMMAND PILOT AND PILOT IN OUTER HATCH OPENING.

- 13. OUTER CREW ACCESS HATCH REMOVED
- 14. GREEN LANYARD ON LIFE RAFT KIT FASTENED AROUND X-X HEAD STRUT
- 15. PRESSURE GARMENT ASSEMBLY NECK DAM DONNED
- 16. RAFT KIT OPENED

NOTE

COMMAND PILOT ASSISTS IN CONNECTING HARDWARE AND WATER KITS TO RAFT.

- 17. HARDWARE KIT AND WATER KIT CONNECTED TO RAFT WITH YELLOW LANYARD
- 18. NO. 2 WHITE RAFT LANYARD CONNECTED TO D-RING OF PRESSURE GARMENT ASSEMBLY

NOTE

INFLATED LIFE VEST AND DEPART SPACECRAFT MANEUVERING THE LIFE RAFT USING ATTACHED LANYARD.

WARNING

SWIMMING TO LIFE RAFT IS NOT
ADVISABLE.

19. SENIOR PILOT SEATED IN RAFT

STABLE I ATTITUDE

CREW ACCESS HATCH EGRESSPILOT'S CHECK LIST

- | | | |
|----|---|--|
| 1. | GLOVES | REMOVED AND STOWED |
| 2. | RESTRAINT HARNESS | UNSTRAPPED |
| 3. | HELMET | REMOVED AND STOWED |
| 4. | UMBILICAL | DISCONNECTED |
| 5. | HEADREST | LOWERED |
| 6. | SEAT PAN | LOWERED INTO 170°
POSITION |
| 7. | ARM RESTRAINT AND HAND CONTROLLER | REMOVED AND GIVEN
TO SENIOR PILOT |
| 8. | LIFE PRESERVER | ATTACHED TO PRESSURE
GARMENT ASSEMBLY |

NOTE

PILOT SLIDES INTO RIGHT HAND EQUIP-
MENT BAY AREA FOR REMOVAL OF SUR-
VIVAL EQUIPMENT.

NOTE

SURVIVAL KIT RUCKSACKS WILL FALL INTO
THE LEG SUPPORT AREA OF THE PILOT'S
COUCH.

- | | | |
|-----|---|---------------------------|
| 9. | SURVIVAL CONTAINER
RETAINING LATCH | PRESSED UPWARD |
| 10. | SURVIVAL CONTAINER
RETAINING BAR | RELEASED |
| 11. | RUCKSACK NO. 1 | HANDED TO SENIOR
PILOT |

C-10

- 12. GREEN LANYARD ON
LIFE RAFT KIT FASTENED AROUND X-X
HEAD STRUT

NOTE

PILOT MOVES TO THE HEAD AREA OF
HIS COUCH AND AIDS IN THE REMOVAL
OF THE INNER HATCH.

- 13. INNER CREW ACCESS HATCH REMOVED AND STOWED
- 14. OUTER CREW ACCESS
HATCH HANDLE PULLED

NOTE

PILOT AIDS SENIOR AND COMMAND
PILOT IN OUTER HATCH OPENING.

- 15. PRESSURE GARMENT ASSEMBLY
NECK DAM DONNED
- 16. RAFT RUCKSACK HANDED TO SENIOR
PILOT

NOTE

AFTER HARDWARE AND WATER RUCKSACKS
ARE CONNECTED TO THE LIFE RAFT BY
THE SENIOR PILOT; THE PILOT INFLATES
THE RAFT OUTSIDE THE HATCH OPENING.

- 17. NO. 1 WHITE RAFT LANYARD CONNECTED TO D-RING
OF PRESSURE GARMENT
ASSEMBLY
- 18. LIFE RAFT INFLATED

NOTE

INFLATE LIFE VEST AND DEPART
SPACECRAFT MANEUVERING THE LIFE
RAFT USING ATTACHED LANYARD.

WARNING

SWIMMING TO RAFT IS NOT ADVISABLE.

