NAVAIR 01-230HLC-1M

SUPPLEMENTAL

# NATOPS FLIGHT MANUAL

## MID-AIR RETRIEVAL SYSTEM

*NAVY MODEL*

## SH-3A (MARS)

## HELICOPTERS

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ISSUED BY AUTHORITY OF THE CHIEF OF NAVAL OPERATIONS
AND UNDER THE DIRECTION OF THE COMMANDER,
NAVAL AIR SYSTEMS COMMAND

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*15 August 1972*

## LIST OF EFFECTIVE PAGES

Insert latest changed pages; dispose of superseded pages in accordance with applicable regulations.

Total number of pages in this manual is 90, consisting of the following:

| Page No. | Issue |
|---|---|
| Title | Original |
| A/P | Original |
| Flyleaf 1 | Original |
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# INTERIM CHANGE SUMMARY

*The following Interim Changes have been canceled or previously incorporated in this manual:*

| INTERIM CHANGE NUMBER(S) | REMARKS/PURPOSE |
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*The following Interim Changes have been incorporated in this Change/Revision:*

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# SECTION I

# AIRCRAFT

Except for the following, all other aircraft data is covered in NAVAIR 01-230HLC-1.

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### PART 1 - GENERAL DESCRIPTION



### PART 2 - SYSTEMS



### PART 4 - AIRCRAFT OPERATING LIMITATIONS

## PART 1 - GENERAL DESCRIPTION

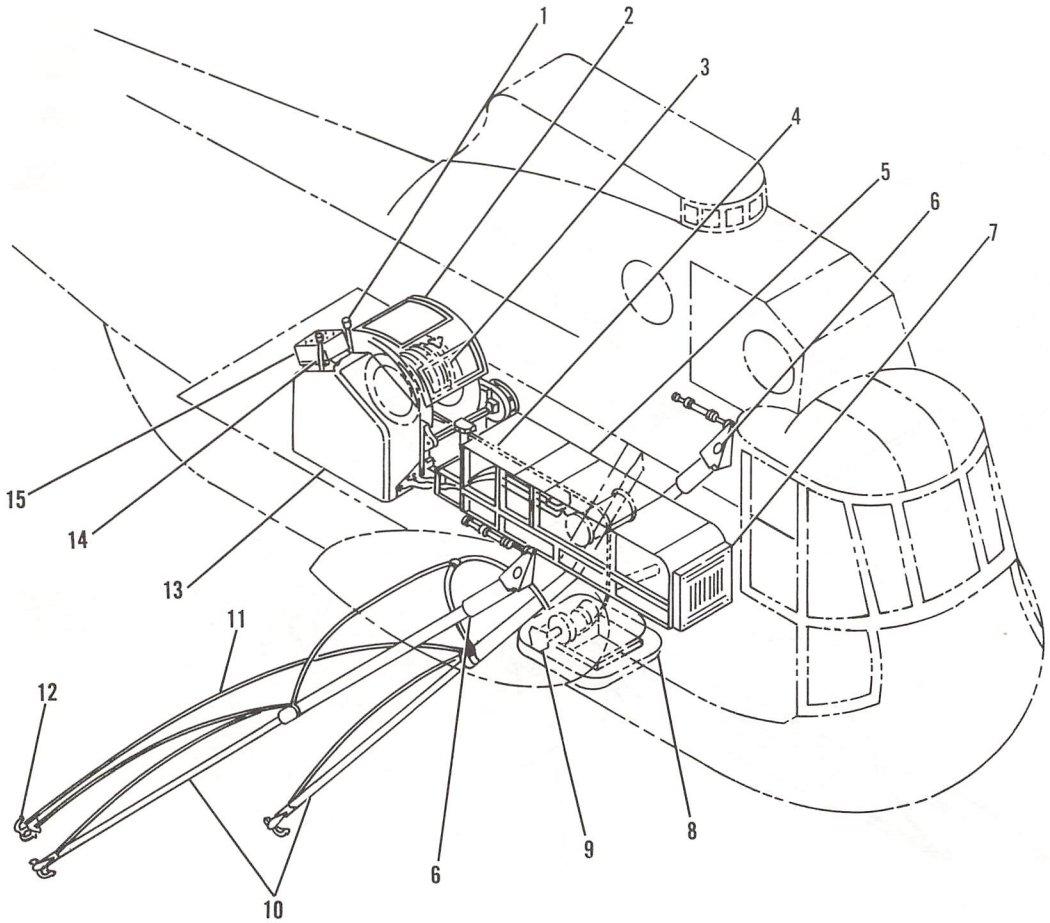
### THE HELICOPTER.

The SH-3A (MARS) helicopter is equipped with a mid-air recovery system (MARS) that provides the capability to engage and retrieve a capsule, nose cone, or other object descending by parachute. The SH-3A (MARS) helicopter is configured by AFC No. 303 and removes the sonar capability. The crew consists of a pilot, copilot, winch operator, and pole operator. Familiarity with the helicopter may be obtained by referring to figures 1-1, 1-2, and 1-3. The cabin floor has been replaced with honeycomb reinforced floor panels that contain standard tie-down rings and studs to restrain cargo and secure troop seat. A trough well opening is provided in the cabin floor to accommodate MARS. In addition, soundproofing in the cabin compartment has been removed. Parachute deflectors (7, figure 1-3) are installed on both sides of the helicopter between the side of the fuselage and forward tip of the sponson to reduce the possibility of snagging the engagement parachute with a sponson.

### MAIN DIFFERENCE TABLE

| ITEM | SH-3A | SH-3A (MARS) |
|---|---|---|
| Mission | ASW | MAR |
| Sonar System | Yes | No |
| Mid-Air Recovery System | No | Yes |
| Soundproofing | Yes | No |
| Torpedo Launchers | Yes | No |
| Approach and Hover Coupler Systems | Yes | No |
| Collective to Lateral Coupling | Yes | No |
| Yaw Pedal Switches | No | Yes |
| Cargo Floor and Two-Man Troop Seats | No | Yes |
| Bubble-Type Cabin Windows | No | Yes |
| Parachute Deflectors for Sponsons, Antennas, and Tailwheel | No | Yes |
| Portable Oxygen Bottles | No | Yes |
| Heat Exchanger | No | Yes |
| Two Additional Cabin Dome Lights | No | Yes |
| 900 lb/min. Fuel Dump System | No | Yes |

Figure 1-1. Main Difference Table




1. WINCH CONTROL HANDLE
2. WINCH COVER
3. WINCH
4. WINCH CABLE
5. TROUGH ASSEMBLY
6. POLE MOUNTS AND ACTUATING CYLINDER
7. POLE ACTUATING HYDRAULIC ASSEMBLY
8. FAIRLEAD ASSEMBLY
9. SHEAVE ASSEMBLY
10. RECOVERY POLES AND POLE HOOKS
11. RECOVERY LOOP
12. FLYING HOOK
13. WINCH HYDRAULIC MODULE
14. BRAKE CONTROL HANDLE
15. WINCH CONTROL PANEL

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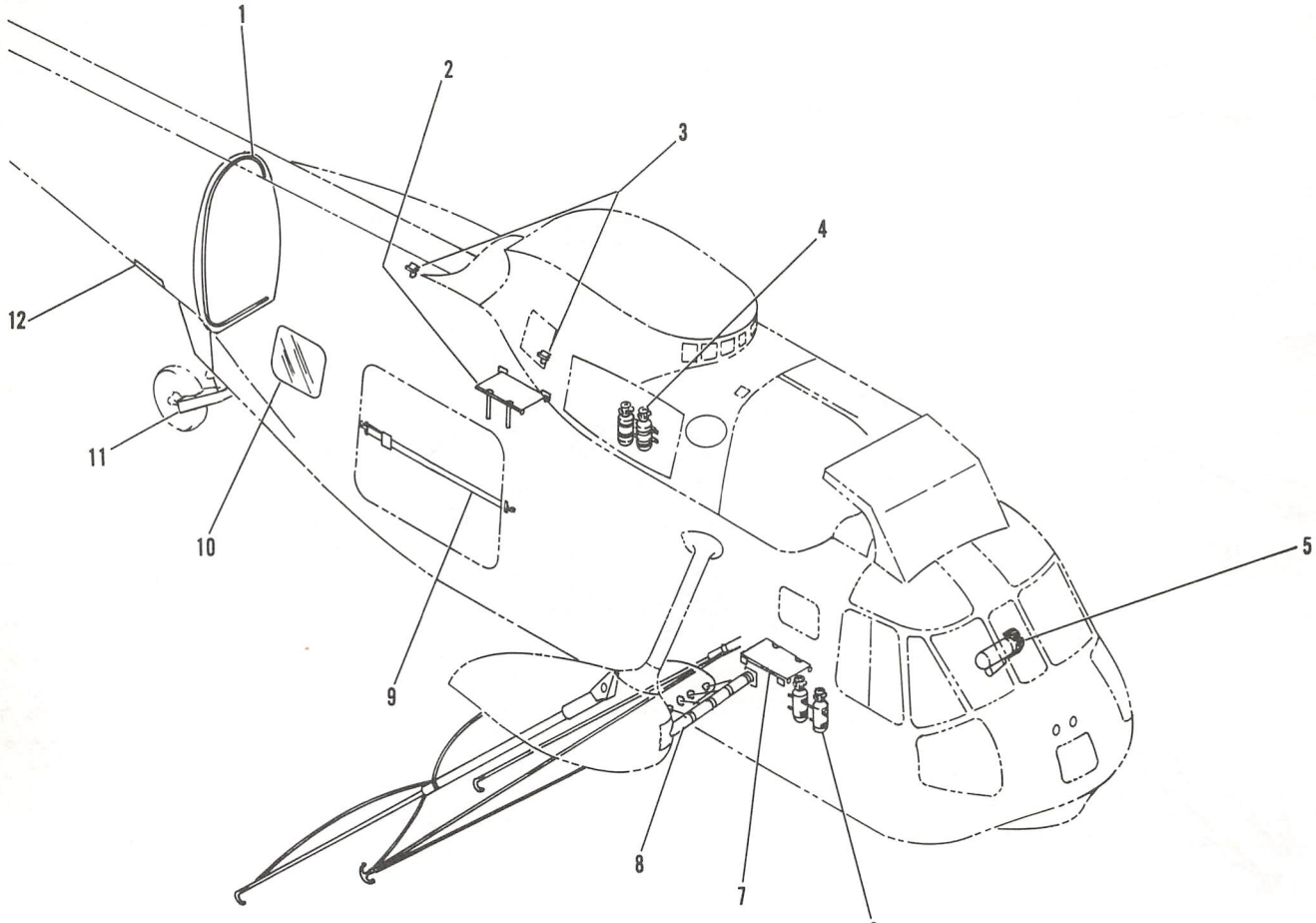
Figure 1-2. MARS Equipment Installation




1. THERMAL BARRIER
2. AFT TWO-MAN TROOP SEAT
3. SAFETY HARNESS ATTACHMENT RINGS
4. CREW PORTABLE OXYGEN BOTTLES
5. PORTABLE FIRE EXTINGUISHER
6. PILOT'S AND COPILOT'S PORTABLE OXYGEN BOTTLES
7. FORWARD TWO MAN TROOP SEAT
8. PARACHUTE DEFLECTOR (BOTH SIDES)
9. CARGO DOOR SAFETY STRAP
10. OBSERVATION WINDOW (BOTH SIDES)
11. TAIL WHEEL FAIRING
12. OBSERVATION WINDOW (TAIL CONE)

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Figure 1-3. MARS Related Furnishings and Equipment

PART 2 - SYSTEMS

ENGINES.

SH-3A (MARS) helicopters are powered by two T58-GE-8F engines.

FUEL SYSTEM.

FUEL DUMP SYSTEM. The fuel dump system provides a means of dumping fuel from the forward tank at a rate of 122 gpm (830 lbs/min), the aft tank at a rate of 118 gpm (800 lbs/min), or simultaneously from both tanks at 134 gpm (910 lbs/min). Fuel is dumped overboard through a tube near the right side of the tail-wheel. The system consists of an electric pump with controlled intakes from the forward and aft tanks, two electrically operated dump valves, a fuel dump control panel, and the necessary wiring.

Fuel Dump Control Panel. The fuel dump control panel (figure 1-4) is located on the instrument panel. The control panel, marked FUEL DUMP, contains two switches; one has marked positions FWD TANK and OFF and the other AFT TANK and OFF. Placing a respective switch in the FWD TANK or AFT TANK position opens the associated tank dump valve and activates the dump pump. The control circuits and dump valves operate on dc power from the essential bus and are protected by circuit breakers, marked FWD TANK and AFT TANK under the general heading FUEL DUMP, located on the overhead circuit breaker panel. The fuel dump pump operates on ac power from the No. 1 generator and is protected by circuit breakers, marked FUEL DUMP, located on the console ac circuit breaker panel.

ELECTRICAL POWER SUPPLY SYSTEM.

Except for deletion of the sonar equipment and addition of the MARS equipment, the basic electrical system is the same as outlined in NAVAIR 01-230HLC-1. Specific changes to the electrical system for MARS equipped helicopters are included with related descriptive text. See figure 1-5 for circuit breaker locations.

LIGHTING EQUIPMENT.

Switches and rheostats for operating all lights except the cabin dome lights, flood-hover lights, spotlight, pilot's compartment spotlight, and cabin panel lights are on the overhead switch panel.

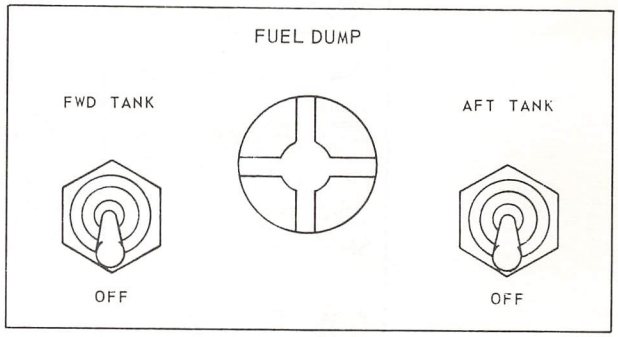



Figure 1-4. Fuel Dump Control Panel

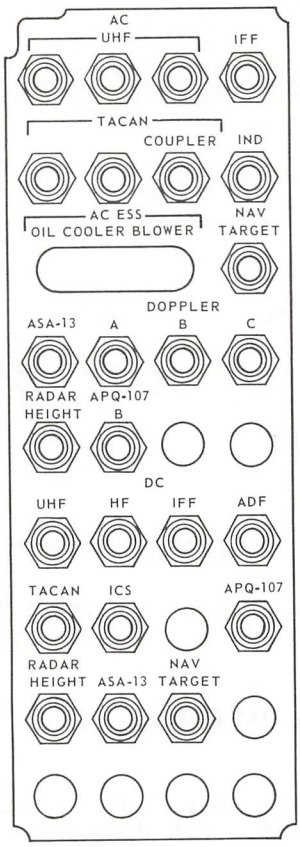
LIGHTS, INTERIOR.

Cabin Dome Lights. MARS helicopters are equipped with four cabin dome lights that are controlled by the pilot's dome light panel in the same manner as the SH-3A. However, the intensity of the four lights is controlled by the crewmen from the cabin dome lights control panel (figure 1-6), located on the right cabin wall. The panel, marked CABIN DOME LIGHTS, contains two rheostats marked FWD and AFT respectively. Each rheostat has marked positions DIM and BRT and is rotated to vary the intensity of the lights. The FWD rheostat controls the forward two lights and the AFT rheostat controls the aft two lights. The lights are powered from the dc primary bus and are protected by a circuit breaker, marked CABIN DOME LTS, located on the overhead circuit breaker panel.

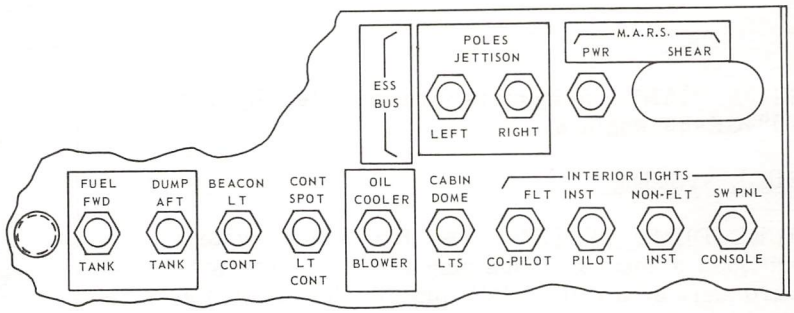
Cabin Control Panel Lights. The intensity of the cabin control panel lights is controlled from the cabin panel lights control panel (see figure 1-9). The control panel, marked CABIN PANEL LIGHTS, contains a rheostat with marked positions DIM and BRT that is rotated to vary the intensity.

LIGHTS, EXTERIOR.

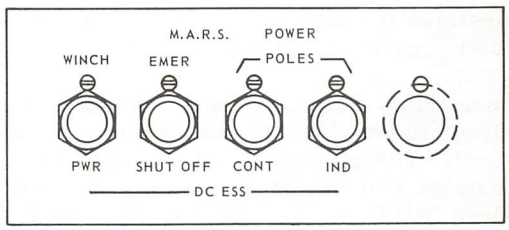
Rotating Anti-Collision Lights. The forward anti-collision light is located on the bottom of the fuselage aft of the trough well opening.



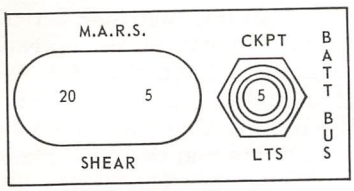

RADIO CIRCUIT BREAKER PANEL
DETAIL B



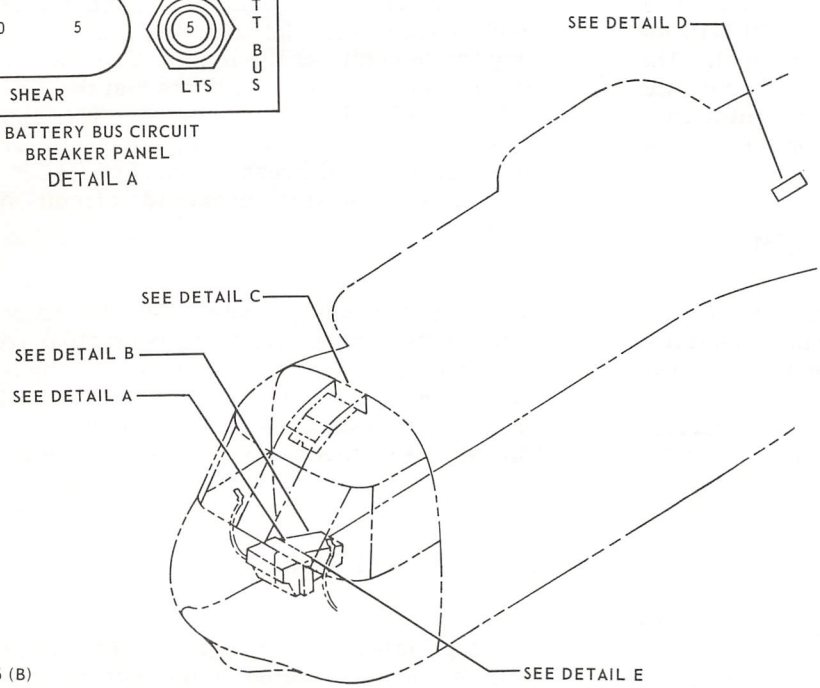

OVERHEAD CIRCUIT BREAKER PANEL
DETAIL C

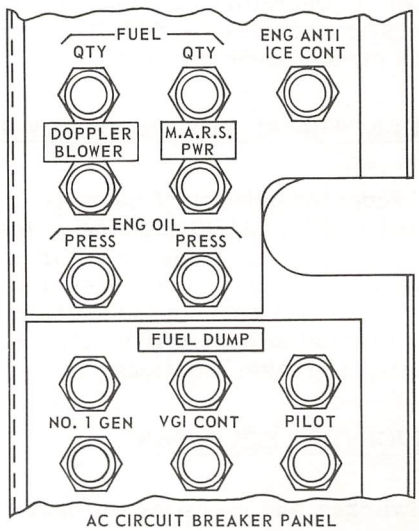



MARS CIRCUIT BREAKER PANEL
DETAIL D




BATTERY BUS CIRCUIT BREAKER PANEL
DETAIL A




AC CIRCUIT BREAKER PANEL
DETAIL E

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Figure 1-5. MARS Circuit Breaker Panels

FLIGHT CONTROL SYSTEM.

ROTARY RUDDER FLIGHT CONTROL SYSTEM.

Rudder Pedals. Electrical switches, mounted on the pedals, cancel directional signals of the automatic flight control system when feet are placed on the pedals.

AUTOMATIC STABILIZATION EQUIPMENT (ASE) AND COUPLER SYSTEM.

The sonar and approach and hover coupler systems have been deleted on MARS helicopters. Therefore, their controls and inputs related to ASE operation are inoperative and should be disregarded.

AUTOMATIC STABILIZATION EQUIPMENT. Yaw pedal switches, one for each rudder pedal, permit the pilots to disengage the heading hold function to execute manual turns. When any switch is depressed by placing feet on the pedals, the directional signals are cancelled until a new reference heading has been established and feet are removed from the pedals.

UTILITY HYDRAULIC SYSTEM.

Equipment operated by the utility hydraulic system includes the main landing gear, rescue hoist, mid-air recovery system, windshield wiper system, and the automatic blade fold system. A heat exchanger is installed to maintain the temperature of return flow of the rescue hoist, pole hydraulic, and winch hydraulic systems. An oil cooler blower, located within the heat exchanger, operates continuously when the electrical system is energized. Blower operation is controlled by a relay that is energized from the dc primary bus and protected by a circuit breaker, marked OIL COOLER BLOWER, located on the overhead circuit breaker panel. The blower operates on ac power from the No. 1 generator and is protected by circuit breakers, marked OIL COOLER BLOWER, located on the radio circuit breaker panel.

LANDING GEAR SYSTEM.

The tail wheel beneath the tail fin is full-swiveling and self-centering, and may be locked in the center position. Tail wheel fairing (10, figure 1-3) is installed to prevent inadvertent snagging of MARS equipment. The fairing is attached to the tail wheel to permit free-swiveling during ground operations.

COMMUNICATION AND ASSOCIATED ELECTRONIC EQUIPMENT.

The primary differences between the communication and associated electronic equipment for MARS

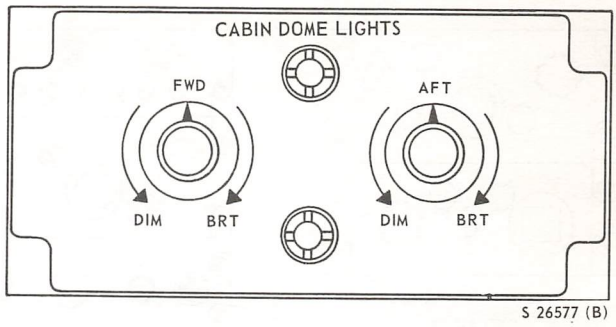



Figure 1-6. Cabin Dome Lights Control Panel

equipped helicopters and basic SH-3A helicopters is deletion of the sonar equipment and AN/ARA-25A, and modification of the AN/AIC-14A intercommunication and antenna systems. The intercommunication system (figure 1-7) provides intercommunications for the pilot, copilot, rescue hoist operator, winch operator, and pole operators. The pilot's, copilot's, and rescue hoist operator's AN/AIC-14A intercommunication systems remain unchanged. The three other cabin communication stations, one on the forward left-hand cabin wall and one each on the aft left and right-hand cabin walls are described herein. See figure 1-8 for antenna locations.

AN/AIC-14 INTERPHONE-RADIO CONTROL SYSTEM. The interphone-radio control system amplifies interphone and received radio signals and provides control for ICS isolation between pilots and crewmen and crew radio transmission on HF and UHF frequencies set by the pilot.

Interphone Control Panels. Each crewmember has an ICS master control and receiver selector panel. In addition, the forward left-hand station is equipped with a radio-ICS transmitter selector panel, the forward and aft left-hand stations are equipped with a transmitter selector panel, and the rescue hoist operator and aft right-hand stations are equipped with an ICS mixer control panel. The system operates on direct current from the essential bus and is protected by a circuit breaker, marked RADIO BUS NO. 1, located on the overhead circuit breaker panel, and by a circuit breaker marked ICS that is located on the radio circuit breaker panel (see figure 1-5).

The AN/AIC-14 system operates when the No. 1 radio master switch on the overhead switch panel is in the ON position. The pilot, copilot, and forward and aft left-hand cabin stations are provided with radio communications on HF and UHF and audio reception from ADF. The set provides separate interphone communications between the pilot and copilot and between the forward and aft left-hand cabin compartment stations. The forward and aft left-hand cabin compartment stations

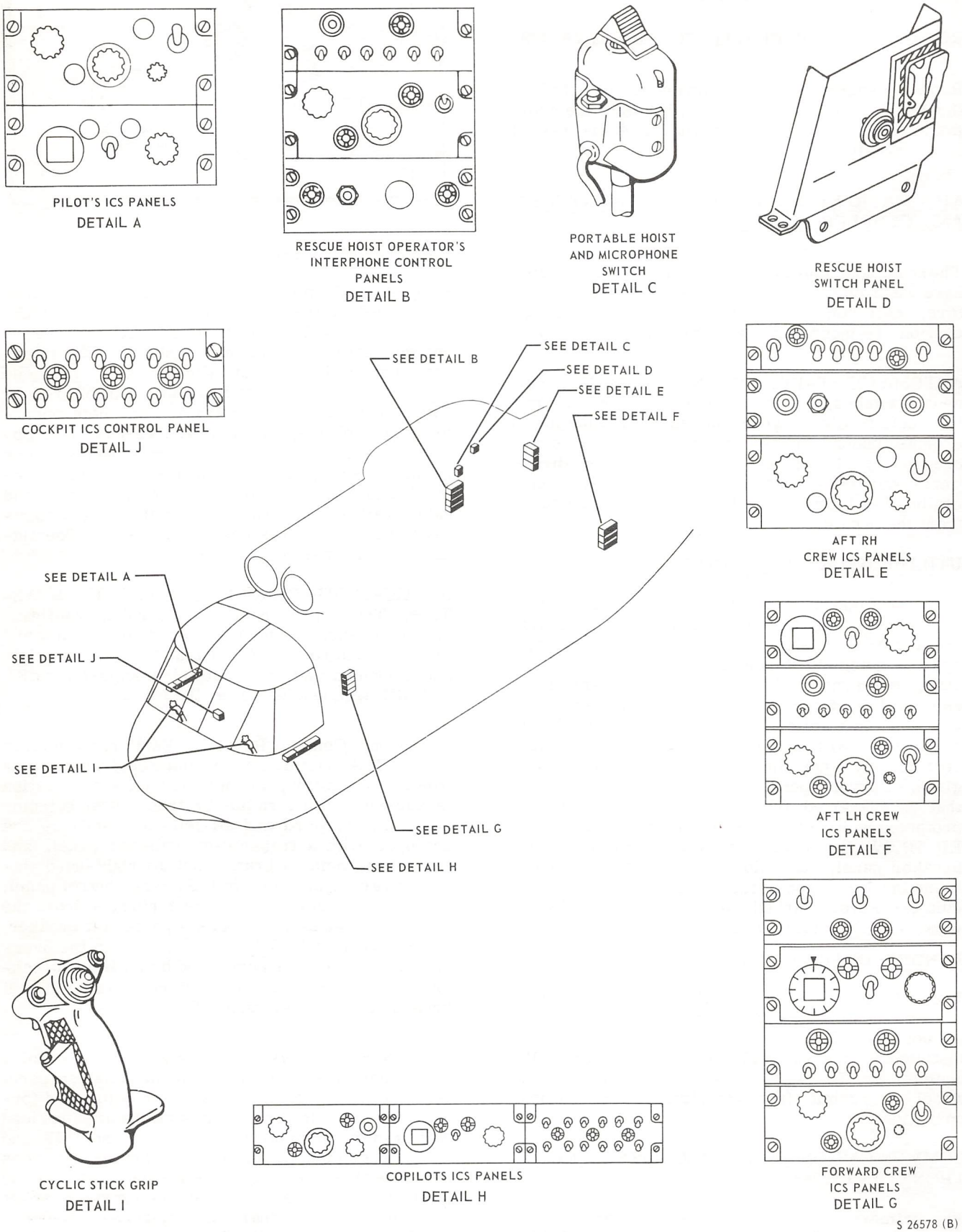
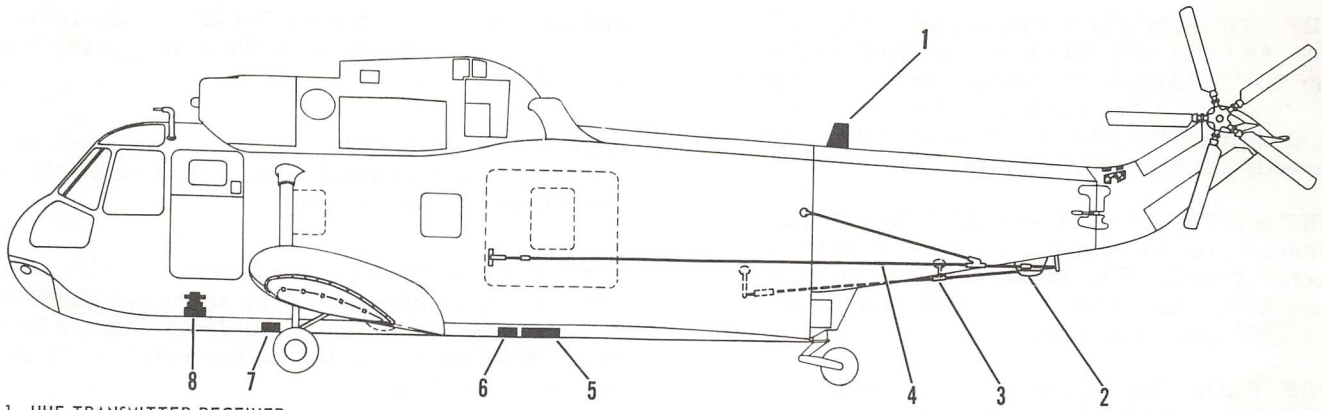



Figure 1-7. Intercommunication System




1. UHF TRANSMITTER RECEIVER
2. LF AUTOMATIC DIRECTION FINDER - LOOP
3. LF AUTOMATIC DIRECTION FINDER - WIRE (SENSE)
4. HF TRANSMITTER RECEIVER - WIRE
5. RADAR ALTIMETER
6. IFF RADAR IDENTIFICATION SET
7. TACAN NAVIGATION SET
8. DOPPLER

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Figure 1-8. Antennas

can select either the pilots' or MARS crewman ICS. The pilot's interphone can be connected to all ICS stations by either the SONAR CALL switch on the collective pitch lever grip, or placing the SONAR INTERCOM switch on the overhead switch panel in the ON position.

ICS Mixer Control Panel. The rescue hoist operator and aft right-hand cabin stations are equipped with ICS mixer control panels that operate in the same manner as outlined for the hoist operator in the SH-3A.

Interphone Operations.

To turn the system on:

1. No. 1 radio master switch - ON (Overhead switch panel).

2. AMPL SEL switch (all stations) - NORM (ICS master control panel).

3. MIC SEL switch (all stations) - COLD (ICS master control panel).

4. TRAN SEL switch (Pilots' and forward and aft left-hand cabin stations) - ICS OR DESIRED TRANSMITTER (Transmitter selector control panel).

5. ICS control switch (Pilots' and forward and aft left-hand cabin stations) - ON (Transmitter selector control panel).

To transmit:

6. Pilot or copilot depress microphone trigger switch on cyclic stick. Cabin compartment crewmembers depress microphone switch.

To secure the system:

1. No. 1 radio master switch - OFF.

ICS Master Control Panels. Except as indicated herein, ICS master control operation is as outlined for the SH-3A. The CALL position cannot cancel the SONAR DIRECT mode on any MARS crew station receiver selector panel so marked as the sonar equipment has been removed.

Transmitter Selector Control Panels. Transmitter selector control panels are provided for the pilot, copilot, and forward and aft left-hand cabin stations that operate in the same manner as outlined for the SH-3A.

Receiver Selector Panel. The receiver selector panels for the pilot and copilot operate in the same manner as outlined for the SH-3A. The receiver selector panels for the forward and aft left-hand cabin stations, the aft right-hand cabin station, and the rescue hoist operator's station, except for SONAR DIRECT position, operate in the same manner as outlined for the sonar and hoist operators in the SH-3A.

Crewman's Radio-ICS Transmit Selector Panel. The forward left-hand cabin station is equipped with a radio-ICS transmit select panel that operates in the same manner as outlined for sonar operators in the SH-3A.

Hoist Operator's Receiver and Transmitter Selector Panel. The hoist operator's receiver and transmitter selector panel operates in the same manner as outlined for the SH-3A.

UHF TRANSMITTER-RECEIVER (AN/ARC-52). The AN/ARA-25A has been removed; therefore, the ADF position of the function switch is inoperative and does not transmit power and received signals through the AN/ARC-52 radio set to the UHF direction group for ADF operations.

UHF ANTENNA SELECTOR SWITCH. MARS helicopters are not equipped with a UHF antenna selector switch. The lower antenna has been removed and the upper (alternate) antenna is used for UHF communications.

UHF RADIO DIRECTION FINDER GROUP (AN/ARA-25A). MARS helicopters are not equipped with an AN/ARA-25A UHF direction finder group.

RADAR ALTIMETER (AN/APN-171(V)). MARS helicopters are equipped with an AN/APN-171(V) radar altimeter system that operates in the same manner as outlined for the SH-3A.

SONAR SYSTEM.

MARS helicopters are not equipped with a sonar system. In addition, the sonar dome guillotine switch and range and bearing and hydrostatic indicators have been removed from the instrument panel.

EMERGENCY EQUIPMENT.

SEA ANCHOR. MARS helicopters are not equipped with a sea anchor tow line installation.

TROOP CARRYING EQUIPMENT.

TROOP SEATS. Two nylon-webbed, two-man troop seats (2 and 6, figure 1-3) with safety belts are installed on the right-hand side of the cabin; one forward of the trough assembly and the other aft of the winch assembly. The seats may be removed or folded up against the bulkhead when not being used.

MISCELLANEOUS.

SAFETY STRAP AND SAFETY HARNESS ATTACHMENTS. A safety strap (8, figure 1-3) may be installed across the cargo door opening by attaching the strap to fittings provided on each side of the door opening. In addition, two safety harness attachment fittings (3, figure 1-3), one each in line with each side of the cargo door opening, are provided in the cabin ceiling.

OXYGEN EQUIPMENT. Installation provisions are provided for portable walk-around oxygen equipment. The pilot's and copilot's oxygen installation (5, figure 1-3) is located on the bulkhead at the entrance to the pilot's compartment, and the winch and pole operator's installation (11, figure 1-3) is located on the left-hand cabin wall opposite the cargo door.

THERMAL BARRIER. MARS helicopters are equipped with a thermal barrier (1, figure 1-3) at the entrance to the tail cone.

PORTABLE FIRE EXTINGUISHERS. MARS helicopters are equipped with an additional portable fire extinguisher (4, figure 1-3) located on the forward bulkhead to the left of the entrance to the pilot's compartment.

OBSERVATION WINDOWS. MARS helicopters are equipped with three bubble-type observation windows to facilitate visual reference to MAR operations. One each is located on each side of the aft cabin wall (9, figure 1-3), and the other (12, figure 1-3) is located in the bottom of the tail pylon aft of the tail wheel area.

MID-AIR RECOVERY SYSTEM (MARS).

The mid-air recovery system is certified to recover an object (4000 pounds maximum weight) descending by parachute. The system contains a hydraulically operated energy absorbing winch, appropriate fairing to lead the winch cable outside the helicopter, a loop of nylon rope attached to the end of the winch cable which contains three strategically located hooks. Two hydraulically operated poles extend below and aft of the helicopter to spread and support the loop for engagement with the target parachute of the descending object. The winch, trough, and associated equipment are located in the cargo compartment near the cg of the helicopter. Hydraulic and electrical power for the MARS system is obtained from the helicopter utility hydraulic system and the dc electrical system. A rapid pick-up assembly is carried in the helicopter as part of the MARS to provide capability of picking up an object unassisted from water or land after a normal parachute descent. The rapid pick-up assembly is capable of sustaining loads up to 5000 pounds when used in conjunction with the Model 80G winch. The rapid pick-up assembly consists of a shepherd's-type hook attached to an aluminum pole approximately 20 feet long. The hook is attached to the winch cable by means of a load line. Pick-up is accomplished by maneuvering the helicopter over the object and manually snapping the hook to the riser assembly. After the hook is attached, the pole is jerked free of the hook and the object may be picked up, reeled in as desired, and returned to a pre-determined location. The system consists primarily of a model 80G energy absorbing winch, winch control panel, trough assembly, sheave and fairlead assemblies, recovery poles, pole mount assemblies

and hydraulic system, recovery loop assembly, and a rapid pick-up assembly (surface).

To prepare for a recovery operation, the winch cable is led through the trough over the center of gravity roller, down through the opening in the fuselage, under the sheave, and aft along the underside of the fuselage to the recovery loop, where it is attached. The loop is attached to the poles, which are extended to present a target window. The pilot maneuvers the helicopter so that one or more pole hooks and/or flying hook engage the target parachute. The loop is pulled free of the poles and the winch pays out until the brakes are applied and the winch decelerates smoothly to a stop. The winch operator then reels in until the object is brought to a stow position for delivery to the designated landing spot/docking area.

WINCH ASSEMBLY. The winch (3, figure 1-2), designed to absorb the energy encountered during engagement and package reel-in, contains a drum and shaft assembly, a brake system, and a level wind assembly. After the engagement parachute is engaged, the cable pays out and causes the drum to rotate. The rotating drum turns a gear and ball screw arrangement that is attached to a hydraulic piston inside the drum shaft. The shaft contains a programmed orifice that regulates hydraulic pressure to the drum brake in proportion to drum speed and revolutions. This programmed braking permits the package to accelerate to a rate that is proportional to the speed of the helicopter and minimize the imposing strain. Power to reel in the package is supplied by a hydraulic motor that is powered by pressure from the utility hydraulic system (see figure 1-11). The winch and winch brake hydraulic systems may be shutoff from the utility hydraulic system by actuating the emergency shutoff switch, marked EMER HYD SHUT-OFF, located on the MARS CONTROL panel (see figure 1-9). The emergency shut-off valve receives power from the dc essential bus through a circuit breaker, marked EMER SHUT-OFF, located on the MARS circuit breaker panel. The winch receives electrical power from the dc essential bus, through a circuit breaker marked WINCH PWR, located on the MARS circuit breaker panel.

Drum and Shaft Assembly.

**CAUTION**

If, at any time during the reel-in operation, it is observed that the winch drum has stopped turning while the winch shaft is still turning, the reel-in operation must be stopped immediately. This condition, caused by excessive line tension or loss of brake pressure, may damage the winch if reel-in operations are continued.

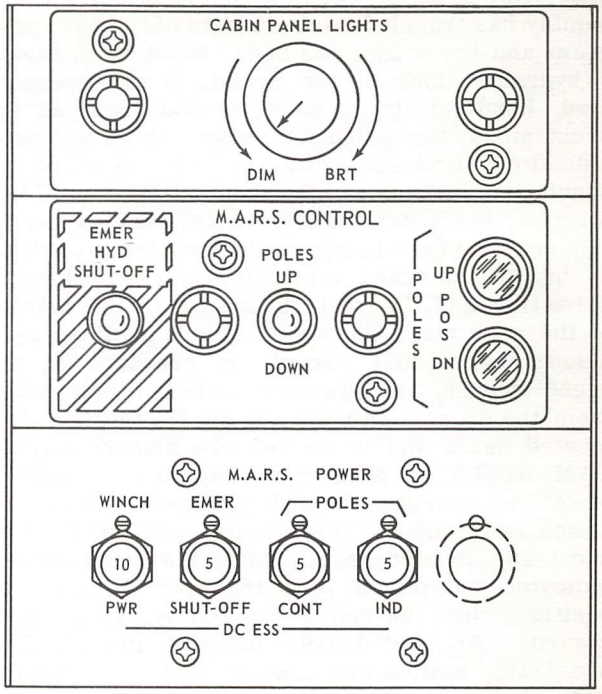



Figure 1-9. MARS Cabin Compartment Control Panels

The drum and shaft assembly, held in position between two side frames, contains the winch cable and brake system. The drum contains 377 feet of 7/16 inch-diameter stainless steel cable and the shaft contains the brake system. Bearing arrangement permits the drum to revolve when the shaft is stationary, as during an engagement, and to revolve with the shaft, as during reel-in or reel-out. The shaft end that projects from the gear box side frame contains two swivel fittings that admit final and holding brake pressure from the respective pressure regulators.

Winch Brake System. The winch brake system absorbs the energy encountered during engagement by automatically controlling the speed that the winch pays out the cable. The brake also holds the package in the stowed position. The hollow winch shaft is filled with hydraulic fluid and contains a piston and sleeve assembly. The piston and sleeve assembly, containing a suitably located port, is mechanically drawn along a cam shaft by action of the drum as it revolves during pickup. The cam shaft is programmed to allow a governed amount of hydraulic fluid to flow from one side of the piston to the other through the orifice created by the cam shaft program and the port in the piston and sleeve assembly. The flow restriction at the orifice develops back pressure ahead of the piston which is fed to the brake assembly to cause the drum to decelerate. The velocity of the piston and hydraulic flow through the orifice are proportional to the speed of the drum. The drum will

decelerate to a stop when the piston and sleeve assembly has traveled the full length of the cam program and the orifice has been closed off to create a hydraulic lock at the brake. If an excessive load, 8000 pounds or more, should occur as the drum stops, two pressure relief valves are provided to relieve the hydraulic lock and allow the winch line to run off the drum. After a MARS mission, the piston and sleeve assembly is manually rewound back to the ready-for-pickup position by inserting a speed wrench (6, figure 1-10) into a drive fitting (3, figure 1-10) located on the outside of the gear box. The drive clutch is disengaged during the manual rewind, by pressure on the speed wrench, and the gear train is disconnected from the drum. An indicator pin (2, figure 1-10), located below and to the left of a placard marked CAM RESET is flush with the cover when the clutch is disengaged, and protrudes when the clutch is engaged. The actuator rod end (5, figure 1-10), located directly below the crank socket, indicates the piston is in the ready-for-pick-up position when the end of the rod starts to move inward. An over-travel indicator pin (4, figure 1-10), located immediately above the actuator rod, begins to extend from the cover when the piston and sleeve assembly reaches the full pay out position. The manual clockwise winding of the speed wrench must be stopped before the over-travel indicator pin extends more than 3/32 of an inch to avoid damage to the ball screw. When the piston and sleeve assembly has been satisfactorily rewound, the planetary drive clutch is engaged, and the brake control handle is in the NORMAL position, respective microswitches close to cause the READY FOR PICK-UP light, located on the winch control panel, to illuminate to indicate that the system is properly configured to pickup the package.

Brake Control Handle. The brake control handle (13, figure 1-12), located to the right of the winch control panel, has marked positions NORMAL BRAKE and FINAL BRAKE. With the handle placed in the NORMAL BRAKE position, holding brake pressure is used to actuate the brake to prevent the winch line from paying out before an engagement is made. Holding brake pressure is indicated by the pressure gage, marked HOLDING BRAKE PRESS, located on the winch control panel, and should be 35 ± 5 psi which is equal to a holding brake tension sufficient to prevent cable payout. When the handle is placed in the FINAL BRAKE position, after engagement and completion of winch line payout, approximately 210 ± 10 psi brake pressure is applied and causes the brake to act as a clutch while reeling in the package with the winch hydraulic motor. The handle is placed in the FINAL BRAKE position whenever the hydraulic motor is used to reel in or reel out the winch. Final brake pressure is indicated by a light marked FINAL BRAKE PRESS, located on the winch control panel (figure 1-12), that illuminates when the brake pressure reaches 175 psi.

Level Wind Mechanism. The level wind mechanism assures proper distribution of the winch line on the drum. The mechanism consists of a grooved lead screw shaft mounted between the side frames of the winch, and a pair of level wind rollers (10, figure 1-10) mounted on the level wind follower assembly. The follower tooth of the level wind follower assembly is engaged with the grooves of the lead screw shaft. The rollers are lowered to straddle the winch line during reel in, and are raised upward and locked prior to pickup and/or when approached by winch line and loop hardware and parachutes during reel-in. The level wind mechanism is driven by the winch drum through a clutch. To position the level wind rollers, the hand wheel (8, figure 1-10) is turned in either direction, disengaging the clutch to permit the level wind rollers to be positioned.

WINCH CONTROL PANEL. The winch control panel (figure 1-12), mounted to the right of the drum housing, contains the circuit breakers condition lights, holding brake pressure indicator, cable cutter panel, power switch, and winch light switch and dimmer rheostat. The power switch, marked PANEL PWR with marked positions ON and OFF, controls the input of electrical power to the control panel. When the switch is placed in the ON position, power is supplied to the four condition lights, the panel edge lights, and the winch lights switch. Winch panel power is received from the dc essential bus, through a circuit breaker marked WINCH PWR, and is protected by circuit breakers marked SYS PWR and PANEL PWR located on the winch control panel. The condition light, marked PANEL PWR ON, will illuminate when the power switch is in the ON position and the panel is energized. The winch light switch, marked WINCH LIGHTS with marked positions ON and OFF, controls the input of electrical power to the winch lights. The winch lights are powered from the dc essential bus and protected by a circuit breaker, marked WINCH PWR, located on the winch control panel. The dimmer rheostat, marked PANEL LIGHTS with marked positions OFF and BRT, is rotated out of the OFF position to vary the intensity of the panel lights. The cable cutter panel, marked CABLE CUTTER, contains two lights marked ARMED and two switches marked CUT. The ARMED lights will illuminate when the control switches, located on the pilot's cable cutter and pole jettison control panel, are placed in the ARMED position and the system is armed. The CUT switches are then depressed to actuate the cable cutters. The holding brake pressure indicator, marked HOLDING BRAKE PRESS, provides an indication of the holding brake pressure. The indicator shows holding brake pressure only when brake control handle is in the NORMAL BRAKE position. The holding brake pressure indicator is