19. PILOT SEATED IN RAFT

STABLE I ATTITUDE

FORWARD HATCH EGRESS

COMMAND PILOT'S EGRESS CHECK LIST

- 1. GLOVES REMOVED AND STOWED
- 2. RESTRAINT HARNESS UNSTRAPPED
- 3. HELMET REMOVED AND STOWED
- 4. UMBILICAL DISCONNECTED
- 5. SEAT PAN LOWERED TO 170°
POSITION
- 6. ARM RESTRAINT AND HAND CONTROLLER REMOVE AND STOWED
- 7. LIFE PRESERVER PACKS OBTAINED FROM STOWAGE
- 8. LIFE PRESERVER PACK ATTACHED TO PRESSURE
GARMENT ASSEMBLY

NOTE

COMMAND PILOT PUTS ON LIFE PRESERVER
AND GIVES OTHERS TO SENIOR PILOT AND
PILOT.

NOTE

SENIOR PILOT MAY NEED ASSISTANCE OF
COMMAND PILOT TO OPEN FORWARD HATCH.

- 9. FORWARD HATCH STOWED BENEATH CENTER
COUCH

NOTE

PILOT AND SENIOR PILOT EXIT TO FOR-
WARD BULKHEAD PRIOR TO RECEIVING
RAFT KIT, WATER, AND HARDWARE KITS.

- 10. WATER CONTAINER AND HARDWARE KIT PASSED TO PILOT

- 11. PRESSURE GARMENT ASSEMBLY NECK DAM DONNED

NOTE

COMMAND PILOT EXITS TO FORWARD
BULKHEAD AND INSURES SENIOR
PILOT IS SEATED IN RAFT PRIOR
TO DEPARTING SPACECRAFT.

- 12. WHITE MANLINE CONNECTED TO D-RING
OF PRESSURE GARMENT
ASSEMBLY

NOTE

INFLATE LIFE VEST AND DEPART
SPACECRAFT BY HOLDING GREEN
LIFE RAFT LANYARD AND USING
THE FORWARD VIEWING WINDOW
FRAME AS A FOOTHOLD, MANEUVER
INTO LIFE RAFT.

NOTE

IF REQUIRED, RETRIEVE LIFE RAFT
BY PULLING ON LANYARD.

WARNING

SWIMMING TO RAFT IS NOT ADVISABLE.

- 13. COMMAND PILOT SEATED IN RAFT

STABLE I ATTITUDE
FORWARD HATCH EGRESS

SENIOR PILOT'S EGRESS CHECK LIST

- | | | |
|----|---|---|
| 1. | GLOVES | REMOVED |
| 2. | RESTRAINT HARNESS | UNSTRAPPED |
| 3. | HELMET | REMOVED AND STOWED |
| 4. | UMBILICAL | DISCONNECTED |
| 5. | SEAT PAN | LOWERED INTO 170°
POSITION |
| 6. | ARM RESTRAINT AND HAND CONTROLLER | REMOVED AND STOWED |
| 7. | LIFE PRESERVER PACK | ATTACHED TO PRESSURE
GARMENT ASSEMBLY |
| 8. | PRESSURE GARMENT
ASSEMBLY NECK DAM | DANNED |
| 9. | WRENCH | REMOVED FROM WORKSHELF
DRAWER IF NECESSARY |

NOTE

SENIOR PILOT STANDS ON HIS COUCH,
 INSERTS THE 5/32 ALLEN HEAD WRENCH
 INTO THE LOCK AND TURNS COUNTER-
 CLOCKWISE. UTILIZING THE SCREWJACK
 MECHANISM, THE HATCH IS TURNED
 COUNTER-CLOCKWISE TO REMOVE.

NOTE

REMOVAL OF HATCH MAY REQUIRE
 ASSISTANCE OF COMMAND PILOT.

- | | | |
|-----|-------------------------|---|
| 10. | FORWARD HATCH | OPENED AND LOWERED
TO COMMAND PILOT AND
PILOT |
|-----|-------------------------|---|

NOTE

THE SENIOR PILOT EXITS TO THE FORWARD BULKHEAD.

- 11. RAFT KIT STOWED ON TOP OF DROGUE CHUTE CAN
- 12. RAFT KIT (ASSISTED BY PILOT) OPENED
- 13. WHITE MANLINE CONNECTED TO D-RING OF PRESSURE GARMENT ASSEMBLY
- 14. WATER RUCKSACK AND HARDWARE ATTACHED TO RAFT BY YELLOW LANYARD

NOTE

SENIOR PILOT INSURES PILOT IS SEATED IN RAFT BEFORE DEPARTING SPACECRAFT.