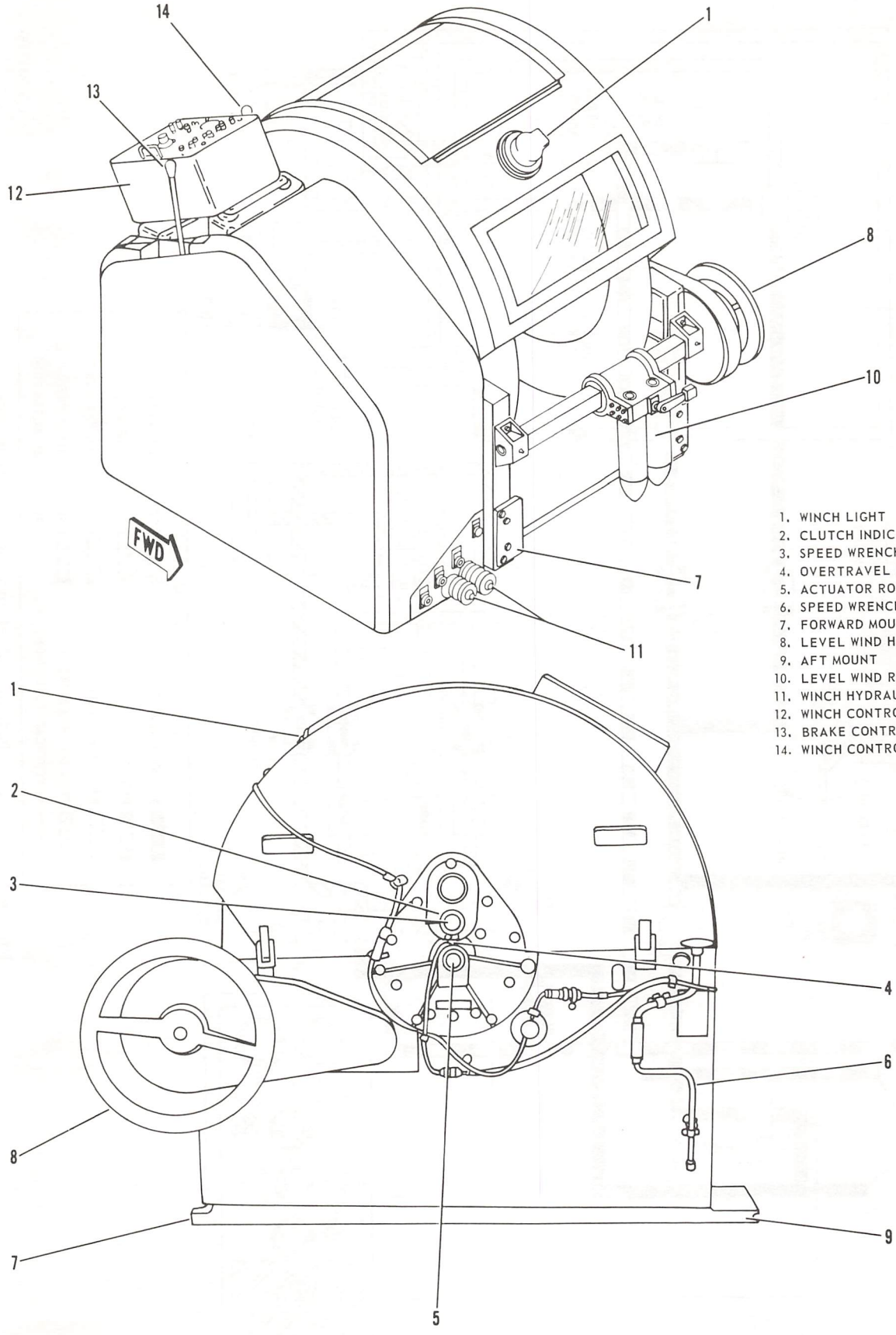



Figure 1-10. Winch Cover Side Panel Components

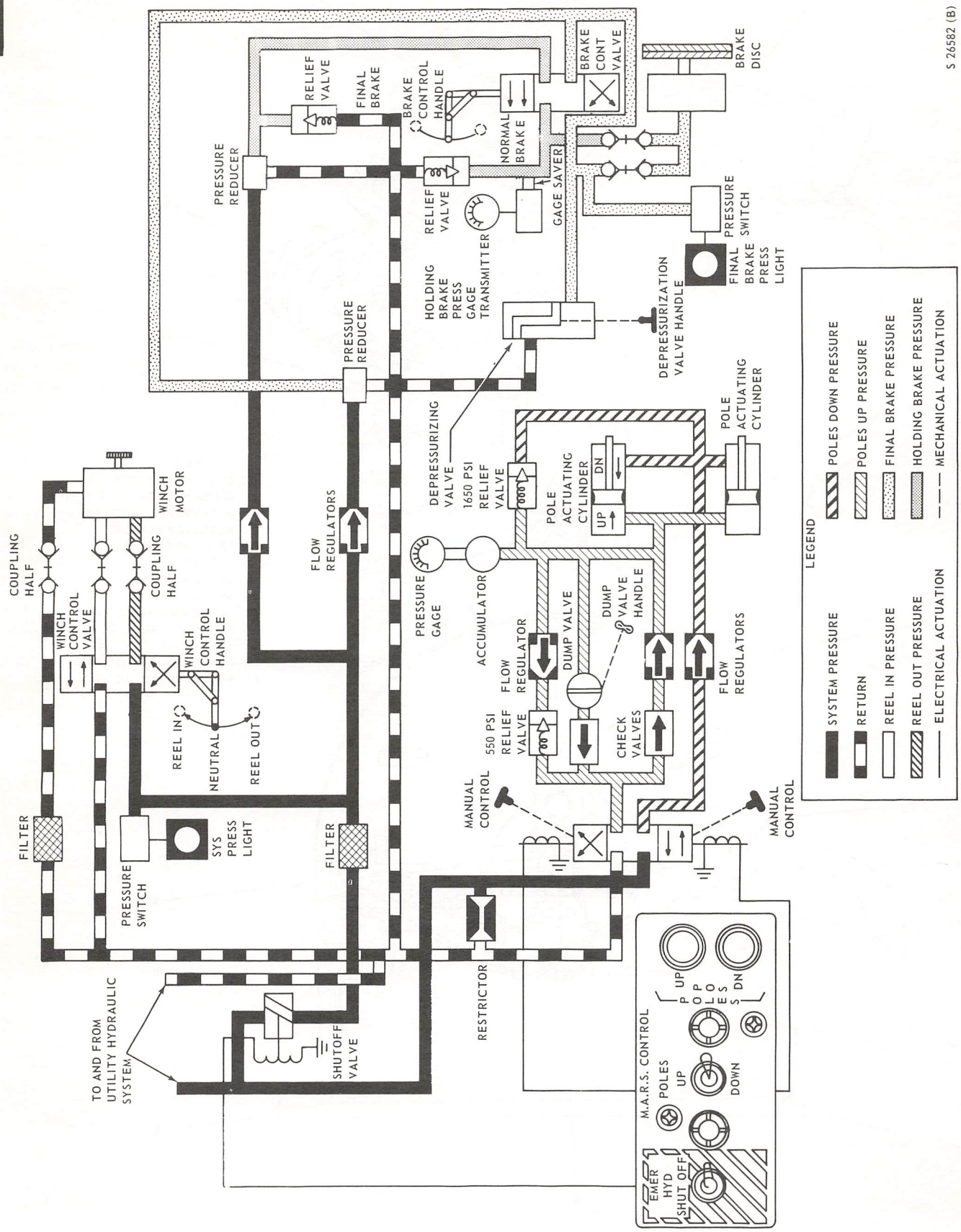



Figure 1-11. MARS Hydraulic System Schematic Diagram

powered by 26 volts ac from the ac essential bus, through a circuit breaker marked MARS PWR, located on the ac circuit breaker panel and protected by a circuit breaker marked INST PWR and located on the winch control panel. The system pressure condition light, marked SYS PRESS, illuminates when the system hydraulic pressure reaches 2000 psi, and will extinguish when the pressure has decreased to 1500 psi. The final brake pressure condition light, marked FINAL BRAKE PRESS, will illuminate when the final brake pressure is above 175 psi, and extinguish when the pressure has decreased below 175 psi. The condition light, marked READY FOR PICK-UP, will illuminate when the winch pressurizing piston is in the ready for pick-up position, the planetary drive clutch is engaged, and the brake control handle is in the NORMAL BRAKE position, to indicate the system is ready for a mid-air recovery.

WINCH CONTROL HANDLES. The winch control handles, one (14, figure 1-10) located to the left of the winch control panel and the other (1, figure 1-13) on the left side of the trough assembly have marked positions REEL IN and REEL OUT. The control handles are used to reel the winch cable in or out by controlling the flow of hydraulic fluid to the winch hydraulic motor. When a handle is placed in either the REEL IN or REEL OUT position, hydraulic fluid is supplied to the hydraulic motor in direct proportion to the distance the handle is moved from the neutral (center) position. As the speed of the motor is governed by the amount of pressure and flow supplied to it, the reel-in or reel-out time will depend on the speed of the motor.

TROUGH ASSEMBLY. The trough assembly (5, figure 1-2) consists of two fiberglas side panels, an end cover, and four hinged trough covers that form a rectangular trough shaped housing. The housing, which is bolted to the helicopter frame through the floor, provides protection for the crew from the moving winch line during recovery operations. The trough assembly is located over the well opening in the floor of the helicopter. The center of gravity roller is located in the trough so that the action of line loads during flight will be towards the center of gravity of the helicopter. The cable cutter sheave, which guides the winch line through the cable cutters, is also mounted in the trough aft of the center of gravity roller. The two electrically operated cable cutters are secured to a hinged cover directly over the cable cutter sheave (5, figure 1-13) and may be raised when not in use. When the cable cutters are not in use, the sheave is manually retracted into an opening by use of a lever located on the right side of the

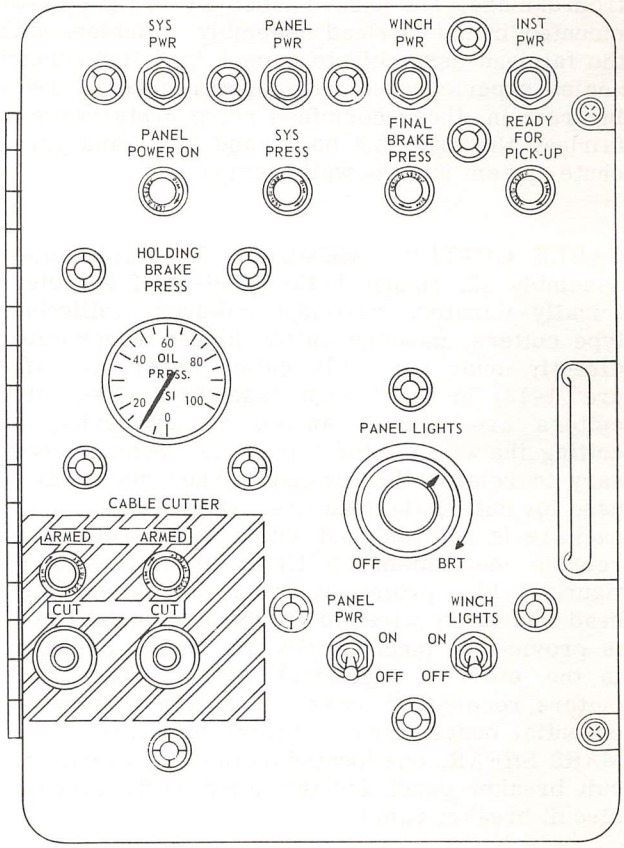



Figure 1-12. Winch Control Panel

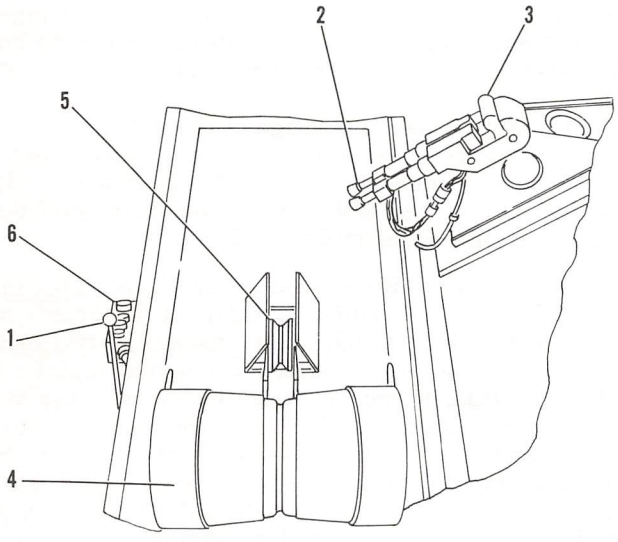
trough. As the sheave is retracted, spring-loaded doors close over the opening and create an unobstructed path for the hooks and engagement chute during recovery. The hinged trough covers are raised to observe passage of the hooks and engagement chute over the center of gravity roller. The winch remote control handle (1, figure 1-13) is mounted on the right side of the trough opposite the cable cutter assembly (3, figure 1-13).

Center of Gravity Roller Assembly. The center of gravity roller assembly (4, figure 1-13) consists of a center sheave and shaft assembly, two end rollers resembling truncated cones and installed with the smaller ends next to the center sheave, and two end roller shields with mounting plates for attaching the cg roller assembly to the trough beam assembly. A groove is provided in the center sheave for the normal position of the winch line during operations. The roller assembly is mounted in the trough assembly so that the winch line load is brought towards the normal center of gravity of the helicopter during flight.

SHEAVE AND FAIRLEAD ASSEMBLIES. The fairlead assembly (8, figure 1-2), bolted to the underside of the fuselage at the trough well opening, deflects the load line and protects the fuselage

from damage. The sheave assembly (9, figure 1-2), mounted in the fairlead assembly, combines with the fairlead assembly to accept load line contact angles experienced during aerial recovery. During reel-in, these combined components serve to fairlead the load line hooks and loop, and parachute system into the well opening.

CABLE CUTTER ASSEMBLY. The cable cutter assembly (3, figure 1-13) consists of two electrically-actuated, cartridge-powered, guillotine-type cutters, mounted on the hinged trough cover directly over the cable cutter sheave (5, figure 1-13) in the trough assembly. The cable cutters are used as an emergency device for cutting the winch cable if it should become necessary to release the package. They may also be used for cutting the load line, when docking, if the package is not equipped with an automatic ground release mechanism. A firing pin extension (2, figure 1-13), projecting from the cutter firing head and safety wired to prevent accidental firing, is provided to mechanically fire the cable cutters in the event of electrical failure. The cable cutters receive dc power from the battery and essential buses, through circuit breakers marked MARS SHEAR, one located on the battery bus circuit breaker panel and the other on the overhead circuit breaker panel.




1. WINCH REMOTE CONTROL HANDLE
2. MANUAL FIRING PIN EXTENSION
3. CABLE CUTTER ASSEMBLY
4. CENTER-OF-GRAVITY ROLLER ASSEMBLY
5. CABLE CUTTER SHEAVE
6. CABLE CUTTER CONTROL PANEL

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Figure 1-13. Trough Assembly Components

Cable Cutter Control Panels. The cable cutter control panels, one for the pilot and two for the winch operator, provide the means of electrically actuating the cable cutters. The pilot's control panel, marked CABLE CUTTER, is part of the cable cutter and pole jettison control panel (figure 1-14), located on the cockpit console. The panel provides master control for arming the system and contains two lights, marked ARMED, and two control switches. The panel also contains markings No. 1 and No. 2 that associate respective switches and lights with separate power sources. The control switch and ARMED light associated with the marking No. 1 relate to the cable cutter powered by the dc essential bus, which may be actuated by the winch operator's CUT switch or by depressing the button, marked WEAPON, located on the copilot's cyclic stick grip. The control switch and ARMED light associated with the marking No. 2 relate to the cable cutter powered by the battery bus, which may be actuated by the winch operator's CUT switch or by depressing the button, marked WEAPON, located on the pilot's cyclic stick grip. The control switches have marked positions ARMED and SAFE. When the switches are placed in the ARMED position, the system is armed and will be so indicated by the ARMED lights on each control panel. When the switches are in the SAFE position, the cable cutters cannot be electrically actuated.

The winch operator's control panels, one (6, figure 1-13) located on the right side of the trough housing aft of the remote control handle, and the other on the winch control panel (figure 1-12), are identical and operate in the same manner. Each panel contains two lights, marked ARMED, that illuminate when the system has been armed by placing the pilot's control switches in the ARMED position, and two switches marked CUT that are

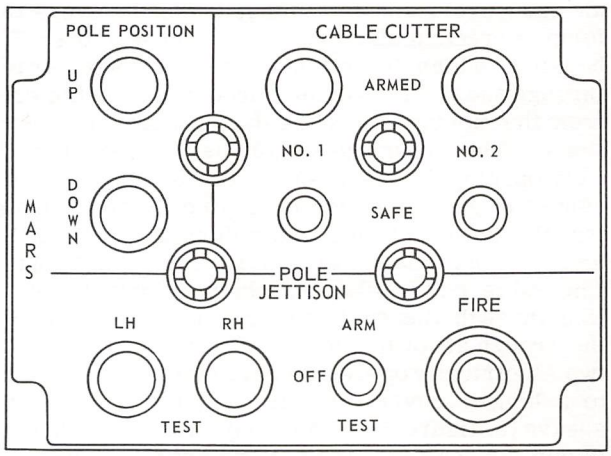


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Figure 1-14. Cable Cutter and Pole Jettison Control Panel

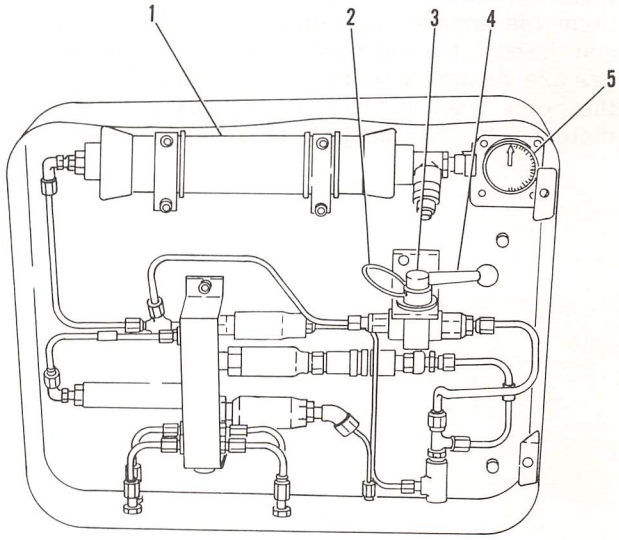
depressed to actuate the cable cutters. The power sources for each switch and light corresponds to those outlined for the pilot's control panel.

RECOVERY POLE INSTALLATION. The recovery poles, installed in pole mount assemblies located on the sides of the fuselage, are used to position the recovery loop to engage an engagement chute during aerial recovery. The installation consists of two recovery poles, two pole mount assemblies, a hydraulic assembly located on the end of the trough, a control switch and associated condition lights, and a pole jettison control panel.

Recovery Poles. The two aluminum recovery poles (10, figure 1-2), used to hold the recovery loop in position to form a target window for the engagement chute, are hydraulically operated and electrically controlled. The 19-foot poles may be lowered through a 44-degree vertical plane and, when lowered, each pole is splayed outward approximately 10 degrees. Each pole is attached to its pole mount assembly by use of a spring pin and saddle assembly. When not being used, the poles are stored in an up (horizontal) position, parallel to each other on the sides of the fuselage. The end of each pole is equipped with a spring clip retainer that holds a recovery hook.

Pole Mount Assembly and Hydraulic System. The pole mount assembly consists of two pole mounts and cylinder assemblies (6, figure 1-2) and are mounted on the sides of the fuselage. These assemblies hold the recovery poles and provide the means for them to be raised or lowered. The pole hydraulic system (figure 1-15) contains an electrically operated four-way solenoid valve, flow regulator valves, relief valves, accumulator (1, figure 1-15) and pressure gage (4, figure 1-15), dump valve (3, figure 1-15), and actuating cylinders. The four-way solenoid valve, depending on the position of the pole control switch, directs utility hydraulic system pressure to the up or down side of the actuating cylinders. The actuating cylinders tilt the pole holders so that the aft ends of the poles lower when pressure is applied to retract the actuators and raise to horizontal when pressure is applied to extend the actuator. The four-way solenoid valve may be operated manually in the event of electrical failure. The flow regulators limit the flow of hydraulic fluid to the actuators to control the time constant for raising and lowering the poles. The gage is used to register the 200 ± 50 psi air charge of the accumulator. The relief valves will relieve the system pressure if an excessive load should develop during a recovery operation. The system may be depressurized by actuating the system dump valve, located in the pole actuating hydraulic system, after the shut-off valve in the utility hydraulic system supply line has been closed. The dump valve is opened by removing the locking pin (2, figure 1-15), lifting the toggle handle (5, figure 1-15), then rotating it in a 90-degree arc to the open position.

Pole Actuator Control Switch and Condition Lights. The pole actuator control switch, located on the MARS CONTROL panel (see figure 1-9) and marked POLES, has marked positions UP and DOWN. The associated condition lights, one marked UP and the other DN and related to the marking POLES POS, provide visual indication of the status of the poles. These lights also work in conjunction with the pilot's pole condition lights, one marked UP and the other DOWN and related to the marking POLE POSITION, located on the cable cutter and pole jettison control panel (figure 1-14). Placing the switch in the DOWN position will cause the recovery poles to lower to the down position and the appropriate condition lights to illuminate. Placing the switch in the UP position will cause the recovery poles to be raised to the up (horizontal) position and the appropriate condition lights to illuminate. The pole control switch is energized from the dc essential bus through a circuit breaker marked CONT. The condition lights are also energized from the dc essential bus through a circuit breaker marked IND. Both circuit breakers are under the general heading POLES and located on the MARS circuit breaker panel.




1. ACCUMULATOR
2. DUMP VALVE LOCKING PIN
3. DUMP VALVE
4. TOGGLE HANDLE
5. PRESSURE GAGE

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Figure 1-15. Pole Hydraulic System

Pole Jettison System. The pole jettison system consists of explosive bolts, installed in the pole attachments to the pole mount assemblies, and a pole jettison control panel. The pole jettison control panel, marked POLE JETTISON, is part of the cable cutter and pole jettison control panel. (See figure 1-14.) The panel contains a control switch with marked positions ARM, OFF, and TEST, a jettison switch marked FIRE, and two test lights marked LH and RH. When the control switch is placed in the ARM position and the FIRE switch is depressed, the explosive bolts will be energized and jettison both recovery poles. The system is tested by placing the control switch in the TEST position, depressing the FIRE switch, and observing that the test lights illuminate. The system is powered from the dc essential through two circuit breakers, marked LEFT and RIGHT and under the marking POLES JETTISON, located on the overhead circuit breaker panel.

RECOVERY LOOP ASSEMBLY. The recovery loop (11, figure 1-2) is formed from nylon rope which extends from the free end of the winch line to the tip of each pole. The loop contains two pole hooks, attached to the recovery poles with spring retainers, and a flying hook (12, figure 1-2). The loop is held in position below the helicopter by the recovery poles to engage the engagement chute of the object being retrieved. Upon contact, engagement between the hooks and the engagement chute form the connection between the MARS equipment and the object being recovered. The spring retainers are designed to release the pole hooks from the poles when an engagement force of approximately 250 ± 25 pounds is realized.

RAPID PICK-UP ASSEMBLY.

**CAUTION**

A new load line is required for each scheduled and accomplished training and/or operational pick-up mission. The winch operator will closely inspect the load line during preflight check for nicks, fraying, discoloration, burns, and insecurity of splicing. If the load line is damaged or suspected to be damaged, it will be replaced prior to mission start. A training mission can consist of any number of retrievals as long as the load line is not damaged.

The rapid pick-up assembly (figure 1-16) consists of a two-section, telescoping, aluminum pole, approximately 20 feet long; an end fitting, a hook assembly, and a nylon load line, 100 (±4) feet long, that connects to the helicopter winch cable. A cable assembly with a safety snap and grounding clip is attached to the pole to provide static ground and prevent loss of pole should it slip from the operator's grasp. The end fitting is attached to the hook by means of a Ball-Lok-type fitting which requires approximately a 75-pound pull to free it from the hook. The load line is attached to the winch cable by means of a standard screw pin shackle. The excess load line is reeled on the winch drum and the other end is fed out through the winch fairing and back in through the cargo door by means of a running line. This is then attached to the adapter clamp or the hook. The upper pole has a T-handle on the upper end for manual manipulation from the helicopter personnel door.

1. LOWER POLE
2. PIN
3. UPPER POLE
4. CABLE ASSEMBLY
5. CLAMP (ALLIGATOR)
6. SNAP HOOK
7. T-HANDLE
8. LOAD LINE
9. ADAPTER ASSEMBLY
10. HOOK ASSEMBLY
11. END FITTING ASSEMBLY
12. PIN (BALL-LOK)

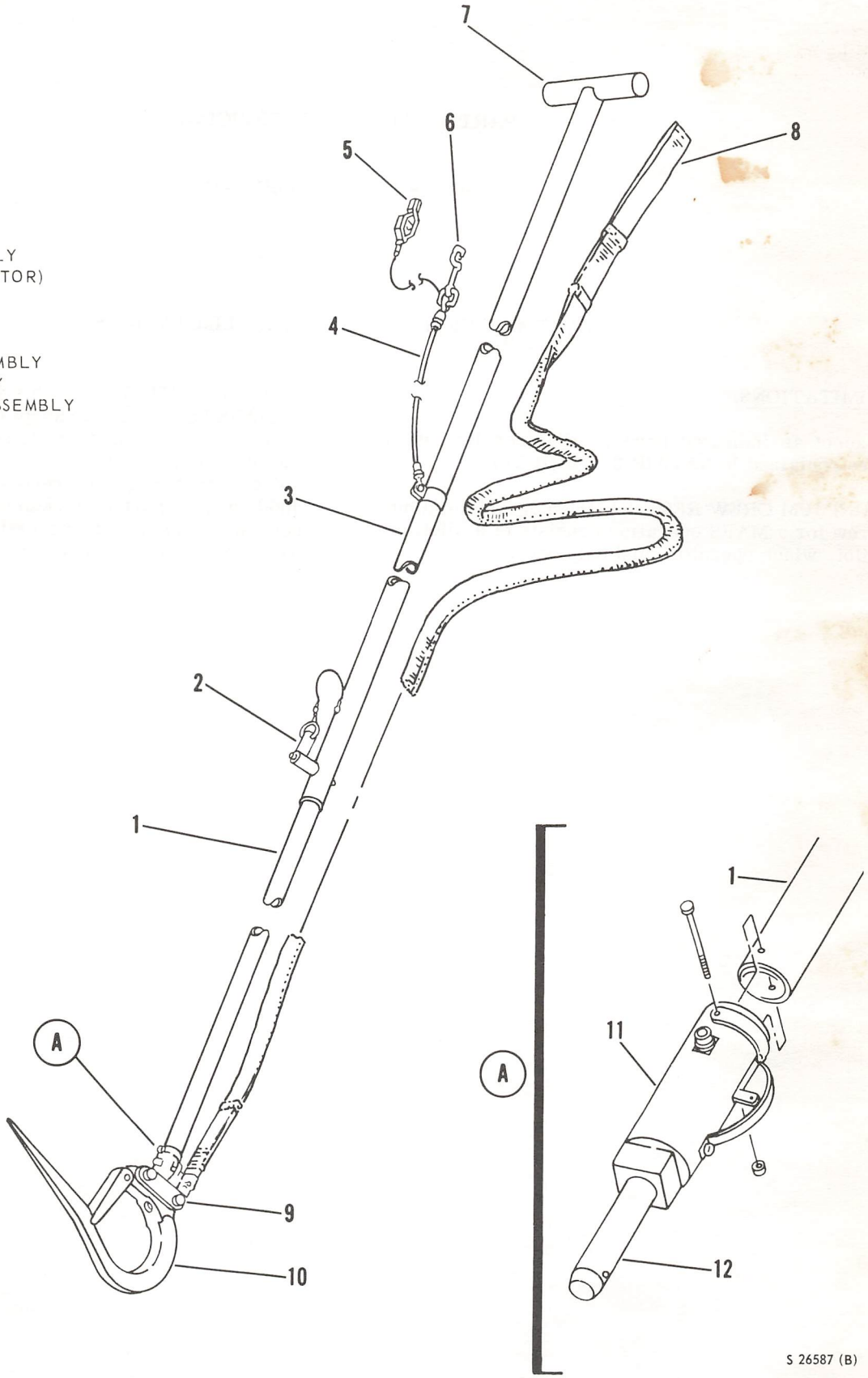



Figure 1-16. Rapid Pickup Assembly

## PART 3 - AIRCRAFT SERVICING

(See NAVAIR 01-230HLC-1)

## PART 4 - AIRCRAFT OPERATING LIMITATIONS

LIMITATIONS.