- 15. HARDWARE AND WATER KIT RUCKSACK LOWERED INTO RAFT

NOTE

INFLATE LIFE VEST AND DEPART SPACECRAFT BY HOLDING GREEN LIFE RAFT LANYARD. USE THE FORWARD VIEWING WINDOW FRAME AS A FOOTHOLD AND MANEUVER INTO LIFE RAFT.

WARNING

SWIMMING TO LIFE RAFT IS NOT ADVISABLE.

- 16. SENIOR PILOT SEATED IN RAFT

STABLE I ATTITUDE

FORWARD HATCH EGRESS

PILOT'S EGRESS CHECK LIST

- 1. GLOVES REMOVED
- 2. RESTRAINT HARNESS UNSTRAPPED
- 3. HELMET REMOVED AND STOWED
- 4. UMBILICAL DISCONNECTED
- 5. SEAT PAN LOWERED TO 170°
POSITION

NOTE

PILOT SLIDES INTO LEG AREA FOR
REMOVAL OF SURVIVAL EQUIPMENT.

NOTE AND CAUTION

TWO RUCKSACKS WILL FALL INTO THE
LEG SUPPORT AREA OF THE PILOT'S
COUCH.

- 6. SURVIVAL CONTAINER RETAINING
LATCH PRESSED UPWARD
- 7. SURVIVAL CONTAINER RETAINING BAR RELEASED
- 8. RUCKSACK NO. 1 HANDED TO SENIOR
PILOT
- 9. GREEN LIFE RAFT LANYARD FASTENED AROUND TOP
OF REAR X-COUCH STRUT
OR RECOVERY LOOP
- 10. PRESSURE GARMENT ASSEMBLY
NECK DAM DONNED

NOTE

PILOT WILL ASSIST THE COMMAND PILOT
IN STOWING THE FORWARD HATCH BENEATH
THE CENTER COUCH AND THEN EXIT TO
THE FORWARD BULKHEAD.

- | | | |
|-----|--|---|
| 11. | WATER AND HARDWARE RUCKSACK | ATTACHED TO RAFT KIT
WITH YELLOW LANYARD |
| 12. | WATER CONTAINER AND
HARDWARE KIT RUCKSACK | STOWED IN DROGUE
CHUTE CAN AREA |
| 13. | EXIT TO FORWARD BULKHEAD | ACCOMPLISHED |
| 14. | RAFT KIT (ASSISTED BY
SENIOR PILOT) | OPENED |
| 15. | RAFT | REMOVED AND INFLATED |
| 16. | WHITE MANLINE | ATTACHED TO D-RING ON
PRESSURE GARMENT
ASSEMBLY |
| 17. | RAFT | LOWERED INTO WATER |

NOTE

INFLATE LIFE VEST AND DEPART SPACE-
CRAFT BY HOLDING GREEN LIFE RAFT
LANYARD. USE THE FORWARD VIEWING
WINDOW FRAME AS A FOOTHOLD AND
MANEUVER INTO LIFE RAFT.

WARNING

SWIMMING TO RAFT IS NOT ADVISABLE.

- | | | |
|-----|-----------------|----------------|
| 18. | PILOT | SEATED IN RAFT |
|-----|-----------------|----------------|

STABLE II ATTITUDE

FORWARD HATCH EGRESS

COMMAND PILOT'S CHECK LIST

- 1. GLOVES REMOVED
- 2. HELMET REMOVED AND STOWED
- 3. UMBILICAL DISCONNECTED

NOTE

AFTER THE SENIOR PILOT UNLOCKS THE FORWARD HATCH AND INITIATES THE SCREWJACK OPERATION THE COMMAND PILOT PLACES THE PLVC SWITCH TO OPEN AND ACTIVATES THE ENVIRONMENTAL CONTROL SYSTEM BLOWER ON PANEL 25 WHICH OPENS THE POSTLANDING VENTS LOCATED ON FORWARD HATCH.

WARNING

AIR PRESSURE WILL INCREASE AS THE TUNNEL AREA IS FLOODED. THE CREWMEN SHOULD CLEAR THEIR EARS.

NOTE

ANKLE HARNESS SHOULD BE RELEASED PRIOR TO BODY HARNESS.