Except as indicated herein, all other limitations are contained in NAVAIR 01-230HLC-1.

MINIMUM CREW REQUIREMENTS. The minimum crew for a MARS operation consists of a pilot, co-pilot, winch operator, and pole operator.

WEIGHT LIMITATIONS. Structural changes made to MARS helicopters to adapt them for the mid-air recovery system have made no apparent change in the center of gravity. The maximum weight of objects that may be recovered in mid-air is 4000 pounds. Surface pickup from the water should not be attempted if the estimated weight of the package exceeds 5000 pounds.

# SECTION II

# INDOCTRINATION

(See NAVAIR 01-230HLC-1)

# SECTION III

# NORMAL PROCEDURES

Except for the following, all other normal procedures are covered in NAVAIR 01-230HLC-1.

## TABLE OF CONTENTS

### PART 1 - MISSION PLANNING



### PART 3 - SHORE-BASED PROCEDURES

## PART 1 - MISSION PLANNING

### WEIGHT AND BALANCE.

The weight of the object being recovered and the hover capability must be determined prior to each mission. This is necessary to ensure that the additional weight and center of gravity changes do not exceed established limits.

## PART 2 - BRIEFING/DEBRIEFING

## PART 3 - SHORE-BASED PROCEDURES

## PILOT'S PROCEDURES

PREFLIGHT INSPECTION.

The pilot in command shall be responsible for the performance of the preflight inspection in accordance with figure 3-1.

INTERIOR INSPECTION.

1. Fire extinguisher, first aid, and pyrotechnic kits.

2. Emergency air bottle, charged (2500 to 3000 psi).

3. Cabin and cockpit escape hatches and areas, secure.

4. Transmission area, check for leaks.

5. Life rafts and parachutes, as required.

6. Prior to a MAR launch, the crewman shall ensure that the winch and pole operator's preflight checklist is complete.

BATTERY START NO. 1 ENGINE.

1. Circuit breakers and switches - CHECKED.

2. Brakes and tailwheel - CHECKED.

3. Beeper trim switch - ON.

4. Ignition switches - NORMAL.

5. Manual throttles, speed selectors - FREE AND OFF.

6. Emergency start switches - OFF.

7. Rotor brake - CHECKED (320 psi minimum).

**CAUTION**

If low rotor brake pressure requires recycling manual rotor brake with blades folded, personnel shall be placed on either side of the helicopter holding the blades in order to prevent shifting of head while the manual rotor brake is off.

8. Fuel panel - CHECKED.

9. Start mode switch - MANUAL.

10. Battery switch - ON.

11. Fire warning/caution advisory panel - CHECKED.

12. Accessory drive switch - FORWARD, LIGHT ON.

13. No. 1 engine - START.
To start the engine move the speed selector to the stop, depress the starter button and hold depressed, then move the speed selector aft to the shutoff position. When the engine has accelerated to 14% $N_g$ and $T_5$ is below 100°C, advance the speed selector to ground idle.

14. Engine start switch - DEPRESS AS NECESSARY TO CONTROL $T_5$.
When engine lite-off is evident, depress the engine start switch on the cyclic stick grip. Hold the switch depressed as necessary until $T_5$ stabilizes.

**Note**

Compressor stalls may occur if $N_g$ is allowed to decelerate.

15. At 45% $N_g$ starter - DISENGAGED.
Disengage starter by releasing the starter button.

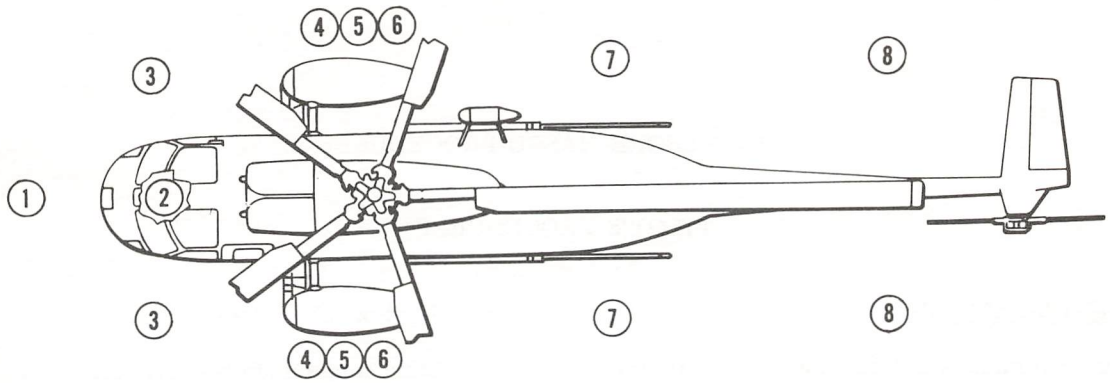
16. All gages - CHECKED.

17. Speed selector - 104% $N_f$.

18. Generator switches - ON.

19. Blade panel, radios, hoist - CHECKED, ON.

20. Lights - AS REQUIRED.




1. GENERAL INITIAL INSPECTION
   - a. Wheel chocks in place
   - b. Number and proper adjustments of tiedowns, if attached.
2. COCKPIT INSPECTION
   - a. Landing gear handle down
   - b. Fuel quantity
   - c. Tailwheel locking handle locked
   - d. Parking brake set
   - e. Battery switch off
   - f. Rotor brake on-Pressure up
3. NOSE SECTION
   - *a. Personnel door for security
   - *b. All protective covers removed
   - *c. Condition of windows, windshields and windshield wipers
   - *d. Battery-connected and safety wired, door secured, vents clear
   - *e. Electronics compartment-security, circuit breakers, leaks, door-closed, locked and water tight. Flood lights for condition.
   - f. Bottom skin for cracks, corrosion, distortion and defective rivets or screws.
4. RIGHT FRONT OF FUSELAGE
   - a. External power receptacles for cleanliness
   - *b. Heater air intake and heater exhaust-clear
   - *c. Condition and cleanliness of doppler antenna
   - *d. Tires for cuts, blisters, uneven wear, proper inflation
   - *e. Landing gear system-for leaks, loose connections
   - *f. Sponson inspection-panels for security, drain screws installed, flotation bags
   - g. Parachute deflector for condition and security
   - h. Recovery pole, pole mount, and actuating cylinder for condition and security
   - i. Hover light for security of bracket
   - j. Fuel, oil, hydraulic leakage
   - k. Bottom skin for cracks, corrosion, distortion and defective rivets or screws
   - l. Condition of anti-collision light
   - *m. TACAN antenna for condition
4. LEFT FRONT OF FUSELAGE
   - *a. Tires for cuts, blisters, uneven wear, proper inflation
   - *b. Landing gear system for leaks, loose connections
   - *c. Sponson inspection-panels for security, drain screws installed, flotation bags, hover light
   - d. Parachute deflector for condition and security
   - e. Recovery pole, pole mount, and actuating cylinder for condition and security
   - *f. Fuel, oil, hydraulic leakage
   - *g. Fuel filler caps (2) for security
   - h. Doppler antenna for condition and cleanliness
   - i. Bottom skin for cracks, corrosion, distortion and defective rivets or screws
5. RIGHT (ENGINE, ROTARY WING HEAD, TRANSMISSION)
   - a. Tail rotor drive shaft housing for condition and security
   - b. Fire bottle for proper pressure
   - c. Transmission oil cooler, fan, fan belt and brackets for condition, leaks and security
   - d. Accessory section lines and wiring for condition, leaks and security
   - e. Utility reservoir fluid level

     NOTE

     An overfilled utility reservoir may indicate internal leakage between the damper reservoir and the utility system.

   - f. Blade BIM indicators for normal indication
   - g. Damper reservoir for proper level
   - h. Anti-flapping and droop restrainers for broken springs
   - i. Accumulator for proper precharge 1500 psi (blades spread)
   - j. AN/APN-171 antenna checked
   - k. Hydraulic filters (2) for proper indication
   - l. Blades for cracks, dents, bonding separations
   - m. Exhaust casing for cracks, buckling, dents, hot spots and security
   - n. Flex shaft for security
   - o. Air, fuel, and oil lines for leakage, chafing and security
   - p. Stator vane actuators for alignment and security
   - q. Oil tank for leakage, proper level security of filler cap
   - r. Starter for security, bellmouth area free of foreign objects damage
   - s. Ice shield and pitot tube airspeed adapter (if installed) for security and proper installation
   - t. Pitot cover removed
   - u. Fire detection system for continuity and security
   - v. Engine and transmission access doors secure
5. LEFT (ENGINE, ROTARY WING HEAD, TRANSMISSION)
   - a. Tail rotor drive shaft housing for condition and security
   - b. Fire bottle for proper pressure
   - c. Pri-aux reservoir fluid levels
   - d. Transmission oil cooler, fan, fan belts and brackets for condition, leaks and security
   - e. Accessory section, lines and wiring for condition, leaks and security
   - f. Damper reservoir for proper level
   - g. Blade BIM indicators for normal indication
   - h. Anti-flapping and droop restrainers for broken springs
   - i. AN/APN-171 antenna checked
   - j. Accumulator for proper precharge 1500 psi (blades spread)
   - k. Blades for cracks, dents and bonding separations
   - l. Hydraulic filter (1) for proper indication
   - m. Main gear box oil level
   - n. Exhaust casing for cracks, buckling dents, hot spots and security
   - o. Flex shaft for security
   - p. Air, fuel, and oil lines for leakage, chafing and security
   - q. Stator vane actuators for alignment and security
   - r. Oil tank for leakage, proper level, security of filler cap
   - s. Starter for security, bellmouth area free of foreign objects damage
   - t. Ice shield and pitot tube airspeed adapter (if installed)
   - u. Pitot cover removed
   - v. Fire detection system for continuity and security
   - w. Engine and transmission access doors secure

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Figure 3-1. Preflight Inspection (Sheet 1 of 2)

6. RIGHT BOTTOM HULL
   *a. Fuel tank sump drains (4) for leakage
   *b. Fuel tank filter drain (1) for leakage
   c. Access plates for security
   *d. MARS trough opening well lip for cracks, dents and distortion
   e. Bottom skin for leaks, cracks, corrosion, distortion and defective rivets or screws

6. LEFT BOTTOM HULL
   *a. Fuel tank filter drains (1) for leakage
   *b. Bilge drain plugs (7) and flapper valves (7) for security
   c. Access plates for security
   *d. MARS trough opening well lip for cracks, dents and distortion
   e. Bottom skin for leaks, cracks, corrosion, distortion and defective rivets or screws

7. RIGHT REAR OF FUSELAGE
   a. Blades for cracks, dents and tears
   b. Blade racks off
   c. Rescue hoist for leakage
   *d. Cabin door for security and damage
   *e. Pressure fueling adapter for leakage and security
   *f. Fuselage for dents, or tears in skin
   g. Observation window for condition and cleanliness
   h. Bottom skin for cracks, corrosion, distortion and defective rivets or screws
   i. Recovery loop for condition and security
   *j. Condition of IFF Antenna
   k. Fuel dump port for security

7. LEFT REAR OF FUSELAGE
   a. Thermal discharge indicator for red seal
   b. Blades for cracks, dents and tears
   c. Blade racks off
   *d. Fuselage for dents or tears in skin
   e. Observation window for condition and cleanliness
   *f. Tailwheel tire for cuts, blisters, and proper inflation. Grounding wire for condition and security
   *g. Tailwheel locking pin in place (locked). Tailwheel oleo strut for leaks, proper extension
   *h. Top of tail oleo strut for damage. Tailwheel locking wire for condition
   i. Tailwheel fairing for condition and security.
   *j. Pylon lockpins for positive locking; ratched handle in proper position
   *k. Pylon folded lockpin indicator retracted
   *l. HF antenna for condition and security
   *m. Bottom skin for cracks, corrosion, distortion, defective rivets or screws
   n. RAD ALT antenna for condition and cleanliness

8. RIGHT SIDE OF TAIL CONE AND PYLON
   *a. Condition and security of LF/ADF wire and loop antennas and UHF antenna
   b. Tail rotor drive shaft housing for condition and security
   *c. Pylon hinge secure
   *d. Intermediate and tail rotor gear boxes, cooling air intakes and exhaust openings for condition, overheating, obstruction and leakage
   *e. Stabilizer and static wicks for condition and security
   *f. Anti-collision light for condition
   *g. Skin for cracks, corrosion, distortion and defective rivets or screws
   h. Observation window for condition and cleanliness

8. LEFT SIDE OF TAIL CONE AND PYLON
   a. Intermediate and tail rotor gear box and openings for leakage and obstructions.
   *b. Rotary rudder head components secure
   c. Rotary rudder blades for dents or cracks and direction of rotation
   d. Gust lock removed
   *e. Skin for cracks, corrosion, distortion and defective rivets or screws
   f. Pylon hinges for cracks

NOTE
Crewmen interior and preflight checks are in Section IX

*Denotes areas on crewmen's preflight checklist

S 26588.2 (B)

Figure 3-1. Preflight Inspection (Sheet 2 of 2)

**Note**

The normal light indications on the blade fold panel when the blades are folded are safety valve warning light, control lockpins advance light, and blades folded light. When the blades are spread, normal light indications are blade spread light and flight position light on. Abnormal indications must be noted or corrected, as appropriate.

21. Anti-ice - CHECKED/AS REQUIRED.

22. Fuel quantity - CHECKED.

23. Landing gear - CHECKED.

24. Compass system, IFF, console switches - AS REQUIRED.

25. Cable cutter and pole jettison control panel - CHECKED.

26. RAD ALT, BAR ALT, RAWS - SET/TEST.

27. Start mode switch - NORMAL.

**Note**

Continue at DETAILED AUTOMATIC BLADE SPREADING PROCEDURE or FUNCTIONAL CHECKLIST, as appropriate.

## NORMAL STARTING PROCEDURES.

The No. 1 engine is started first to provide power for the accessory drive section. The No. 1 engine

may be started using either ac or dc external power, or if neither is available by using the battery. After the No. 1 engine is started and run up above generator cut-in speed, generator power can be used to start the No. 2 engine. A fireguard shall be standing by when starting engines.

1. Circuit breakers and switches - CHECKED.

2. Brakes and tail wheel - CHECKED.

3. Battery switch - ON.

**Note**

Observe instruments and lights to ensure battery operation.

4. External power - CONNECTED.

**CAUTION**

If the warning lights power circuit breaker has popped and ac external power is connected and turned on, the No. 2 generator load will be lost.

**Note**

If external power output is suspect during engine start with the blades folded, the battery switch should be left in the ON position to prevent the primary servos from being energized in the event electrical power is lost.

5. Battery switch - OFF.

**CAUTION**

When using external power for an extended period, the battery switch should be in the OFF position to prevent overcharging the battery.

6. Landing gear - CHECKED.

a. Indicators - DOWN.

b. Landing gear actuating lever - DOWN.

c. Landing gear warning light - PRESS TO TEST.

d. Emergency landing gear extension handle - DOWN, FORE-AND-AFT, and SHEAR WIRED.

e. Emergency landing gear release handle - AFT and SHEAR WIRED

7. Accessory drive switch - FORWARD, LIGHT ON.

8. Blade panel, radio masters, hoist, trim - CHECKED/ON.

**Note**

The normal light indications on the blade fold panel when the blades are folded are safety valve warning light, control lockpins, advance light, and blades folded light. When the blades are spread normal light indications are blade spread light and flight position light on. Abnormal indications must be noted or corrected, as appropriate.

9. Anti-ice - CHECKED AS REQUIRED.

**Note**

No. 1 engine anti-ice switch - ON. Below 10°C OAT if visible moisture is present.

10. Emergency start switches - OFF.

11. Rotor brake - CHECKED (320 PSI MINIMUM).

**CAUTION**

If low rotor brake pressure requires recycling manual rotor brake with blades folded, personnel shall be placed on either side of the aircraft holding the blades in order to prevent shifting of head while the manual rotor brake is off.

12. Ignition switches - NORMAL.

13. Manual throttles, speed selectors - FREE AND OFF.

14. Start mode switch - AS REQUIRED.

15. Fire warning, caution, advisory panels – CHECKED.

16. Fuel panel/quantity - CHECKED.
In checking the fuel panel, the fuel switch shall be open, crossfeed as desired.

**Note**

Starting with booster pumps off will assist in reducing engine purifier contaminant wash out.

17. Lights - AS REQUIRED.

18. No. 1 engine - START. To start No. 1 engine, the speed selector is moved forward in the SHUTOFF detent to the stop, starter button depressed, speed lever moved aft and the starter button smoothly released. As the engine accelerates to 20 percent $N_g$, $T_5$ is below 100°C, and positive indication of oil pressure is noted, turn booster pumps on and advance speed selector to GRD IDLE.

**CAUTION**

Do not operate starter continuously for more than 30 seconds, except in an emergency. Do not attempt more than three starts in any 30-minute period. Allow 3 minutes between starts. The starter should be capable of motoring the engine 19 percent $N_g$. Failure to do so may result in hot starts.

**CAUTION**

Power turbine inlet temperature ($T_5$) should be less than 100°C prior to advancing the engine speed selector to GRD IDLE. If engine lite-off does not occur within 10 seconds after the engine speed selector has been advanced to the GRD IDLE position, move the engine speed selector to the SHUTOFF position. Depress the starter button and move the booster pump switches to the OFF position. Before attempting another start, allow the engine to stop rotating and wait 3 minutes for fuel to drain from the manifolds, combustion chambers, and exhaust hood before repeating starting procedure.

If the gas generator does not accelerate, monitor the power turbine inlet temperature indicator. If the temperature continues to rise, and/or a hot start is evident, abort the start immediately by moving the speed selector to the SHUTOFF position, and depressing the starter button momentarily.

**Note**

When the engine lites off and accelerates to approximately 45 percent $N_g$ speed, the current sensitive holding coil in the automatic drop-out relay automatically cuts off electrical power to the starter and ignition systems.

19. All gages - CHECKED.

**CAUTION**

If power turbine inlet temperature ($T_5$) rises abnormally or reaches 700°C, immediately shut down the engine. If $T_5$ continues to rise above 700°C, note time above 700°C and indicated maximum temperature. If engine fire follows, as may be indicated by a continuous temperature in excess of 300°C, engage the starter without ignition and motor it until the fire is extinguished.

20. Booster pumps - OFF.

**Note**

Booster pumps should be off to check for engine flameout due to possible air leak in a fuel line. If airframe fuel filters have been changed just prior to the flight, the boost pumps should be left on for about one minute after starting engine to purge air from fuel lines and preclude engine flameout.

**CAUTION**

Upon initial indication of a lack of accessory drive when operating in accessory, the engine should be shut down immediately and not restarted. Continued operation could cause severe damage to the main transmission. Lack of accessory drive is indicated by the loss of hydraulic (primary, auxiliary, and utility) pressure, generator power, and transmission oil pressure.

During ferry flights, or off-base helicopter operations, it may be necessary to refuel with a different fuel type than was used during the prior flight or ground run. Operation with a fuel, or a fuel mixture which differs from the fuel type set on the flow divider and the fuel density set on the fuel control can affect engine starting characteristics as indicated below:

| Fuel in Engine Fuel System | Flow Divider Setting | Fuel Control Setting | Probable Effect on Start |
|---|---|---|---|
| JP-4 | JP-5 | JP-4 | Hot Start |
| JP-4 | JP-4 | JP-5 | Cold Hangup |
| JP-4 | JP-5 | JP-5 | Hot Start |
| JP-5 | JP-5 | JP-4 | Slightly Warm |
| JP-5 | JP-4 | JP-5 | Cold Hangup |
| JP-5 | JP-4 | JP-4 | Cold Hangup |

**Note**

Fuel in engine system will not change for first start after refueling unless engine fuel system has been drained.

Engine starts after refueling with fuel other than the type set on the flow divider and fuel control should be monitored closely for possible overtemperature indications.

If prolonged operations are anticipated with fuel other than set on the flow divider and fuel control, adjustments should be reset to the type fuel being used.

21. Speed selector - 104% $N_f$.

**Note**

During operation in accessory drive, minor oscillations in the power turbine speed of the No. 1 engine may be encountered due to actuation of the overspeed protection system. Normally, decreasing No. 1 $N_f$ slightly will eliminate these oscillations.

22. Generators, battery, external power - ON, DISCONNECTED.

23. Compass system, IFF, console switches - AS REQUIRED.

**Note**

During shipboard operations the compass system must be reset after becoming airborne, when free of local magnetic disturbance. Resetting will provide more accurate readouts sooner than if the system were allowed to slave by itself.

**CAUTION**

When operating in accessory drive for extended periods of time with rotors stopped, the main transmission may overheat because the oil cooler is inoperative.

DETAILED AUTOMATIC BLADE SPREADING PROCEDURE.

**CAUTION**

The primary servo is not normally pressurized when the blades are folded but will pressurize if all electrical power to the helicopter is lost or secured, or if an open circuit develops in the safety valve switch. Pressurization of the primary servo when the blades are folded will put undue stress on control linkages and may damage the control lockpins.

1. Servo sensor - CHECKED.

a. Servo switch - AUX OFF.
If auxiliary servo pressure drops, the primary servo sensor is defective.

2. Area clear - CHECKED.

**Note**

Spread/fold power will not be available if the No. 2 engine fuel firewall valve switch is open.

**Note**

The ASE should be off during blade spreading to prevent inadvertent control inputs.

3. Safety valve switch - OPEN.

4. Blade fold master switch - ON.

a. Fold power indicator light - ON.

b. No. 1 blade position light - ON.

5. Blades fold-spread switch - SPREAD.

a. Blades folded light - OFF (when first blade moves).

b. Control lockpins advance light - OFF (when pins are disengaged).

c. Blades spread light - ON.

6. Safety valve switch - CLOSE.

a. Safety valve warning light - OFF.

b. Fold power indicator light - OFF.

c. Primary servo hydraulic pressure - 1500 PSI.

7. Rotor brake - 320 psi MINIMUM.

8. Blade fold master switch - OFF.

a. No. 1 blade position light - OFF.

b. Flight position light - ON.

9. Blades fold-spread switch - OFF.

**CAUTION**

Check with ground crewman to ensure that blades are in proper spread position and that the blade lockpins are securing the blades in place.

FUNCTIONAL CHECKLIST.

1. Hoist and hoist ICS - CHECKED.

2. Flotation gear - CHECKED.

a. Rotary selector test switch - L1, L2, R1, and R2.

b. Indicating light - ON, in each position.

c. Rotary selector test switch - OFF.

3. Landing gear lockpins - SIGHTED.

4. Rotor brake lever - OFF.

**Note**

Observe freedom of the rotary wing to turn for approximately 1/8 of a revolution. Rotation may be slow due to the low residual torque in accessory drive; however, rotation should be an indication of freedom of the rotor brake pucks from dragging on the rotor brake disc. Movement of the controls may assist in rotating the rotary wing.

5. Rotor brake lever - ON.

6. Servos - CHECKED.

a. Auxiliary and primary servo hydraulic pressure indicators - NORMAL RANGE.

b. Flight control servo switch - PRI OFF. Primary servo pressure indicator should indicate a drop to zero and caution light should illuminate.

c. Trim release button (on cyclic stick) - DEPRESS. Collective pitch lever - ACTUATE FULL UP.

d. Actuate cyclic stick from one extreme to the other in lateral, then fore-and-aft directions. Repeat cyclic stick movements with collective down.

e. Flight control servo switch - ON.

f. Flight control servo switch - AUX OFF. Auxiliary servo hydraulic pressure indicator should indicate a drop to zero and caution light should illuminate.

**Note**

The rudder pedals must be properly positioned before making this check. When turning auxiliary servo off, note that stick jump does not exceed 1/8 inch in cyclic, and 1/16 inch in rudder and collective to insure proper rigging of auxiliary servo pitot valve. Collective should be at least 4 inches from minimum during this check.

g. Trim release button (on cyclic stick) - DEPRESS. Collective pitch lever - ACTUATE FULL UP. Actuate cyclic stick from one extreme to the other in lateral, then fore-and-aft directions. Repeat cyclic stick movements with collective down.

h. Depress left rudder pedal and lift collective to full up position. Note left rudder pedal rearward movement of approximately two inches due to collective to yaw coupling. Depress right rudder pedal and lower collective to full down position. Note right rudder pedal rearward movement of approximately two inches due to collective to yaw coupling.

**Note**

Full actuation of flight controls should be possible in any one direction in one second with no evidence of binding.

i. Flight control servo switch - ON.

Auxiliary servo hydraulic pressure indicator should indicate normal pressure and caution light should go off.

7. Basic ASE - CHECKED.

a. Initial warm-up time 3 minutes ± 30 seconds.

b. ASE - ENGAGE.

c. Hover indicator - A MODE.

d. Pitch and roll valve check.

(1) Cyclic stick - MOVE FORE, AFT, RIGHT, and LEFT.

Note that the roll and pitch bars on hover indicator can be moved full travel in each extreme and follow movement of cyclic stick.

e. Cg trim knob - MOVE KNOB AND NOTE THAT PITCH BAR ON HOVER INDICATOR CAN BE MOVED FULL TRAVEL IN EACH EXTREME AND FOLLOWS MOVEMENT OF CG TRIM KNOB. Reposition pitch bar.

f. Yaw trim - CHECK PROPORTIONAL BAND.

Center pedals. Slowly turn yaw trim knob. At initial movement of pedals, check the yaw indicator deflection (1/2 to 1 increment). Depress the closest pedal switch and observe that the yaw indicator returns to mid position. Repeat for opposite rudder.

g. ASE engage disengage check.

(1) ASE, BAR ALT, and CPLR, engage buttons - DEPRESS.

(2) Pilot's AUTO STAB REL button (cyclic stick) - DEPRESS. Check that all engage button lights go off.

(3) ASE, BAR ALT, and CPLR, engage buttons - DEPRESS.

(4) Copilot's AUTO STAB REL button (cyclic stick) - DEPRESS.

Check that all engage button lights go out.

**WARNING**

Use of the hardover switches on the ASE channel monitor panel should not be utilized with the blades folded to preclude damage to the rotary wing and control linkages. In addition, ASE hardovers should not be induced in flight unless prior ground tests have been made. Repeated use of the hardover switches may cause ASE valve failure. In the event that an induced hardover should cause an ASE valve failure, a hydraulic hardover may occur and can be eliminated only by securing the auxiliary servo hydraulic system.

8. Navigator test (if desired).

a. Computer switch - POWER.

b. Variation knob - SET.

c. C2404A mode selector knob - REM (remote).

d. C2403A crab illumination control knob - AS DESIRED.

e. C2403A slew switch - CHECK.

f. C2403A mode selector knob - TRACE (if desired).

g. C2404A mode selector knob - STBY.

h. C2404A 20 NM/IN scale button - DEPRESS.

i. Function operation - CHECK.

(1) Function switch - TGT/CTR.

(2) Range set knob - 060 MILES.

(3) Bearing set knob - 030 DEGREES.

(4) Insert button - DEPRESS.
Crab should move to a point three inches in a 210-degree direction and remain.

(5) Mark button - DEPRESS.

**Note**

Circle should touch part of cross.

(6) Function switch - OCT/PP.

(7) Insert button - DEPRESS.
Crab should move 3 inches in a 030-degree direction to center of board, mark and return.

(8) Function switch - OCT/RR.

(9) A/C to base selector button - DEPRESS.

(10) BDHI computer selector button - DEPRESS.

(11) Memory selector button - DEPRESS.

(12) Insert button - DEPRESS.

(13) BDHI and true course and distance indicator bearing 030-degree distance 60 miles.

(14) BASE to DEST - DEPRESS.

(15) Memory and insert - DEPRESS.

(16) BDHI and TCDI - 030°, 60 MILES.

(17) A/C to DEST - DEPRESS.

(18) BDHI and TCDI - 030°, 120 MILES.

(19) A/C CTR and insert - DEPRESS.
Crab should center.

9. Radar and barometric altimeters - SET.

10. RAWS - TEST.

STARTING NO. 2 ENGINE AND ROTOR ENGAGEMENT.

The procedures, cautions and notes found under items 18 through 23 of Starting No. 1 Engine in this section apply.

1. Fuel panel - CHECK.

2. No. 2 engine - START.

3. All gages - CHECKED.

4. No. 2 friction - SET.

5. Booster pumps - OFF.

6. ASE - OFF.

7. Shoulder harness - LOCKED.

8. Collective - MINIMUM (Copilot monitor).

9. Area clear, engage signal.

**WARNING**

Before rotor engagement, be sure personnel are clear of the rotary wing and rotary rudder blades. For ground clearances, see figure 1-112 in NAVAIR 01-230HLC-1.

10. Rotor - ENGAGE.

**Note**

Advance No. 2 speed selector for a 2% $N_g$ increase, place rotor brake in detent, caution light off. Maintain torque values between 40 to 60 percent. Anti-flapping restrainers should release at approximately 30 percent $N_r$. Droop stops should release at approximately 75 percent $N_r$.

**CAUTION**

The rotor should not be engaged in winds above 45 knots due to excessive rotary wing blade flapping. When engaging the rotor in high or gusty winds, the rotor should be accelerated as rapidly as possible without exceeding torque limits.

11. $N_r$. - MAXIMUM.

12. No. 2 engine FLAT PITCH - CHECKED. Normally power turbine speed ($N_f$) is 105 to 109% for single engine with maximum travel on speed selector. If a single engine flat pitch check does not fall within the normal readings, one of the following can be expected:

a. Area of 104 to 105%. 100% $N_r$ may not be available for maximum single engine power performance.

b. Difference of more than one percent between both engines. Speed selectors may not match.

**Note**

The area between 104 and 105% $N_f$ is not considered a safety of flight item. However, this information should be noted on the discrepancy sheet upon return from the flight. Any reading below 104% $N_f$ is a safety of flight item.

13. No. 1 speed selector - GROUND IDLE.

**CAUTION**

Illumination of either the TAIL TAKE-OFF caution light (if installed) or the generator caution lights at this time indicates malfunction of the main transmission tail takeoff freewheel unit. Do not secure No. 1 engine until rotor is stopped, to preclude loss of servo pressures. Advance the No. 1 engine to 104% $N_f$, cycle the generator switches, and proceed with normal shutdown. Do not switch to flight position.

14. Accessory drive switch - AFT, ACCESSORY DRIVE AND BLADE PANEL LIGHTS OUT.

**CAUTION**

If after placing the accessory drive switch in the aft position, and the accessory drive light remained on or in case of any other indication that the transmission did not actually shift to the flight mode, return the accessory drive switch to the forward position before moving the No. 1 engine speed selector from the ground idle position.

15. No. 1 speed selector - MAXIMUM.

16. No. 2 speed selector - ZERO TORQUE.

17. No. 1 engine FLAT PITCH - CHECKED.

18. $N_r$, TORQUES, FRICTION - 104%, MATCHED SET.

BEFORE TAXIING.

1. Cable slack - REMOVED.

2. Winch operator's before taxiing check - COMPLETED.

TAXIING.

TAXIING PROCEDURE. All ground taxiing in congested areas shall be done under positive control of a qualified taxi director. Utilize his signals as an aid; however, remember that the pilot and not the lineman is responsible for the safety of the helicopter.

**WARNING**

The tip-path height forward of the helicopter must be monitored to prevent endangering taxi directors and line personnel.

1. Area - CLEAR.

2. Chocks/tie-downs - REMOVED.

3. Tail wheel lock handle - UNLOCK.

4. Shoulder harness - LOCKED.

5. Parking brake - OFF.

6. Brakes - CHECKED.

7. Tail wheel - CHECKED.

**Note**

To allow the tail wheel lockpin to release proceed as follows:

a. Allow helicopter to taxi forward a few feet to relieve possible binding of the lockpin due to tail wheel tire side loading.

b. Exert rotary rudder pedal pressure (normally left) in varying amounts to balance inherent torque which may prohibit disengagement of tail wheel lockpin during step 1.

c. Do not place the tail wheel lock handle in the LOCKED position during ground turns. The helicopter must be rolling in a relatively straight line when the tail wheel is LOCKED to prevent shearing of the lockpin.

**WARNING**

In the event the wheel brakes bind or lock-up, or helicopter is inadvertently taxied into a hole or obstruction, the nose will pitch down and an immediate lift-off may be required to prevent damage to the aircraft. During all phases of ground taxi, pilots must be constantly alert for the necessity to lift-off and all occupants must remain securely strapped in until cleared to leave their seats by the pilot.

**CAUTION**

Taxi speed is controlled with coordinated use of cyclic, collective and toe brakes. Rapid application of excessive aft cyclic without sufficient load on the rotor system may cause the retreating blade to strike the tail cone.

Maintain 104 percent $N_r$ so that an immediate takeoff can be accomplished if a crosswind should tilt the helicopter. When taxiing crosswind, hold the cyclic stick slightly into the wind.

POST TAKEOFF.

1. After a normal vertical takeoff, check all engine and flight controls.

**Note**

If the helicopter is equipped with a mixed configuration of engines wherein one has been modified by Power Plant Change No. 111 and the other has not, minor torque differences will be noted that require more frequent trim adjustments to match torques.

2. Landing gear wheels - UP.

3. Crewman - PERFORM POST TAKEOFF CHECK.

**Note**

Crewman must obtain permission from helicopter commander prior to leaving seat.

MID-AIR RECOVERY OPERATIONS.

The following procedures are written for the basic MAR system composed of a tandem parachute system with a 100 foot main chute. The intent of the procedures can also be applied to small tandem systems and single parachute recovery systems. Amplified procedures for mid-air recovery of the HAST are discussed separately in this section.

HELICOPTER POSITIONING. The helicopter normally orbits at 10,000 feet MSL, or as required by weather conditions in the vicinity of the recovery point. Geographical positioning is accomplished by radar vectoring, navigational aids, map reading, or a combination of these means.

ESTABLISHING THE APPROACH.

**WARNING**

Crewmembers will be alert to ensure that the descending drag chute and attached MARS main chute container will not create a hazard.

**CAUTION**

The inbound heading to the chute system will be adjusted so that the load line will not be pulled through the main canopy on engagement. If the load line is pulled through the main canopy, it will burn as a result of friction and may subsequently break.

When the parachute and suspended package are located visually, the helicopter is flown directly towards it. Upon initial visual contact, a flight path should be established and altitude adjusted so that the top (apex) of the main parachute is level on the horizon. By maintaining this sight picture, a rate of descent for the helicopter will be established to approximate the descent of the parachute system. When the engagement chute can be positively located, the sight picture will be adjusted to place the top of the engagement chute on the horizon. The position of the load line indicator will then be determined. In the event that the load line indicator is missing, an observation pass will be required to positively determine the load line position. This observation pass may be made by the recovery helicopter or another aircraft. The ideal inbound approach heading will place the helicopter on the opposite side of the main parachute, 180 degrees from the load line. A satisfactory

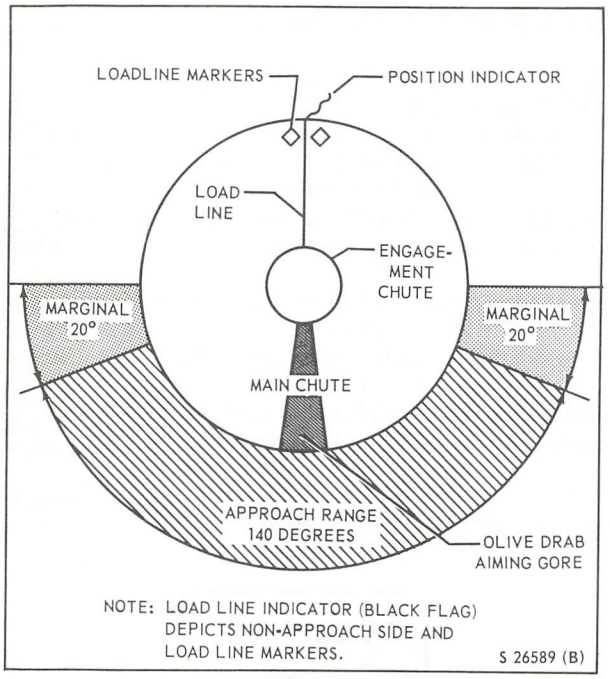



Figure 3-2. Helicopter Approach Range (AQM-91A Configuration)

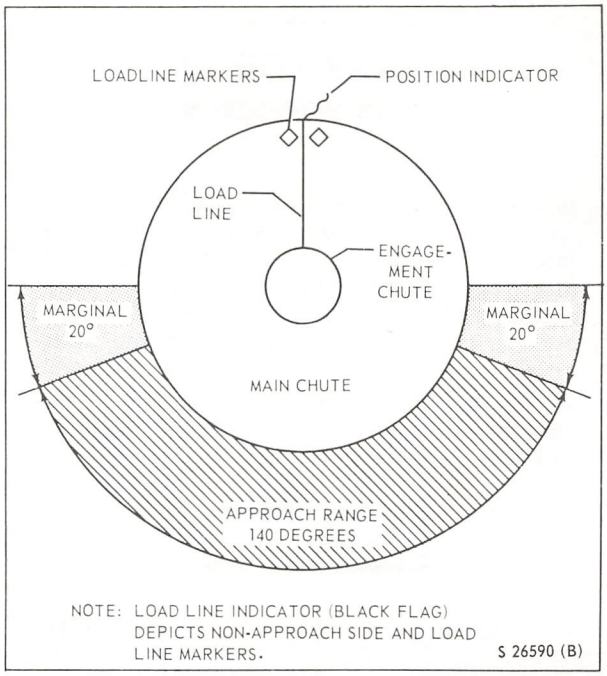



Figure 3-3. Helicopter Approach Range (Typical 81.6-Foot Configuration)

approach can be accomplished within 70 degrees either side of the ideal heading, which results in a 140-degree approach range (see figures 3-2 and 3-3). Any approach outside of this approach range will result in a marginal engagement and possible loss of the object being recovered.

**Note**

The main canopy may rotate during descent and require adjustment of the approach heading.

FALSE HORIZONS. Clouds, smoke, haze, mountains or other phenomena may present a non existent, partial, or complete horizon which is not a true horizon based on the curvature of the earth. When these conditions exist, the pilot must use all available horizon references in his crosscheck to establish the desired approach angle to the engagement chute. Extreme difficulty may be experienced in judging the helicopter's exact position relative to the engagement chute until a few seconds prior to anticipated contact. Examples of these conditions are depicted in figure 3-4.

ESTABLISHING THE APPROACH (APEX TIE BROKEN - LOAD LINE FREE FROM TOP OF MAIN CANOPY).

**CAUTION**

MARS recovery will not be attempted until a visual check is made to ensure load line is not wrapped around the main canopy above the release mechanism. Under these conditions, engagement would pull the load line through the main canopy lines and may break the load line by burning or possibly prevent main chute separation. After confirming the load line is free, the inbound heading will be adjusted so that the load line is not pulled through the main canopy.

ESTABLISHING THE APPROACH (MARS D OR 81.6-FOOT RECOVERY SYSTEM). The approach technique for the MARS D recovery system is the same as for other systems except that visual reference for determining the direction of approach is obtained solely by reference to the white aiming panel. The load line has no position indicator (black flag). It is attached to the main parachute on the opposite side from the white aiming panel; therefore, the approach will be toward the white aiming panel (see figure 3-5). Figures 3-8 and 3-9 apply to the MARS D system except for the design of the main canopy and deletion of the position indicator from the load line.

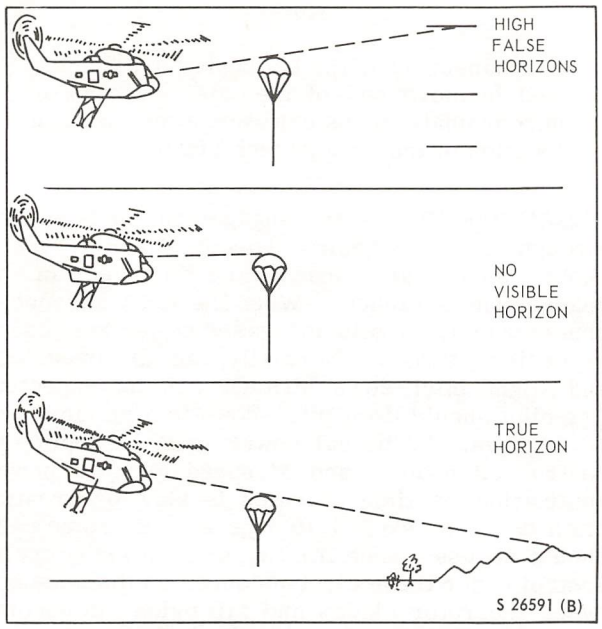



Figure 3-4. False Horizons

**Note**

Recovery of drones in the broach position that are equipped with external pods or tanks can result in a wing over which can cause entanglement of vehicle risers with the external stores. A severe wing over maneuver could also result in a severed vehicle riser or load line. The recovery of these vehicles while generally in line with the helicopter heading is preferred; however, the hazards are not considered sufficient to preclude recovery in a broached condition.

ESTABLISHING THE APPROACH (AQM-91 SERIES MID-AIR RECOVERY SYSTEM).

**CAUTION**

An attempted recovery with the nose of the package oriented outside of the 140-degree desired segment (see figure 3-6) should only be attempted when the operational situation is such that a mid-air recovery must be made, and time is not sufficient to allow the package to attain a more favorable alignment. Recovery attempts with the package oriented in this position can result in a package wing over which could result in cutting recovery system risers and subsequent loss of the package.

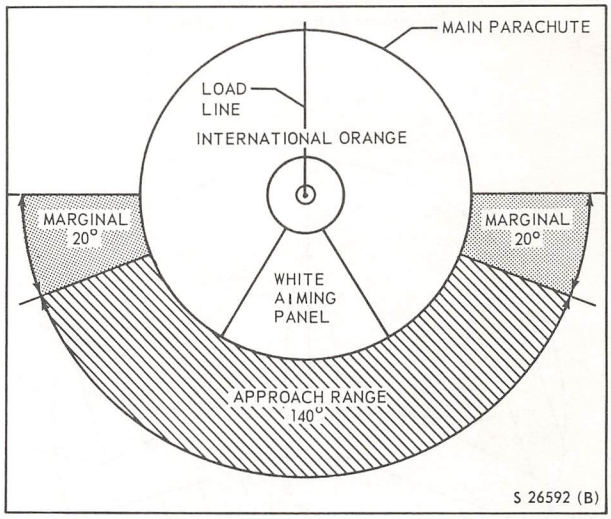



Figure 3-5. Helicopter Approach Range (Vertical View Typical MARS D or 81.6-Foot Configuration Main Canopy)

**CAUTION**

If the stabilization chute is prematurely released, the package ground impact bags and the ground chute release system will be inoperative.

**CAUTION**

MARS recovery will normally not be attempted if a riser restraint malfunction occurs, as indicated by a nose down attitude of the package. However, certain emergency situations may require that the recovery be accomplished.

The approach technique for the AQM-91 series MARS is the same as for other systems. Chute configuration is the same as shown in figure 3-2. When possible, the package should be aligned within 70 degrees either side of the helicopter inbound approach heading at engagement (figure 3-6).

PASSES. The desired airspeed for engagement is 50 knots IAS. Successful engagements can be expected between 45 to 60 knots IAS. After establishment of the approach, additional corrections may be required to place the engagement chute within the limits of the poles and the loop and hook assembly engagement window (see figures 3-7 and 3-8). The window extends approximately twelve feet below the helicopter and is twelve feet wide at the pole hooks. The flying hook is suspended midway between the pole hooks and at approximately

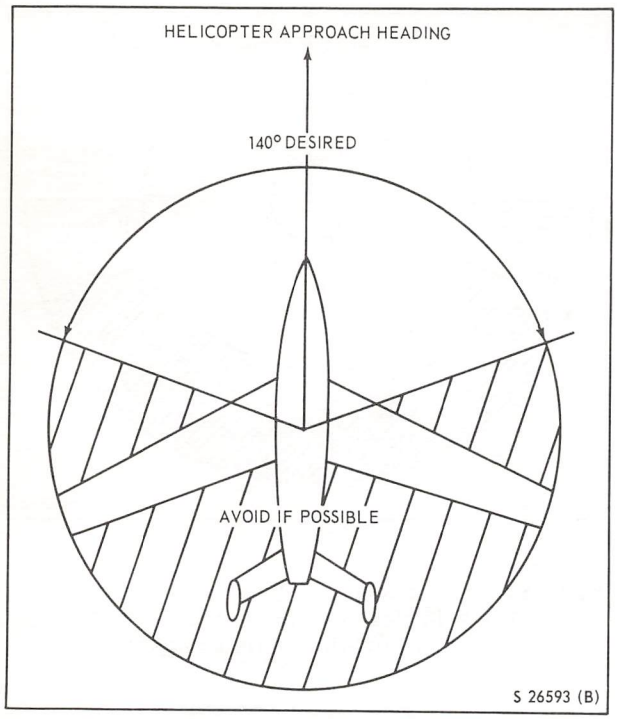



Figure 3-6. AQM-91 Series MARS Orientation Diagram

the same level. The ideal position of the engagement chute would be vertically centered above the main parachute, fully inflated and stable. Normally, it will be offset from the vertical, and can be offset as much as 90 degrees from vertical. The offset is caused by the characteristics of the tandem parachute system and atmospheric conditions. Oscillations in the main canopy may be magnified in the engagement chute. The airflow around the main canopy can cause coning, oscillations, collapsing, climbing, pulsating, or weaving of the engagement chute. Normally a 10- to 20-second downwind is established, followed by a turn to final, to position the aircraft for engagement. This pattern may be entered at any point, based on the pilot's judgement, to obtain optimum final position. The winch and pole operators can assist the pilot in establishing descent rate by repeating the height of the chute system relative to the helicopter. If it appears that a safe and successful engagement cannot be accomplished, the approach will be aborted. The pass abort is accomplished by maneuvering the helicopter clear of the parachute system, maintaining an established rate of descent, executing an immediate 180-degree turn, and flying a race-track pattern with an outbound leg of 10 to 20 seconds to position the helicopter for another pass. Several passes may be required.

**Note**

All maneuvers of the helicopter are magnified in movement of the poles. Abrupt or uncoordinated turns can change the size and location of the engagement window.