- 4. RESTRAINT HARNESS RELEASED

NOTE

LOWER SEAT PAN TO 170° POSITION.

NOTE

COMMAND PILOT OBTAINS LIFE PRESERVER PACKS FROM STOWAGE AND DISTRIBUTES THEM TO CREWMEN.

- 5. LIFE PRESERVER PACK ATTACHED TO PRESSURE GARMENT ASSEMBLY

NOTE

WATER WILL RISE APPROXIMATELY THREE FEET IN THE TUNNEL AREA.

- 6. FORWARD HATCH OPENED AND STOWED

NOTE

COMMAND PILOT FEEDS GREEN RAFT LANYARD TO SENIOR PILOT AS HE EXITS THROUGH TUNNEL.

NOTE

WHITE MANLINE IS SECURED TO COMMAND PILOT'S SUIT BEFORE EGRESS.

- 7. PRESSURE GARMENT ASSEMBLY
NECK DAM DOWNED

NOTE

EXIT SPACECRAFT FEET FIRST.

WARNING

WHEN EGRESSING, FOLLOW THE LIFE RAFT LANYARD TO THE SURFACE.

NOTE

AFTER CLEARING SPACECRAFT, INFLATE THE LIFE VEST.

- 8. COMMAND PILOT SEATED IN RAFT

STABLE II ATTITUDE

FORWARD HATCH EGRESS

SENIOR PILOT'S CHECK LIST

- 1. GLOVES REMOVED
- 2. HELMET REMOVED AND STOWED
- 3. UMBILICAL DISCONNECTED

NOTE

RELEASE ANKLE HARNESS PRIOR TO
BODY HARNESS.

- 4. RESTRAINT HARNESS RELEASED
- 5. SEAT PAN PLACED IN 170°
POSITION

NOTE

SENIOR PILOT MOVES INTO TUNNEL AREA
AND REMOVES THE 5/32 ALLEN HEAD
HATCH UNLOCKING TOOL FROM THE WORK-
SHELF DRAWER SINCE THIS DRAWER WILL
BE IN AN UPSIDE DOWN ATTITUDE, CARE
SHOULD BE EXERCISED WHEN OPENING.
TO UNLOCK THE HATCH, THE TOOL IS
TURNED COUNTER-CLOCKWISE. THE SCREW-
JACK IS THEN USED TO PARTIALLY OPEN
HATCH.

NOTE AND WARNING

COMMAND PILOT WILL OPEN THE POSTLANDING
VENTS CAUSING THE TUNNEL AREA TO FLOOD.
SENIOR PILOT SHOULD NOT STAND ON HATCH
WHEN VALVES ARE OPENED.

WARNING

AFTER COMMAND PILOT OPENS THE POST-LANDING VENTS, THE TUNNEL AREA WILL FLOOD CAUSING A RISE IN AIR PRESSURE. THE CREWMEN SHOULD CLEAR THEIR EARS.

- 6. LIFE VEST PACK ATTACHED TO PRESSURE GARMEN'T ASSEMBLY

NOTE

SENIOR PILOT THEN COMPLETES REMOVAL OF HATCH WITH SCREWJACK.

- 7. FORWARD HATCH OPENED

NOTE

FORWARD HATCH IS STOWED BEHIND FOOTREST OF COMMAND PILOT'S SEAT.

- 8. FORWARD HATCH REMOVED AND STOWED

NOTE

AFTER PILOT OPENS THE LIFE RAFT CONTAINER, THE SENIOR PILOT FASTENS THE GREEN LANYARD ON THE RAFT KIT AROUND THE X-X FOOT STRUT.

- 9. GREEN RAFT LANYARD FASTENED

NOTE

WHITE MANLINE IS SECURED TO SENIOR PILOT'S PRESSURE GARMEN'T ASSEMBLY.

- 10. HARDWARE AND WATER RUCKSACKS TO LIFE RAFT KIT ATTACHED
- 11. PRESSURE GARMEN'T ASSEMBLY NECK DAM DONNED

NOTE

EXIT SPACECRAFT FEET FIRST.

NOTE

COMMAND PILOT FEEDS GREEN RAFT
LANYARD TO SENIOR PILOT AS HE EXITS.