ENGAGEMENT. As the engagement chute passes through the engagement window, one or more hooks can engage a load bearing member of the engagement parachute. When the crew announces chute contact, the pilot increases collective setting to desired torque. Normally, an airspeed loss and slight pitch-down attitude can be expected. The pilot should limit pitch-down to a maximum of 10 degrees. Additional power must be applied to control pitch-down and airspeed loss. If power application at time of catch is slow or erratic, pitch down can exceed 10 degrees. Extreme care should be used when limiting pitch down by cyclic control under these circumstances as distance between the rotor blades and tail pylon can become reduced. In addition, a desired power range of 40 to 45 percent torque should be smoothly applied and maintained at time of contact until after initial swing through to assist in minimizing pitch down, increasing blade/pylon separation, and avoiding unnecessary blade loading and stress. The force of engagement pulls the hooks and loop assembly free from the poles. The load induced by the captive package pulls line off the winch until the winch has decelerated smoothly to a stop. When tension on the load line reaches the apex tie, it is broken, and the nylon load line separates from the main canopy. The build-up of load line tension actuates the main canopy release mechanism and the main canopy falls away (see figure 3-9). The package may maneuver violently during initial acceleration and swing-through. The attached stabilization chute reduces the severity of the swing-through (see figure 3-10). Following the swing-through, the package will settle down into a tow position approximately 500 to 900 feet below the helicopter and is ready to be reeled in. Length of cable payout is affected by many factors; package weight, attitude, etc.

**Note**

If the engagement is missed, the pilot will follow the same procedures outlined for an aborted pass.

AFTER CONTACT.

**Note**

Normally, the cable cutters are not used for cutting the load line. Therefore, unless an emergency or unusual situation dictates otherwise, it should be in the up position after cable has been reeled on the drum.

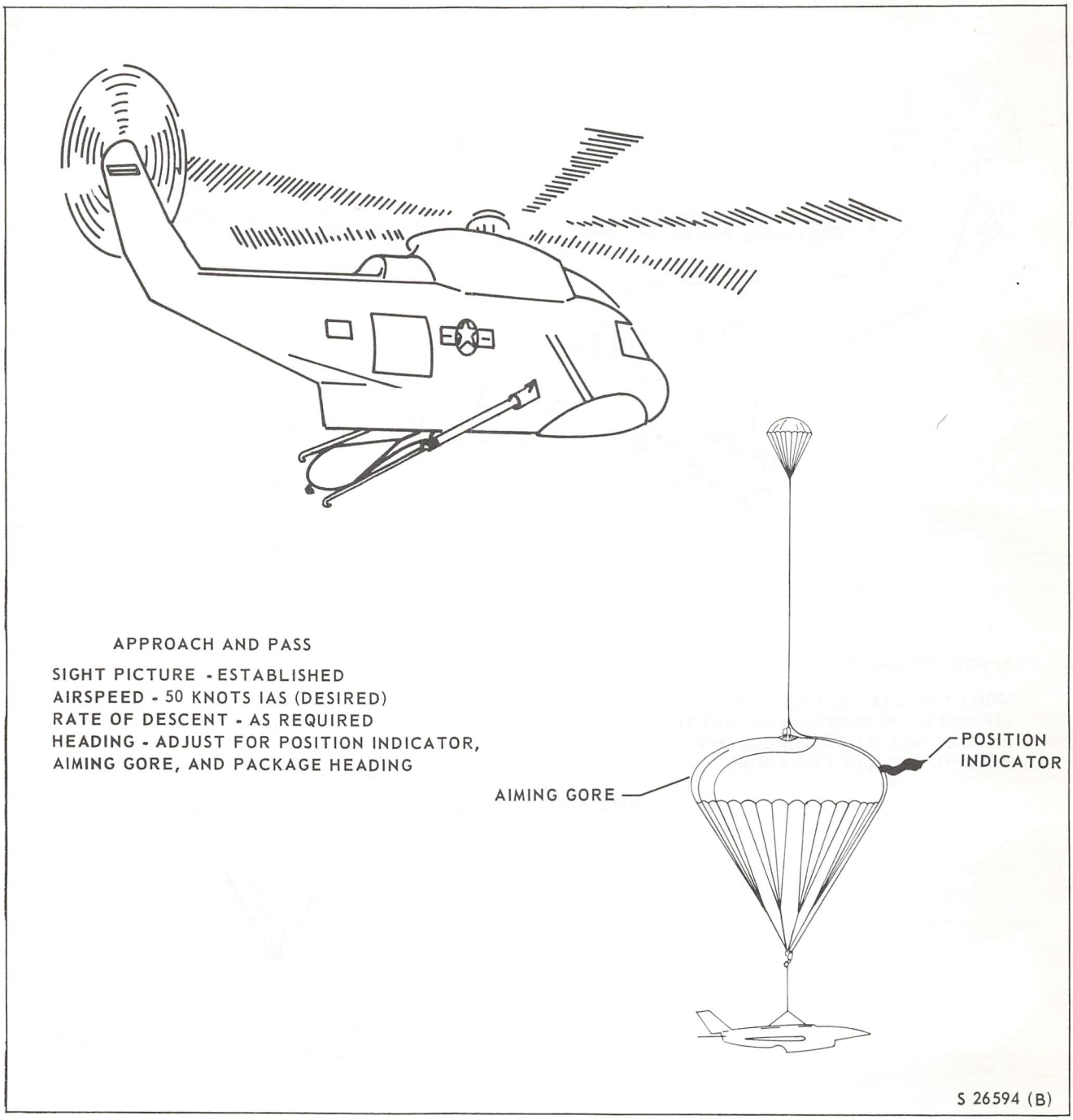



Figure 3-7. Helicopter Approach and Pass (Typical AQM-91 Configuration)

After engagement is made, the winch and pole operators will perform the after contact checks. The winch operator will report the following to the pilot:

1. Chute contact.
2. Partial derigging or complete derigging.
3. Missed pass (no contact), including side on which miss occurred with distance and height.
4. Main chute breakaway or main chute status if separation did not take place.

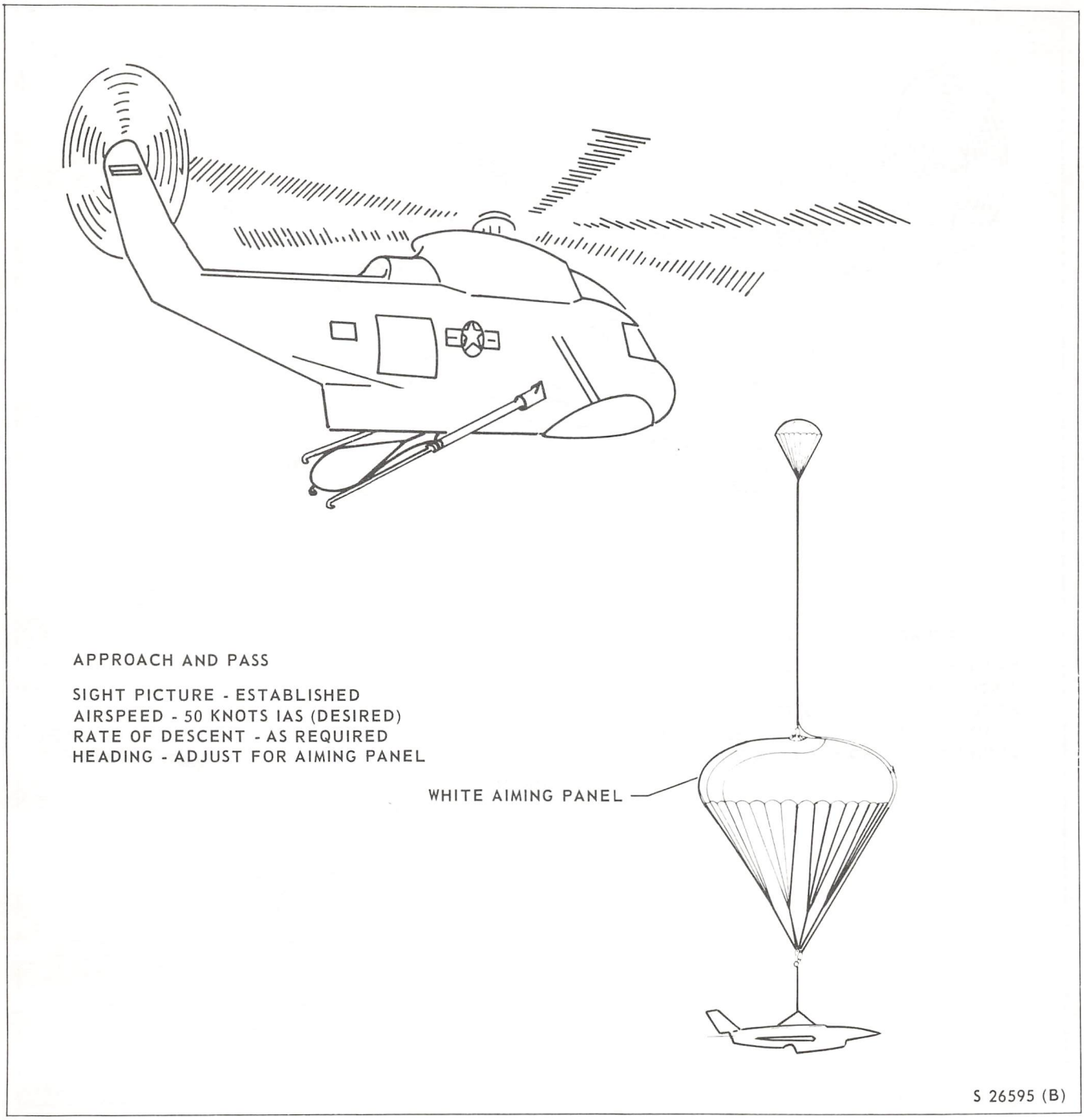



Figure 3-8. Helicopter Approach and Pass (Typical MARS D or 81.6-Foot Configuration)

**WARNING**

If main chute does not breakaway, refer to FAILURE OF MAIN PARACHUTE TO SEPARATE in section III.

5. Stabilization of package.

Note

Report any package oscillations as to estimated lateral and/or longitudinal displacement. Advise pilot when oscillations dampen and package has stabilized. Advise pilot of any canting characteristics in degrees, left or right.

6. Status of stabilization chute, i.e., whether hung up, damaged or fully deployed.

TOW AND REEL-IN.

**WARNING**

During tow and reel-in, the pilot must monitor airspeed so as not to exceed the structural limits of the aircraft. Flying the helicopter/package outside of this envelope will be felt by the pilot as a rotational shuffle or bad damper. Immediately reduce airspeed to stay within the structural limits. Extreme caution should be used by all crewmembers to ensure their actions do not induce oscillation. (Refer to OSCILLATION CONTROL in section V.) During the last 200 feet of reel in, maintain the established aircraft attitude, when possible.

This phase of the operation is started as soon as the suspended package is in a steady tow position. Reel-in is accomplished while the pilot maintains a steady platform at approximately 50 knots IAS. Vertical rate of descent should not exceed 500 feet per minute. The total cable and nylon load line payout to be reeled in is approximately 500 to 900 feet. This includes cable payout, load line length, and total linear length of MARS suspension system; plus an allowance for component stretch. Engagement chute, loop assembly, riser assembly and load line stretch can amount to approximately 150 feet. The MARS package is reeled in in the following sequence: winch cable, connector link, loop assembly, hooks and screw pin shackle attachments, engagement chute, and nylon load line, if applicable. The reel-in operation is terminated when the release mechanism attached to the load line is reeled in to the access well opening approximately four inches from the bottom of the CG roller. Although the winch has a maximum reel-in rate of 42 feet per minute, reel-in will take longer because of the following situations:

In the case of a single hook engagement, five to ten minutes may be required to remove the loose hooks (hooks not engaged). The loose hooks are removed by disconnecting the attaching screw pin shackles.

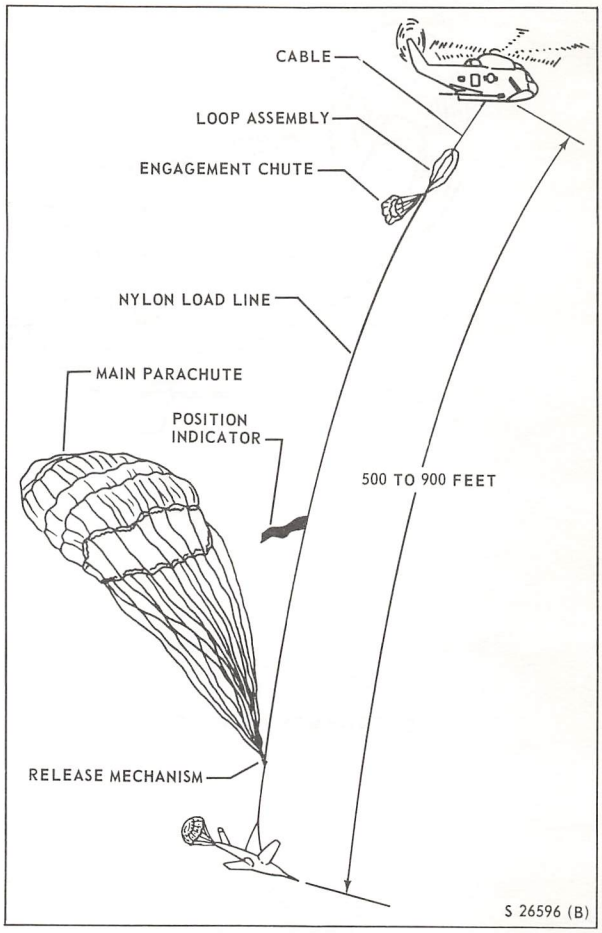



Figure 3-9. Typical Engagement

A flying hook, with or without another pole hook engagement, may result in hook, harness, and parachute entanglement. Extreme caution is required under these conditions to ensure that the entanglement is properly brought over the CG roller. Also, it is necessary to ensure that the nylon load line is adequately protected from possible damage by the hooks and their retaining screw pin shackles while being positioned on the drum.

The engagement chute may remain partially or fully inflated after hook contact. This condition is caused by a hook engagement of a shroud line or by hook engagement of the nylon load line. It may be difficult to bring the engagement chute through the access well in the bottom of the helicopter until it is deflated by the MARS equipment operators. The pilot will experience noticeable aerodynamic

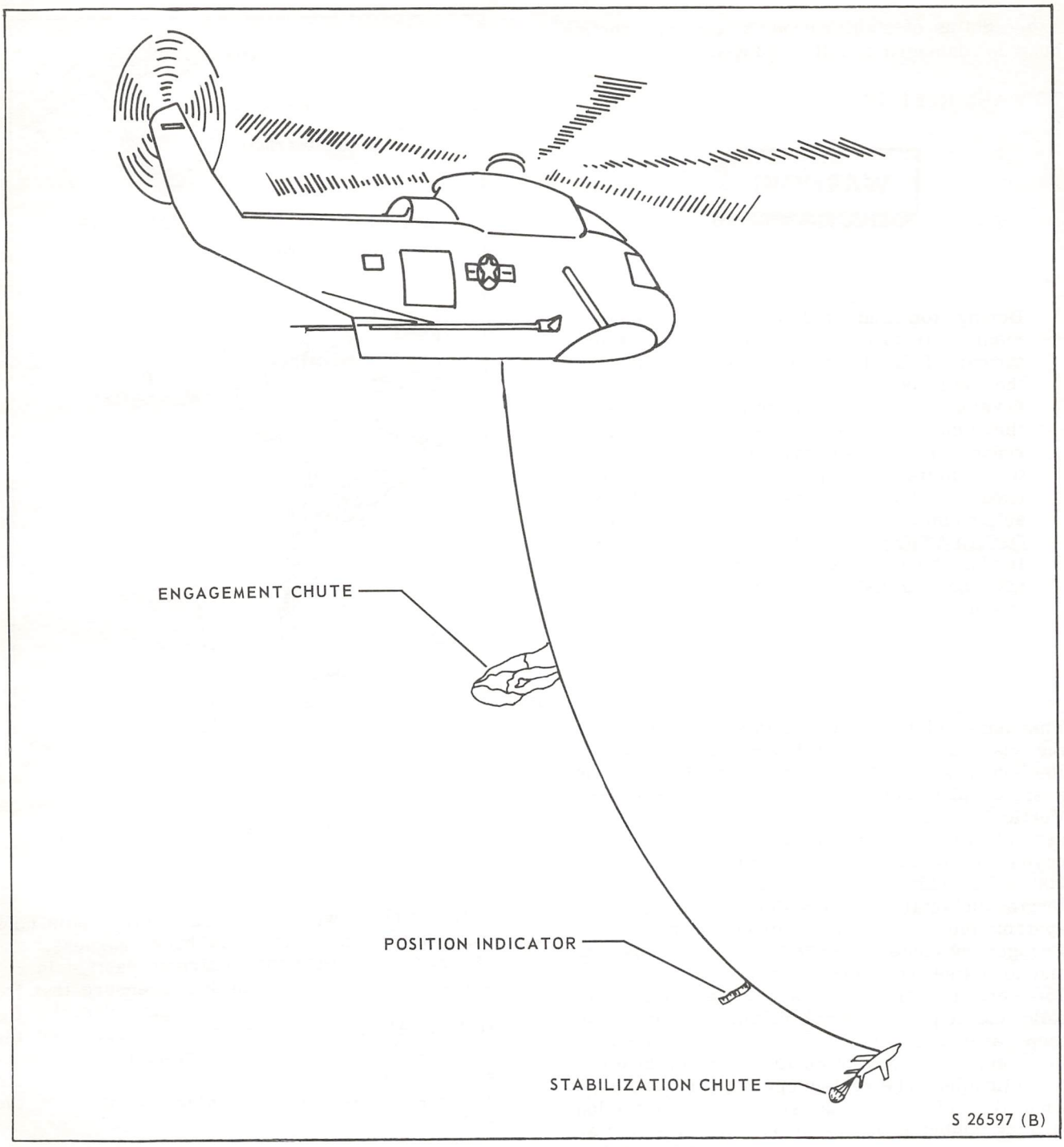



Figure 3-10. Swing-Through of Package After Engagement

drag as a result of the inflated chute and must add power to maintain the desired airspeed. External loads with aerodynamic characteristics have a tendency to fly after attaining a tow position. Corrective action may be necessary to control oscillations. Refer to OSCILLATION CONTROL PROCEDURES in section V.

STOW.

The reel-in operation is completed when the release mechanism is reeled to approximately four inches from the bottom of the CG roller. The external load is now in a stow position and is suspended approximately 20 feet below the helicopter

(see figure 3-11). Acceptable airspeeds in the stowed position may vary widely with external payloads. If required, airspeeds should be increased cautiously to prevent exceeding the stable range of the payload. Descents in excess of 500 feet per minute may also cause instability.

DOCKING.

**CAUTION**

The winch operator will ensure that the load line is completely slack and the release mechanism is away from the package before it is cut. This will lessen the possibility of the release mechanism damaging the payload.

The package is docked at a predesignated location and on a smooth surfaced area to preclude the possibility of incurring any damage. The manner in which it is docked depends primarily on whether the object is in a stowed or unstowed condition.

With the package in a stowed position, approximately twenty feet below the helicopter, docking may take place on any smooth and level surface. The helicopter descends from a hover position at a very low rate until the impact switch of the package touches the ground, actuating the ground release mechanism, and separating the package from the load line. In later systems, which use the six-foot stabilization chute, the impact switch is deactivated after the MAR engagement and separation of the payload is accomplished by manually cutting the load line with an appropriate cutting device (sharp knife or equivalent).

The unstowed situation exists when the suspended package cannot be reeled in completely and must be towed to the docking point at various extended lengths. For systems with deactivated ground release mechanism, follow normal procedure. For systems with active ground release mechanism, refer to DOCKING FROM OTHER THAN STOWED POSITION in section V. After the package has been docked, position the helicopter well clear of the package to preclude damaging it by rotor wash.

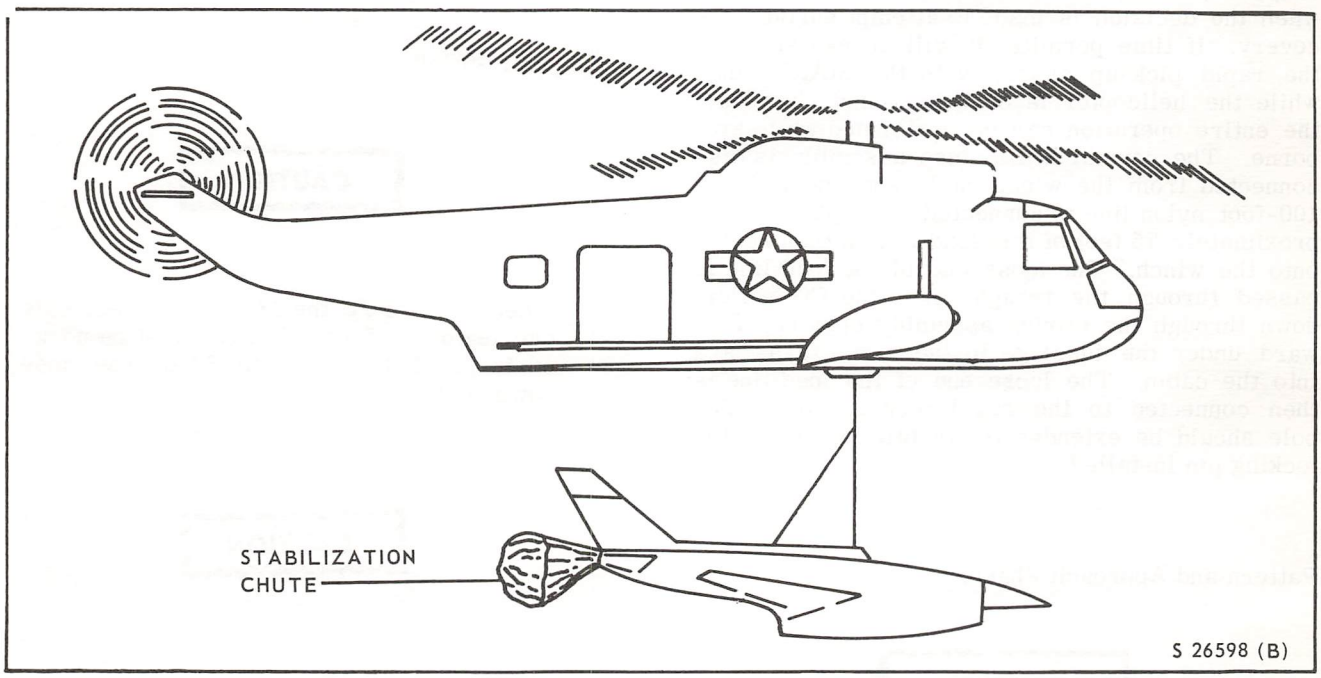



Figure 3-11. Package Stow Position

SURFACE PICK-UP USING RAPID PICK-UP ASSEMBLY.

**CAUTION**

A new rapid pick-up load line is required for each scheduled and accomplished training and/or operational pick-up mission. The winch operator will closely inspect the load line during preflight check for nicks, fraying, discoloration, burns, and insecurity of splicing. If the load line is damaged or suspected to be damaged, it will be replaced prior to mission start. A training mission can consist of any number of retrievals as long as the load line is not damaged.

Surface pickup using the rapid pickup assembly is accomplished as indicated herein.

Equipment Rigging Phase. The equipment preparation required prior to a surface pick-up will vary, depending on the status of the helicopter when the decision is made to attempt surface recovery. If time permits, it will be easier to rig the rapid pick-up assembly to the MARS winch while the helicopter is on the ground; however, the entire operation can be performed while airborne. The normal MARS loop assembly is disconnected from the winch cable and one end of a 100-foot nylon line is connected in its place. Approximately 75 feet of this load line is then reeled onto the winch. The loose end of the load line is passed through the trough, over the CG roller, down through the fairing assembly opening, forward under the fuselage to the cargo door, and into the cabin. The loose end of the load line is then connected to the rapid pick-up hook. The pole should be extended to its full length and the locking pin installed.

Pattern and Approach Phase.

**WARNING**

Ensure that handle end of the pole does not strike or jam flight control push rods.

The pattern and approach for a surface pick-up is very similar to that described for a rescue hoist operation. The approach terminates in a high hover, approximately 200 feet over water, or a medium hover, approximately 50 feet over land. In either case, the hover spot should be far enough down wind to allow the pilot to keep the package in sight. When the hover is established, the winch operator, assisted by the pole operator, will extend the rapid pick-up assembly forward and out through the cargo door. When the handle end of the pole is close enough to the door, the safety cable will be connected to the door frame. Connect both the snap hook and the alligator clip. Carefully lower the hook end of the pole until the pole is extended vertically out of the cargo door. The winch operator, stationed near the CG roller, will tend the remaining load line slack by hand. Only enough slack should be payed out to allow the winch operator freedom of movement of the hook.

Note

If excessive load line is tended out of the helicopter by the winch operator, load line may become entangled in landing gear due to rotor wind blast.

Hook-Up Phase.

**CAUTION**

When recovering the AQM-91 series, only one leg of the forward riser must be hooked to preclude a 70- to 80-degree nose down attitude.

**CAUTION**

If the main parachute is still attached to the package or entangled with the package, or if the MARS load line and entanglement chute are still attached to the package, do not attempt hook-up.

The winch operator will direct the pilot using a high hover, approximately 50 feet over the package, and then direct the pilot down to the package. On AQM, BGM, and BQM-34 recoveries, he will then engage the hook into the riser assembly. Once the hook is engaged in the riser, the winch operator will raise the pole to disengage the hook and stow the pole.

Recovery Phase.

**WARNING**

The winch operator should remain well clear of the trough assembly any time tension is on the load line to preclude possible injury if load line should break.

**CAUTION**

The winch operator should monitor the winch drum continuously to ensure that the winch does not payout inadvertently. Brake slippage may occur and can be controlled by reeling in.

**CAUTION**

Before directing forward flight, the winch operator must ensure that the stabilization chute is clear of the water. Tow, before docking, and docking will be accomplished using normal MARS operation procedures.

When the hook-up is accomplished and the pole is stowed, the pilot may raise the helicopter to a comfortable hover altitude while the winch operator reels the remaining slack load line on the winch. While reeling in, the winch operator should continue to tend the load line by hand to prevent excessive slack from entangling with the package. The winch operator will provide directions to the pilot to maintain a position centered over the package. The winch operator will advise the pilot when all slack has been reeled on the winch. The pilot will lift the package while the copilot closely monitors engine and torque instruments. During water pick-up, the maximum loads will be experienced just as the package breaks the surface, with a noticeable decrease in power required once the package is clear of the water. Because of the additional weight that could be added due to surface tension and/or package compartment flooding, surface pick-up from water should not be attempted if the estimated weight of the package exceeds 5000 pounds. The pilot will maintain a hover until the package is reeled into the stow position (hook approximately eight feet below helicopter).

Running Line. When the rapid pick-up equipment is installed on board the helicopter to facilitate rerigging the hook in the event it becomes disengaged before a successful hook up is made, a running line is installed. This line is constructed of personnel parachute suspension nylon line in the form of a continuous loop. One end of the loop is tied to any convenient place on the left of the trough assembly. The line is then passed through the hole for the manual cable cutter over the CG roller bearing housing, out the well toward the cargo door, then tied to the forward external ICS receptacle. After rerig, the winch operator will pull the loose rapid pick-up hook into the well and tie it to the running line. It is then passed along the underside of the helicopter to the pole operator who will reinstall it on the pole assembly.

SURFACE PICK-UP WITHOUT RAPID PICK-UP ASSEMBLY.

**CAUTION**

A new rapid pick up load line is required for each scheduled and accomplished training and/or operational pick-up mission. The winch operator will closely inspect the load line during preflight check for nicks, fraying, discoloration, burns, and insecurity of splicing. If the load line is damaged or suspected to be damaged, it will be replaced prior to mission start. A training mission can consist of any number of retrievals as long as the load line is not damaged.

Under certain conditions, it may be desirable to pick up an object from the surface without using the rapid pick-up assembly. In this case, the following pick-up procedures will be used:

1. Hook one end of the rapid pick-up line to the winch cable with a screw pin shackle.

2. Reel excess load line on winch. Allow sufficient excess to pass through trough, over the CG roller, down through the fairing assembly and down to the package.

3. Hook load line to package with screw pin shackle in the release mechanism attachment loop.

4. Perform pick-up using recovery phase procedures outlined under recovery phase in this section.

HIGH ALTITUDE SUPERSONIC TARGET (HAST). The high altitude supersonic target (HAST) is a 550 pound hybred rocket powered vehicle which is 13 inches in diameter and 200 inches long. The vehicle has canard control fins and a 40 inch wing span.

HAST Recovery Procedure.

**CAUTION**

Failure to level off after contact will cause the vehicle and parachute to be towed behind the helicopter with the cable in close proximity to the tail rotor.

**Note**

The HAST recovery chute is approximately twice the diameter of other helicopter MARS engagement chutes. It should be expected that this relative size difference will cause an optical illusion of being too low on the chute if the pilot is used to catching smaller parachutes. This will cause high and possible missed passes.

The vehicle recovery sequence begins at very high altitude with drag chute deployment and deceleration of the vehicle. Reefing is used on both the drag and main parachutes. The main parachute is deployed by the drag chute at approximately 35,000 feet and the vehicle descends at a rate of 1500 to 1800 feet per minute. As the system descends to 10,000 feet the helicopter begins a standard MARS pattern at 50 KIAS. There are no heading restrictions for engaging the canopy; however, the orange panels outlining the load bearing members can be used for final approach guidance. Upon contact, smoothly add collective pitch to a power setting which will level off the helicopter; approximately 45% torque. Due to the low weight of the vehicle and large size parachute in tow, reel-in should be accomplished at 40 to 45 KIAS. With the HAST in a stow position, airspeed may be increased up to 55 KIAS for tow if the canard surfaces are at zero deflection. If the canard surfaces are at full up or down deflection, caution must be exercised in determining the maximum safe cruise airspeed as the vehicle nose tends to oscillate. The recommended docking area is a soft surface such as a water bag (fuel bladder 50,000-gallon type).

**Note**

Oscillation of the vehicle can cause translational movement of the chute system. If the approach heading selected is perpendicular to oscillations, main chute translation will be minimized as a factor on the final approach site picture and helicopter heading changes. See figure 3-16.

**Note**

When reeling the parachute in through the well it may become necessary to slow the helicopter to approximately 20 KIAS and climb for the hooks to clear the guide roller and aft fairlead.

**Note**

The recommended crew for a HAST mission is five. A normal crew should be augmented with a second pole operator to observe the HAST reel-in from the ramp as the vehicle will be out of sight of the winch operator during reel-in.

RECOVERY CHUTE SYSTEM.

**CAUTION**

The load line position indicator depicts the nonapproach side of the main parachute.

**CAUTION**

The two 18-inch square black diamonds must not be confused with the load line position indicator.

The following MARS equipment is installed at the aft bulkhead of the package and training devices and is contained in a large can. A smaller conical can, containing a drag chute and attached to the larger can, is used for deceleration of the above devices, as well as for deployment of the recovery chute system. The MARS parachute system consists of two canopies. A large main canopy, which varies in proportion to the payload weight, is used to support the payload during descent. A smaller canopy, called the engagement chute, is deployed directly above the main canopy. It contains structural members and is used as a recovery device for engagement by the helicopter recovery system. A load line connects the structural members of the engagement chute to the

package. During parachute deployment, the load line is attached to the apex of the main chute by a heavy nylon tape. After deployment, the heavy tape is cut by means of a pyrotechnic time delay device. However, the load line remains attached to the canopy apex by a lighter strength nylon breakcord. This cord is broken by the force of the helicopter engagement. The load line is routed down around the main canopy to a release mechanism. An 81.6-foot system or AQM-91A has a position indicator attached to the load line in the area of the main canopy skirt to indicate load line position with respect to the main canopy. This information dictates the approach heading of the recovery helicopter (see figure 3-12). In addition to the load line position indicator, the main canopy incorporates an olive drab aiming gore opposite the load line, which indicates the approach side of the main parachute. Some systems also have two 18-inch square black diamonds adjacent to the load line near the skirt of the main canopy (see figure 3-13). These markers are used to indicate the packed location of the load line. A later system has an improved main parachute color design to provide the helicopter pilot better visual reference during the MARS retrieval approach. The main parachute is predominantly international orange with a large, white keyhole aiming panel opposite the load line (see figure 3-14). The load line position indicator and black diamonds are not used in this system.

The release mechanism is the connecting point of the load line, main parachute riser extensions, and package riser. At engagement, the load is transferred to the load line, breaking the apex tie line and shearing the shear pin in the release mechanism, thereby allowing release of the main parachute. The ground release mechanism is a link in the package riser assembly. Upon ground or water contact, an explosive bolt in the ground release mechanism is electrically fired, and the payload separates from the load line. In most systems incorporating the 147L-1060 release mechanism, release of the main chute after MARS engagement deactivates the electrical circuit to the ground release mechanism. In this type of system, the payload must be separated upon ground contact by cutting the load line.

STABILIZATION CHUTE. A stabilization chute is attached to the aft bulkhead of packages and training hulks for stabilization during swing-through after engagement, reel-in, and while in stow position. The chute is packed between the aft bulkhead and the large, conical can containing the above MARS equipment. In later systems, incorporating the 147L-1060 release mechanism, a larger stabilization chute is deployed at time of main chute separation, after a MARS engagement.

AQM-91 SERIES SYSTEM. When the 154L0050-17 release mechanism is used, a 6 foot-diameter stabilization chute is deployed at time of main chute separation, after a MARS engagement (see figure 3-15).

HIGH ALTITUDE SUPERSONIC TARGET (HAST) SYSTEM. The HAST vehicle is recovered by a two stage parachute system that comprises a 6.9-foot diameter ribbon drogue parachute and a 43-foot diameter ring sail main parachute. The main parachute incorporates two load bearing members which run across the canopy in a cross and connect to the vehicle (see figures 3-16 and 3-17).

BEFORE LANDING CHECK.

1. Instrument panel checklist.

a. Cabin heat - OFF.
5 minutes before landing to allow heater fan to continue to operate and lower duct air temperature before landing.

b. Cable slack - REMOVED.

c. Poles - RECHECKED UP.

d. Lights - SET.

e. Shoulder harness - LOCKED.

(1) Check all helicopter stations.

f. Tail wheel - CHECK.

g. Brakes - CHECKED.

(1) Check for pressure and set as desired.

h. Landing gear - DOWN AND LOCKED.

(1) Check landing gear position indicators. Warning light in lever knob should illuminate, then go out when landing gear is down and locked. Landing gear should extend in approximately 5 seconds.

i. Speed selectors - ADJUSTED.

Note

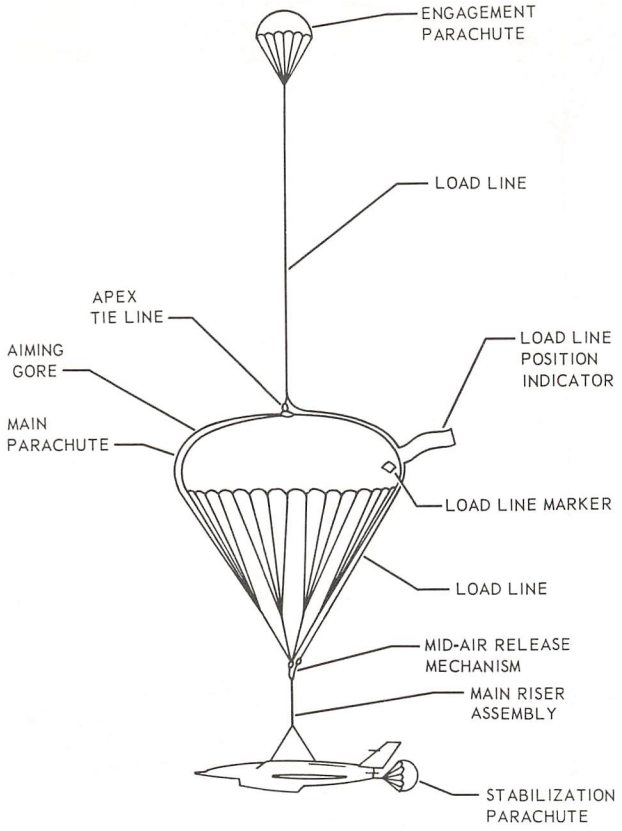
When established in a landing pattern, only item h. needs to be checked for subsequent touch and go landings.

| | CONFIGURATION | | | |
|---|---|---|---|---|
| | AQM 34 G, H, L, M, N, P, Q, R, BGM-34A | TRAINING SYSTEM | AQM 34 J | AQM 91A |
| Engagement Parachute | | | | |
| Type | Ring Slot | Ring Slot | Ring Slot | Ring Slot |
| Size | 24 feet dia | 24 feet dia | 24 feet dia | 21.5 feet dia |
| Load Line | | | | |
| Strength | 9000 lbs | 9000 lbs | 9000 lbs | 14,000 lbs |
| Type | Rolled web | Rolled web | Rolled web | Rolled web |
| Length (eng. chute to apex) | 225 feet | 150 feet | 185 feet | 225 feet |
| (Apex to rel. Mech.) | 155 feet | 135 feet | 135 feet | 160 feet |
| Length TOTAL | 380 feet | 285 feet | 320 feet | 385 feet |
| Apex Tie | | | | |
| Loop | 9000 lbs | 9000 lbs | 9000 lbs | 9000 lbs |
| Breakaway Tape | 1200 lbs | 1200 lbs | 1200 lbs | 1000 - 1500 |
| Cutter delay | 27 sec | 27 sec | 27 sec | 20 sec |
| Main Canopy | | | | |
| Type | Triconical | Triconical | Triconical (Pri) | Triconical |
| Size | 100 feet | 100 feet | Extended skirt 81.6 feet (sec) | |
| Load line pos. ind. | No | See figures 3-2 and 3-3 | No | Yes |
| Aiming Panel | Yes | See figures 3-13 and 3-14 | Yes | Yes |

Notes

1. For training, the black flag position indicator will be used with the white canopy. The black flag is located 55 feet below the apex.
2. The GR-14 chute system will be utilized on several configurations. This system utilizes a 10,000 pound load line from the engagement chute to the apex tie. From the apex tie to the release mechanism, the load line is 12,000 pound strength.
3. The length of winch cable payout is a variable factor depending on package weight, attitude, etc.

Figure 3-12. MARS Parachute and Compartment Configuration Details

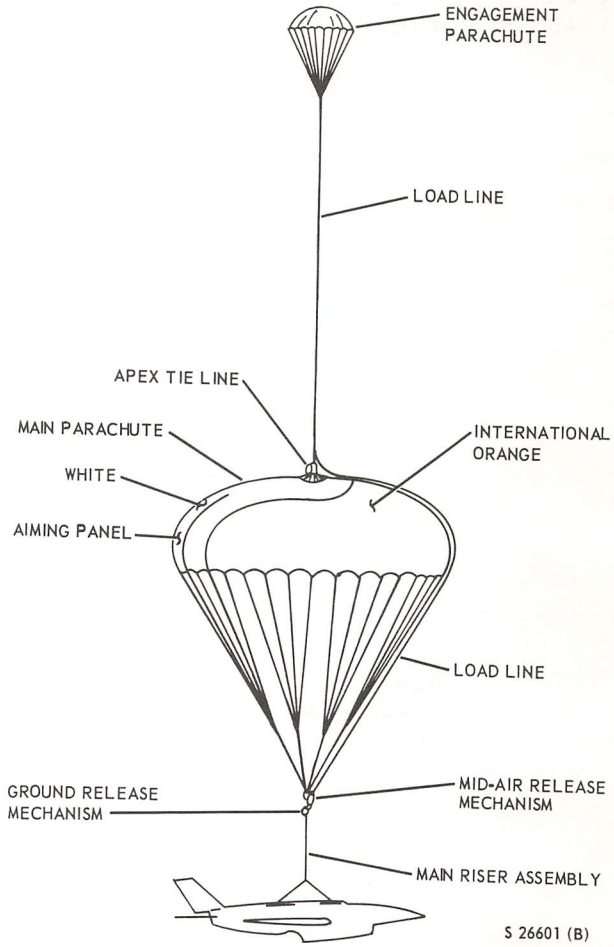



NOTE:

1. FOR COMPONENT DETAILS SEE FIGURE 3-12.
2. IN LATER SYSTEMS, WITH 147L1060 RELEASE MECHANISM, STABILIZATION PARACHUTE WILL DEPLOY AFTER MARS ENGAGEMENT.

S 26600 (B)

Figure 3-13. Typical AQM-91A or 81.6-Foot System Descent - Components Identified in Position for Mid-Air Recovery




S 26601 (B)

Figure 3-14. MARS D System Descent - Components Identified in Position for Mid-Air Recovery

POSTFLIGHT.

1. Visually check for external hydraulic/oil leaks.

2. Visually check main and tail rotor blades.

3. Check ground wire to ensure helicopter is properly grounded.

4. Check helicopter for any missing panels.

5. Winch and pole operators before leaving helicopter checklist completed.

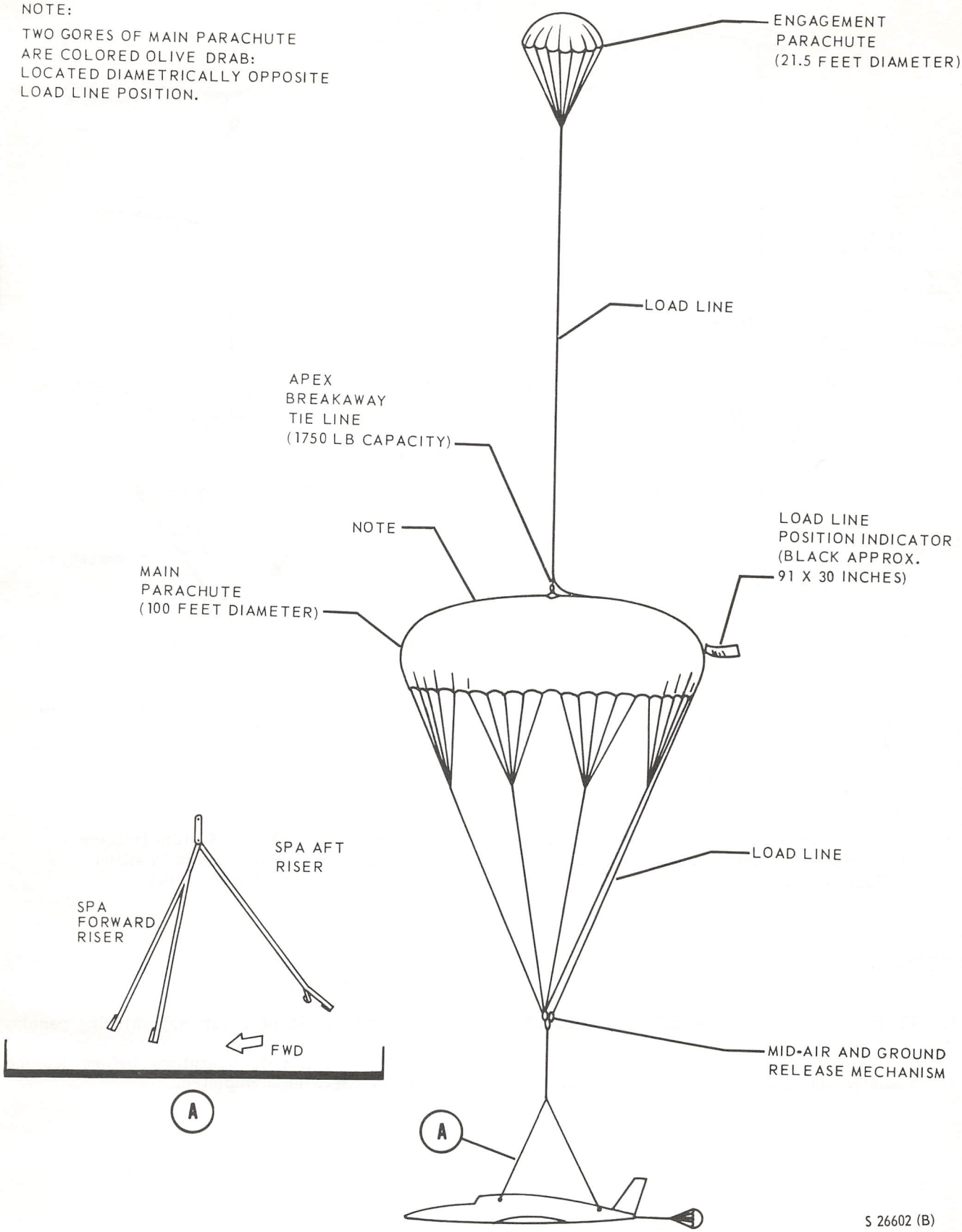



Figure 3-15. AQM-91 Series MARS System Descent - Components Identified in Position for Mid-Air Recovery

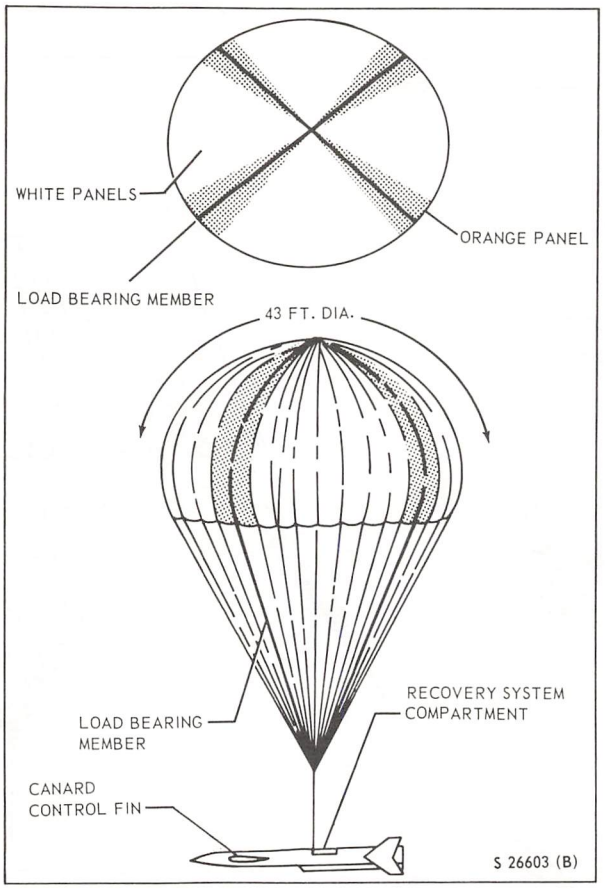



Figure 3-16. High Altitude Supersonic Target (HAST)

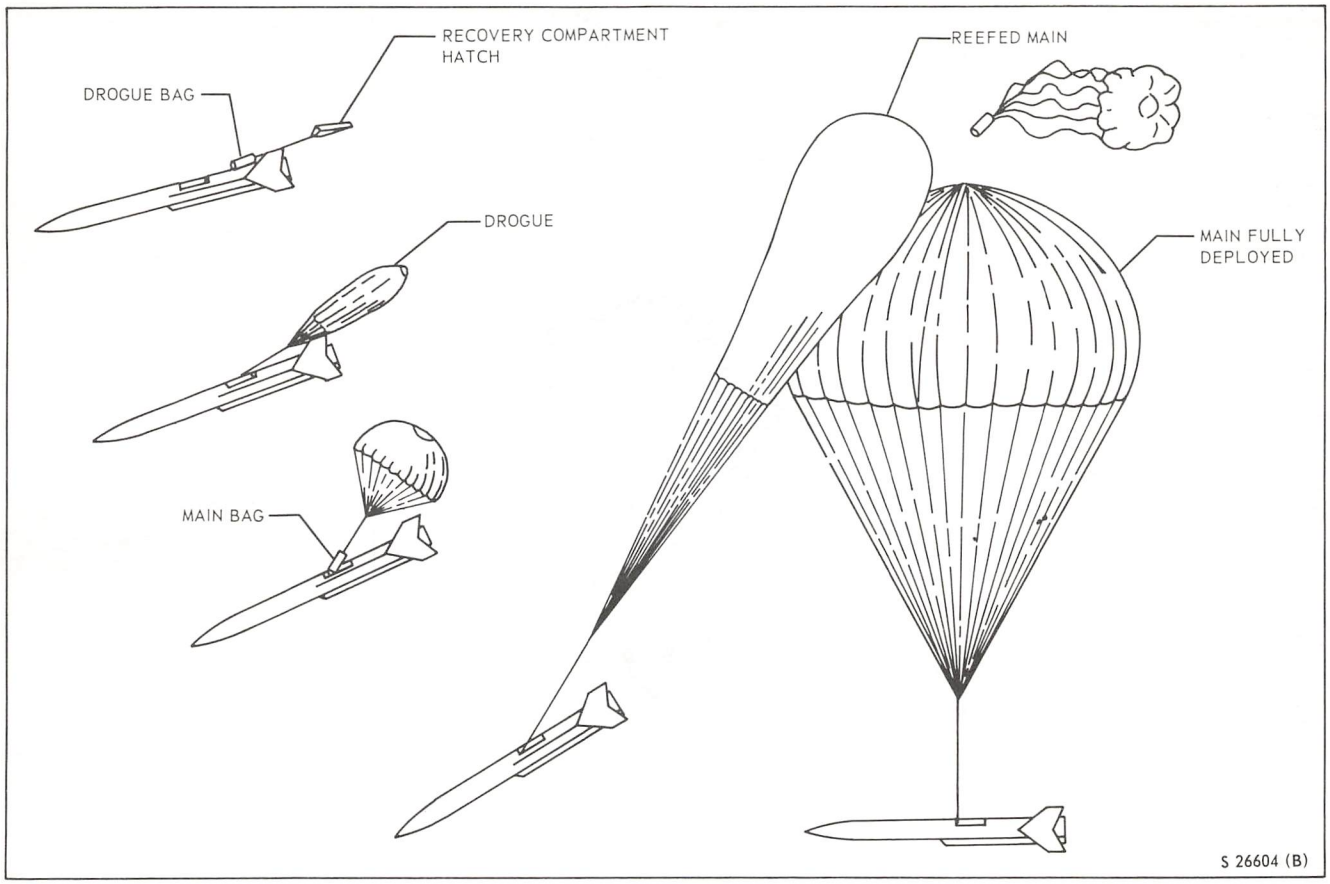



Figure 3-17. HAST Recovery System Deployment Sequence

# SECTION IV

# FLIGHT CHARACTERISTICS

(See NAVAIR 01-230HLC-1)

SECTION V

EMERGENCY PROCEDURES

Except for the following, all other emergency procedures are covered in NAVAIR 01-230HLC-1.