NOTE

UPON CLEARING SPACECRAFT, INFLATE
LIFE VEST.

WARNING

EXHALE WHILE RISING TO THE SURFACE.

12. SENIOR PILOT SEATED IN RAFT

STABLE II ATTITUDE

FORWARD HATCH EGRESSPILOT'S CHECK LIST

- | | |
|------------------------|--------------------|
| 1. GLOVES | REMOVED |
| 2. HELMET | REMOVED AND STOWED |
| 3. UMBILICAL | DISCONNECTED |

NOTE

RELEASE ANKLE HARNESS PRIOR TO BODY HARNESS.

- | | |
|--|---------------------------------------|
| 4. RESTRAINT HARNESS | RELEASED |
| 5. SEAT PAN | PLACED IN 170° POSITION |
| 6. ARM RESTRAINT AND HAND CONTROLLER | REMOVED AND STOWED |
| 7. LIFE PRESERVER PACK | ATTACHED TO PRESSURE GARMENT ASSEMBLY |
| 8. SURVIVAL KIT COVER LATCH | DEPRESSED |

NOTE

SURVIVAL CONTAINER RESTRAINING BAR HANDLE MUST BE PUSHED AWAY FROM PILOT TO RELEASE BAR.

- | | |
|--|----------|
| 9. SURVIVAL CONTAINERS RESTRAINING BAR | RELEASED |
|--|----------|

NOTE

SURVIVAL CONTAINERS MUST BE LIFTED FROM STOWED POSITION AND PLACED ON THE INSTRUMENT PANEL.

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- 10. HARDWARE KIT AND WATER KIT HANDED TO COMMAND PILOT
- 11. RAFT KIT PARTIALLY OPENED TO OBTAIN WHITE MANLINES

NOTE

PILOT EXITS WITH RAFT KIT
PRIOR TO SENIOR PILOT'S EXIT
WITH HARDWARE AND WATER KIT.

- 12. WHITE MANLINE TO PILOT'S SUIT SECURED
- 13. PRESSURE GARMENT ASSEMBLY
NECK DAM DONNED

NOTE

PILOT EXITS FEET FIRST THROUGH
THE TUNNEL JUNCTION.

NOTE

UPON CLEARING SPACECRAFT, INFLATE
THE LIFE VEST.

WARNING

EXHALE AS YOU RISE TO THE WATER'S
SURFACE.

- 14. LIFE RAFT INFLATED
- 15. PILOT SEATED IN RAFT

STABLE II ATTITUDE

MAIN CREW HATCH EGRESSCOMMAND PILOT'S CHECK LIST

- | | |
|------------------------|--------------------|
| 1. GLOVES | REMOVED |
| 2. HELMET | REMOVED AND STOWED |
| 3. UMBILICAL | DISCONNECTED |

NOTE

RELEASE ANKLE HARNESS PRIOR
TO BODY HARNESS.

- | | |
|--|------------------------------|
| 4. RESTRAINT HARNESS | RELEASED |
| 5. SEAT PAN | PLACED IN 170°
POSITION |
| 6. ARM RESTRAINT AND HAND CONTROLLER | REMOVED AND STOWED |
| 7. HEAD REST | FOLDED IN STOWED
POSITION |

NOTE

COMMAND PILOT OBTAINS LIFE
PRESERVER PACKS FROM STOWAGE
AND DISTRIBUTES THEM TO CREWMEN.

- | | |
|--|----------------------|
| 8. LIFE PRESERVER PACK | ON |
| 9. HARDWARE AND WATER KIT RUCKSACK | ATTACHED TO RAFT KIT |

NOTE

SENIOR PILOT MAY REQUIRE THE AID OF
COMMAND PILOT AND PILOT IN REMOVING
AND STOWING THE INNER HATCH.

- | | |
|---------------------------|-----------------------|
| 10. OUTER HATCH | OPENED AND PUSHED OUT |
|---------------------------|-----------------------|

NOTE

SENIOR PILOT EXITS SPACECRAFT WITH
RAFT KIT.

- 11. WHITE MANLINE TO COMMAND
PILOT'S PRESSURE GARMENT ASSEMBLY ATTACHED

NOTE

AS SOON AS SPACECRAFT IS CLEARED,
THE LIFE PRESERVER SHOULD BE IN-
FLATED.

- 12. COMMAND PILOT SEATED IN RAFT

STABLE II ATTITUDE

MAIN CREW HATCH EGRESS

SENIOR PILOT'S CHECK LIST

- 1. GLOVES REMOVED
- 2. HELMET REMOVED AND STOWED
- 3. UMBILICAL DISCONNECTED

NOTE

RELEASE ANKLE HARNESS PRIOR TO BODY HARNESS.

- 4. RESTRAINT HARNESS RELEASED
- 5. SEAT PAN PLACED IN 170° POSITION
- 6. HEAD REST FOLDED AND PLACED IN STOWED POSITION
- 7. LIFE PRESERVER PACKET ATTACHED TO PRESSURE GARMENT ASSEMBLY
- 8. PRESSURE GARMENT ASSEMBLY
NECK DAM DONNED
- 9. TORQUE WRENCH REMOVED FROM WORKSHELF DRAWER IF NECESSARY

NOTE

WORKSHELF DRAWER IS UPSIDE DOWN.

NOTE

SENIOR PILOT CRAWLS ONTO INSTRUMENT PANEL TO THE INNER HATCH. RATCHET IS SET FOR COUNTER-CLOCKWISE OPERATION AND INSERTED INTO INNER HATCH SEALED DRIVE. WRENCH IS TURNED 220° CCW TO UNLOCK INNER HATCH.

NOTE

SENIOR PILOT MAY REQUIRE AID FROM
COMMAND PILOT AND PILOT IN REMOVING
AND STOWING INNER HATCH.

NOTE

INNER HATCH CAN BE STOWED TO THE RIGHT
OF THE HATCH OPENING.

NOTE

WHITE MANLINE OF LIFE RAFT KIT IS
SECURED TO SENIOR PILOT'S PRESSURE
GARMENT ASSEMBLY.

NOTE

THE OUTER CREW HATCH CAN BE PUSHED
OFF USING THE COUCH STRUTS AS SUPPORT.

10. OUTER HATCH OFF

NOTE

UPON CLEARING SPACECRAFT, INFLATE
LIFE VEST AND RAFT.

11. LIFE RAFT INFLATED

12. SENIOR PILOT SEATED IN RAFT

STABLE II ATTITUDE

MAIN CREW HATCH EGRESSPILOT'S CHECK LIST

- | | | |
|----|---------------------|--------------|
| 1. | GLOVES | REMOVED |
| 2. | HELMET | REMOVED |
| 3. | UMBILICAL | DISCONNECTED |

NOTE

RELEASE ANKLE HARNESS PRIOR TO
BODY HARNESS.

- | | | |
|----|---|--|
| 4. | RESTRAINT HARNESS | RELEASED |
| 5. | SEAT PAN | PLACED IN 170°
POSITION |
| 6. | ARM RESTRAINT AND HAND CONTROLLER | REMOVED AND STOWED |
| 7. | LIFE PRESERVER PACK | ATTACHED TO PRESSURE
GARMENT ASSEMBLY |
| 8. | SURVIVAL KIT COVER LATCH | DEPRESSED |

NOTE

SURVIVAL CONTAINER RESTRAINING BAR
HANDLE MUST BE PUSHED AWAY FROM
PILOT TO RELEASE BAR.

- | | | |
|----|---|----------|
| 9. | SURVIVAL KITS RESTRAINING BAR | RELEASED |
|----|---|----------|

NOTE

SURVIVAL KITS MUST BE LIFTED
FROM STOWED POSITION AND PLACED
ON THE INSTRUMENT PANEL.

- | | | |
|-----|---|----------------------------|
| 10. | HARDWARE AND WATER KIT RUCKSACK | HANDED TO COMMAND
PILOT |
|-----|---|----------------------------|

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11. RAFT KIT HANDED TO SENIOR PILOT

NOTE

SENIOR PILOT EXITS WITH RAFT KIT.

12. WHITE MANLINE TO PILOT'S
PRESSURE GARMENT ASSEMBLY SECURED

13. PRESSURE GARMENT ASSEMBLY
NECK DAM DONNED

NOTE

UPON CLEARING HATCH OPENING, INFLATE
LIFE VEST.

14. PILOT SEATED IN RAFT