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## MARS EMERGENCY PROCEDURES.

Failure of the MARS equipment, as installed in the SH-3A helicopter, can occur through failure of its varied parts or systems. If malfunctioning equipment has not been noticed during preflight inspection, it will probably not be discovered until after contact has been made during a mid-air recovery. During this critical period, if equipment malfunctions, the winch operator may have only seconds to apply corrective action or the package may be lost, personnel may be injured, or the helicopter may be placed in a hazardous position. The proper corrective action to take in a certain emergency may depend upon the phase of flight during which it occurs, how critical the mission is, or other factors. The pilot must be the final authority as to the proper action to take.

## FAILURE OF MAIN PARACHUTE TO SEPARATE.

**WARNING**

During the actual engagement, with complete cable payout, the cable may whip aft and injure personnel in the vicinity of the pilot's compartment. If winch and trough covers are not in place, personnel in the vicinity of the trough may also be injured.

**WARNING**

If the main parachute canopy does not release after engagement, it will be necessary to let winch cable pay off the drum or cut the cable with the cable cutters. When the package is released by either means the pilot should avoid abrupt control movements, especially lowering collective, to avoid excessive blade flapping.

If the main parachute canopy fails to release or is slow in releasing upon contact with the engagement chute, the helicopter may pitch down in an extreme attitude with a rapid decrease in airspeed.

## OSCILLATION CONTROL.

EXTERNAL LOAD OSCILLATION. One of the important aspects of aerial recovery of suspended packages is the behavior of the package after it has been recovered. Oscillations (see figure 5-1) during reel-in are likely to occur under certain conditions and are more prone to become critical during the last 200 feet of reel-in. Causes can be attributed to:

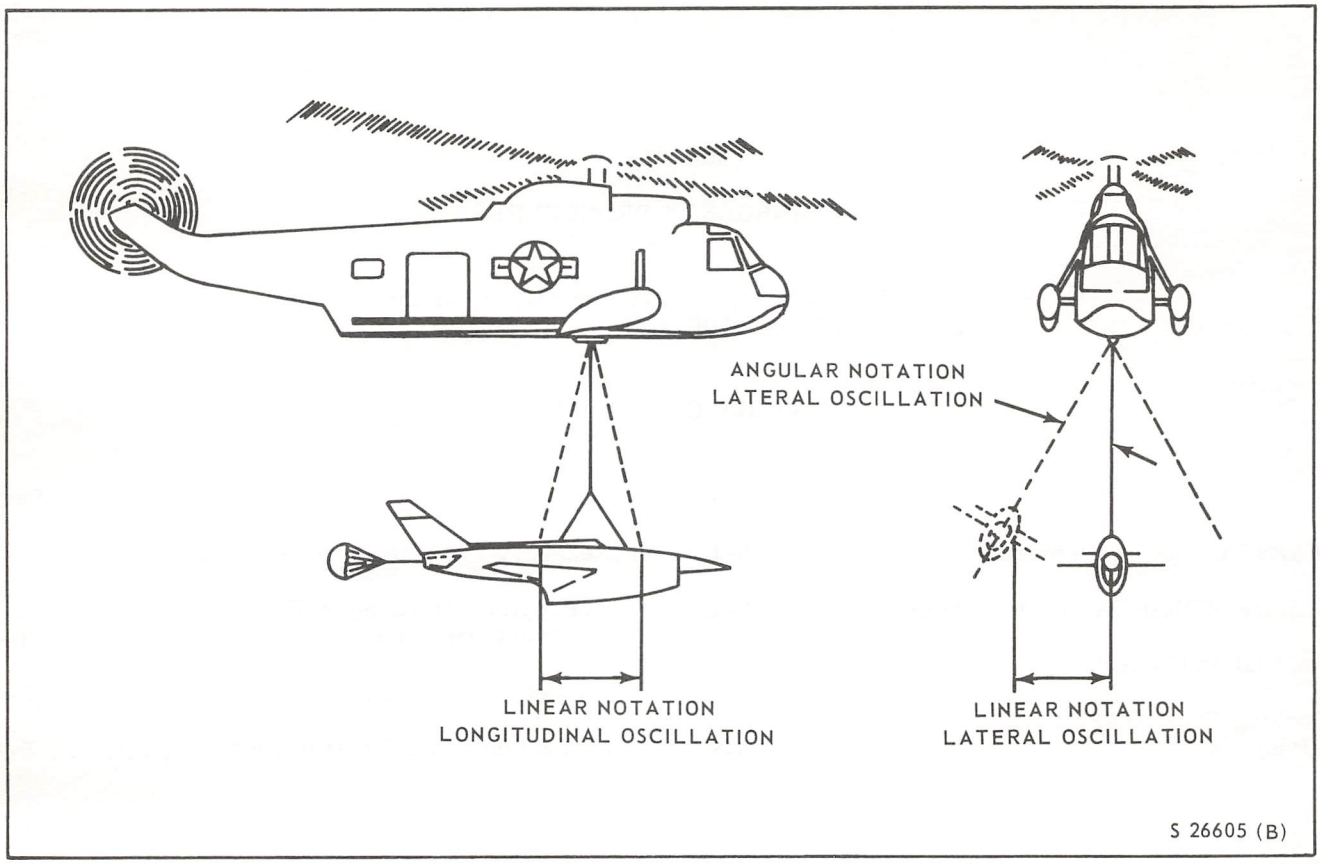


Figure 5-1. Identification of Notations (Oscillations) - Special Purpose Aircraft Oscillations

1. Turbulence.

2. Pilot technique such as uncoordinated flight, fast roll-in/out rates, or large attitude and airspeed changes.

3. Evasive maneuvering.

4. Winch operator technique such as rough and abrupt winch control movement.

5. Excessive fore-and-aft personnel movement in cabin.

6. Package aerodynamic characteristics.

The following procedures or combinations thereof may be successful in dampening or controlling oscillations. The emergency payout procedures will be used only as a final step prior to releasing the package.

EMERGENCY PAY-OUT/REEL OUT.

**CAUTION**

Once the engagement chute is positioned on the drum, it should not be reeled off in an attempt to control oscillation. During any reel-out, the drum should be closely monitored and action taken to preclude damage to the load line by projecting hardware.

The package may either be payed out or reeled out. The severity of oscillation and urgency of corrective action dictate which method will be used. The preferred method is powered reel out by activation of the winch control. By using this method, no more than 50 feet reel out should be made at one time, nor more than 100 feet in any one mission due to heat build-up within the winch (load brake).

EMERGENCY PAY-OUT PROCEDURES.

1. Pressurizing piston - REPOSITIONED 65 TURNS (165 TURNS FOR SURFACE PICKUP). This must be accomplished prior to this need arising as this step is time consuming.

2. Brake control handle - FINAL BRAKE.

**CAUTION**

If time permits, raise level wind rollers prior to placing brake control handle in NORMAL BRAKE position.

3. Brake control handle - NORMAL BRAKE (for 100 foot pay out) (75 feet for surface pickup). The full 100-foot pay out may not occur with package weights of less than 1800 pounds.

**CAUTION**

Do not place brake control handle in FINAL BRAKE position until the drum stops. Premature use of the FINAL BRAKE position with the drum in motion may cause excessive line tension and result in cable or load line failure.

4. Brake control handle - FINAL BRAKE. For additional pay out capability the pressurizing piston must be repositioned. Less than 65 turns may be accomplished, however, a lesser amount of payout will result.

OSCILLATION CONTROL PROCEDURES.

**WARNING**

External packages which have aerodynamic characteristics may cause oscillations to the extent that the package may oscillate into the rotor blades and/or fuselage. If oscillations are such that safety of the helicopter and crew are jeopardized, the package will be jettisoned.

The following procedures or combinations thereof may be successful in dampening or controlling oscillations. Time permitting, these procedures should be tried prior to reel out or emergency payout.

1. Straight and level flight.
2. Small rate turns.
3. Small rate climbs/descents.
4. Gradual airspeed changes.
5. Turning in package cant direction.
6. Hovering out of ground effect.

**Note**

Helicopter should have hovering out of ground effect capability prior to attempting this procedure.

7. Turning in direction of the oscillation.

**Note**

This procedure requires crew coordination to ensure the turn is started at the proper time so as not to aggravate the oscillation. When the package reaches its maximum deflection to one side and starts swinging in the opposite direction, a turn is started in the same way as the oscillation movement. This procedure is normally used on AQM-91 series packages, but is also useful in the AGM, BGM, and BQM-34 series packages.

DOCKING FROM OTHER THAN STOWED POSITION.

**WARNING**

When docking a package from other than a stowed position that has an automatic ground release mechanism installed, ensure that the load line is cut before the package touches the ground (3 - 5 feet) to preclude operation of the ground release mechanism. If the ground release mechanism should actuate, the load line and release mechanism may whiplash up toward the helicopter, causing fuselage damage or fouling in the rotor blades.

When docking a package from other than a stowed position, the winch operator with safety harness attached, will be positioned at the open cargo door to provide clearance information. A ground crewman should be available to assist the pilot in the docking operation by providing appropriate hand signals for ground clearance. If radio communications are not provided, both arms raised parallel over the head will indicate 10-foot clearance. One arm lowered against side of body will indicate 5-foot clearance. Both hands being moved toward the clasped position will indicate smaller corresponding clearance.

RECOVERY POLES DE-RIGGED.

If the recovery poles are completely de-rigged, and no package has been retrieved, the recovery loop should be reeled in immediately to avoid possible damage to the tail rotor.

HELICOPTER EMERGENCIES WITH A PACKAGE ATTACHED.

EMERGENCY PROCEDURE FOR DOCKING HEAVY PACKAGE WITH MARGINAL OR INADEQUATE POWER TO HOVER.

**CAUTION**

Under no circumstances should rotor rpm be allowed to drop below 100% $N_r$.

Adjust collective pitch, as necessary, to maintain the desired approach angle, and dissipate speed gradually throughout the approach. Maintain translation lift until prior to arriving over package docking point. Establish a straight track over the ground and a shallow approach with a slow rate-of-descent. As the helicopter approaches the docking point, increase collective pitch to reduce rate-of descent and slowly flare the aircraft to reach zero ground speed and zero rate-of-descent over the docking point, maintaining at least five feet ground clearance from package. As the aircraft approaches zero ground speed, the pilot will instruct the winch operator to reel out the package. At ground contact, the helicopter will have adequate power to hover and the pilot will instruct the winch operator to cut the load line when release mechanism is clear of aircraft.

BAILOUT.

**WARNING**

Time permitting, poles should be jettisoned before attempting bailout, to prevent injury by striking the poles.

If an emergency should develop during a mid-air recovery that makes it necessary to bailout, the package will be jettisoned.

SINGLE ENGINE FAILURE. If an engine should fail and the helicopter can be flown at a safe rate of descent, the package will be retained if it can be docked. However, if helicopter control and crew safety is jeopardized, the package and/or poles will be immediately jettisoned.

AUTOROTATION. When an emergency develops that requires the helicopter to enter into autorotation, the package will be immediately jettisoned.

MARS EQUIPMENT EMERGENCIES.

WINCH FAILURE. Winch failure may occur through failure of its components or subsystems. If a malfunction has not been noticed during the preflight inspection, it will probably not be detected until after contact has been made during a recovery mission. If the equipment should malfunction during this critical period, the winch operator may only have seconds to take corrective action to preclude the package being lost, possible injury to personnel, or the helicopter being placed in a hazardous situation. As the proper corrective action to be taken in a certain emergency may depend on the phase of flight during which it occurs, how critical the mission is, or other factors, the pilot must be the final authority in determining the proper action to be taken.

POWER TRAIN FAILURE. Power train failure or failure in the winch gear box, is most likely to occur during the recovery operation and will be indicated by the inability of the winch to properly reel in or reel out the package, or by a runaway drum. If the winch can only reel in, the package should be closely monitored. If the package oscillations become dangerous to the extent that the safety of the helicopter and crew are jeopardized, and the winch lacks the ability to reel out, or pay out, the load line/cable must be cut. If the winch lacks the ability to reel in after recovery, it will be necessary to tow and dock the package in its extended position.

WINCH BRAKE FAILURE.

**WARNING**

If winch and trough covers are not in place, personnel in the vicinity of the trough and pilot's compartment may be injured with complete cable payout.

The winch brake has the important function of allowing the package to accelerate to a speed that is comparable to the forward velocity of the helicopter and holding the package in the desired tow length. If the brake fails, the winch line could payout completely. Premature locking of the brakes can cause the helicopter to pitch down excessively and/or the winch line to break. The pilot should be the final authority as to whether to cut the winch line or allow the possibility of the cable running completely off the drum.

RECOVERY POLE FAILURE. The aluminum poles used in the recovery system should not break, even under extreme circumstances, but may bend as a result of a high hit from the engagement chute or a heavy side load. A hook retainer may also malfunction so that the pole hook will not stay in place. A successful mid-air retrieval can be accomplished with a slightly bent pole without difficulty, and pole hooks may be taped to the recovery poles in the proper configuration to allow a good engagement. Successful engagements can also be made with a single pole and hook. If a pole should break, and the broken portion of the pole is retained on the loop assembly, recovery attempts should be terminated.

UTILITY HYDRAULIC SYSTEM FAILURE. Failure of the utility hydraulic system requires mission abort.

WINCH HYDRAULIC SYSTEM FAILURE. Winch hydraulic system failure can be caused by loss of hydraulic power as a result of broken hydraulic lines or hydraulic motor failure. If a hydraulic line should break in the recovery system, the shut-off valve for the hydraulic supply from the utility hydraulic system should be closed. When this is done, the remaining winch line may run off the drum, depending on the location and nature of the break. If the winch hydraulic failure is due to failure of the hydraulic motor, the reel-in and reel-out capability will no longer exist, and the procedures outlined for power train failure should be followed. If the hydraulic motor should fail, do not close the shut-off valve for the hydraulic supply from the utility hydraulic system.

WINCH ELECTRICAL SYSTEM FAILURE. Failure of the winch electrical system will not impede the hydraulic reel-in capability of the winch. However, all indicating lights on the control panel and the winch drum illuminating lights will go out. The holding brake pressure indicator will indicate the pressure reading at the time of failure.

POLE ELECTRICAL FAILURE. The recovery poles are lowered and raised hydraulically but are electrically actuated. If dc power failure should occur so as to render the pole actuating switch inoperative, the poles may be lowered or raised hydraulically by manually actuating the four-way control valve.

CABLE CUTTER FAILURE. In the event of electrical failure, or the cable cutters fail to fire electrically, remove the safety pins (if time permits) from the manual firing pin extension and manually activate the cable cutters by striking the red knob with the palm of the hand. If the safety pins are not removed, a harder impact with the hand is required.

STRIP-SHIP LIST

| NO. PRIORITY | ITEM | LOCATION | STAT NO. | WEIGHT |
|---|---|---|---|---|
| 1. | Jettison Recovery Poles a Safe Condition | | | |
| 2. | Smoke Lights, Hatches, Misc. Equip. | Aft Cabin | - | 35 |
| 3. | Power Supply | Aft Cabin | 280 | 32 |
| 4. | Converter Frequency | Aft Cabin | 280 | 22 |
| 5. | Transmitter | Aft Cabin | 272 | 71 |
| 6. | Navigational Plotter | Cockpit | 123 | 32 |
| 7. | Troop Seats | Cabin | - | 22 |
| 8. | Unnecessary Personnel | | | |

Notes

1. A strip-ship list shall be posted in the cabin compartment.
2. All listed equipment can be removed using the following basic hand tools: (De-energize all equipment prior to removal by use of circuit breakers/ switches)
   a. Diagonals (2 pair)
   b. Crescent Wrenches, 8-inch or larger (2)
   c. Water Pump Pliers (2 pair)
   d. Screwdrivers (2)
   e. Screwdrivers, Phillips Head (2)
   f. Cable Cutters (1)
3. Items 1 through 4 are items which can be removed readily.
4. Total time for complete equipment removal is estimated at one hour. Due to the importance of the time element, it is recommended items 1 and 2 be executed and a takeoff attempted. These items will give a maximum decrease in gross weight for the time involved to execute removal. If the attempt to become airborne is unsuccessful or the helicopter is forced to remain on the water due to darkness (or weather), remove additional items.
5. The ARC-39 radio (aft of thermal barrier) was not included for weight and balance purposes. If removed, it could reduce the gross weight by 37 pounds.

Figure 5-2. Strip Ship List

# SECTION VI

# ALL WEATHER OPERATION

(See Navair 01-230HLC-1)

# SECTION VII

# COMMUNICATION PROCEDURES

(See Navair 01-230HLC-1)

# SECTION VIII

# WEAPON SYSTEMS

(See NAVAIR 01-230HLC-1)

SECTION IX

FLIGHT CREW COORDINATION

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## CREW DUTIES AND RESPONSIBILITIES.

Each crewmember is delegated duties and responsibilities other than the primary duties outlined in section III, NORMAL PROCEDURES. These additional duties and responsibilities are described in this section.

PILOT. Prior to the mission, the pilot will coordinate communications, frequencies, and procedures to be used throughout the mission. Mission abort procedures, orbit and rendezvous times, and locations will be established. He will verify weight of the object to be recovered. The pilot will ensure that all crewmembers are familiar with the requirements of the mission and receive a thorough briefing on crew coordination procedures.

COPILOT. The copilot will assist the pilot as directed during the MARS attempt by calling out heading and rate of descent corrections, airspeed, and altitude. He will have the primary responsibility of monitoring aircraft instruments and power settings from the initiation of the MARS pass until engagement chute contact is accomplished or missed pass is completed. When required, he will monitor the status of the package.

POLE OPERATOR. The pole operator will be responsible for pole operation. He will visually monitor the poles and loop assembly during mid-air recovery operations and advise the pilot of the following conditions:

1. Type of hook engagement on a successful retrieval.

2. Load position, stability and characteristics after engagement.

3. Function of main canopy release.

4. Missed retrievals (to include position of engagement chute).

5. De-rig condition of recovery equipment.

6. Any abnormal conditions observed.

7. Raising and stowing the retrieval poles.

8. Assisting the winch operator during reel-in, as necessary, by positioning the engagement chute, loop assembly, hook(s), and load line on the winch drum as required to preclude load line damage.

9. During landing approach, report aerodynamic status of the extended load and terrain clearance until the docking operation is complete.

10. Accomplish other duties as the pilot may direct.

WINCH OPERATOR. The winch operator will operate the MARS special equipment. During recovery, he will:

1. Operate the winch controls.

2. Report all aspects of the winch operation to the pilot.

3. Coordinate his activities with the pole operator.

4. Advise the pilot of load oscillations during reel-in when visible from the winch operator station.

## WINCH AND POLE OPERATOR'S PROCEDURES.

PREFLIGHT CHECK.

1. Winch status - CHECKED.

Check required inspections completed and maintenance discrepancies recorded. The winch operator will perform a visual inspection for general condition of the winch, winch line, trough, fairlead assembly, and pole mount assemblies.

2. Pressure piston - READY FOR PICKUP.

**Note**

The ready for pick-up indicator, end of actuator rod (5, figure 1-10) will indicate the pressurizing piston is in the ready for pick-up position when the end of the rod begins to move inward as the speed wrench is turned counterclockwise.

3. Planetary drive clutch engaged - CHECKED.

**Note**

An indicator pin (2, figure 1-10) located below and to the left of the CAM RESET placard, is flush with the cover when the clutch is disengaged and protrudes when the clutch is engaged.

4. MARS cabin compartment control panels - CHECKED.

5. Tools and equipment - CHECKED.
Check availability and condition of the following items.

a. Speed handle 1/2-inch drive.

b. Safety harness.

c. Suitable padding.

d. 8-inch adjustable wrench.

e. Pliers.

f. Screwdriver.

g. Knife.

h. Diagonal cutters.

i. One 3/4-inch wrench.

j. Cable cutter cartridges.

k. Pry bar.

l. Manual cable cutter.

m. Cloth tape.

n. Shepard's hook.

o. Oxygen equipment.

p. Rapid pickup assembly equipment.

6. Cargo door safety strap - AS DESIRED.

7. Loop assembly - CHECKED.
Check loop assy for general condition and proper installation.

BEFORE TAXIING.

1. Leak check - COMPLETED.
Visually check winch and pole mount hydraulic plumbing.

2. Cable cutter cartridges - INSTALLED.

3. Cable cutters and sheave - LOCKED.

a. The winch operator will lower the cable cutters and lock trough cover.

b. Cable cutter sheave up.

**WARNING**

If cable cutter trough cover is not properly locked, it may pivot up if the cable cutters are fired causing injury to personnel.

4. Control panel - CHECKED.
Ensure all circuit breakers are set.

5. Control panel switches - ON.

a. Panel power and winch light switches will be placed on.

b. Check for illumination of panel power, ready for pick-up, system pressure and final brake pressure indicator lights.

c. Holding brake pressure - CHECKED.
The holding brake pressure should be 35 ± 5 psi.

6. Cable slack - REMOVED.
To prevent cable damage due to dragging on surface.

**CAUTION**

Exercise extreme caution while working in close proximity to the winch control handle. Package loss and/or damage to the winch may result if the READY FOR PICKUP light is on and the winch control handle is inadvertently actuated due to entanglement in personnel clothing, parachute, etc.

BEFORE CONTACT. Perform the before contact check when directed by the pilot.

1. Poles and loop assy - DOWN.

a. Pole and winch operators extend poles. Winch operator operates pole position switch and pole operator lowers flying hook as poles are let down.

b. Pole position switch - DOWN.

c. Ensure that recovery loop assembly is flying and not tangled.

2. Winch control handle - NEUTRAL.

3. Brake control handle - NORMAL BRAKE.

4. Winch cable - POSITIONED AND SLACK REMOVED.
Remove slack from cable and ensure that cable is properly positioned on winch drum.

5. Hydraulic brake pressure checked - FINAL, NORMAL.

a. Check for maximum deflection of hydraulic pressure gage in FINAL BRAKE position.

b. Check holding brake pressure indicator in NORMAL BRAKE position.

6. Cable cutters - ARMED.

a. Advise pilot to arm cable cutters.

b. Check for amber lights on winch control panel and cable cutter panel.

7. Ready for pick-up indicator light - ILLUMINATED.

8. Poles - RECHECKED.

Note

Poles may creep upward due to increased airspeed or turbulence. Poles should be periodically checked before contact. Reactivate the pole position switch as necessary to maintain poles in full-down position.

9. Leak check - COMPLETED.

a. Visually check pole mount hydraulic plumbing.

b. Visually check visible winch hydraulic plumbing.

10. After contact check - REVIEWED.

ON DOWNWIND.

1. Brake handle - CYCLE.
Cycle brake lever to stabilize normal brake pressure.

Note

If successful MARS is not accomplished, proceed immediately to no pick-up checklists.

AFTER CONTACT.

1. Poles - UP AND STOWED.
The pole operator will raise and secure poles in the stowed position after package has stabilized to a tow position, and the winch operator has moved to the control position and has the package in sight.

2. Brake control handle - FINAL BRAKE.

**CAUTION**

Do not add final brake before drum stops after initial swing through. Premature braking will cause excessive line tension and may result in load line failure and loss of package.

3. Pressurizing piston - AS REQUIRED.

a. If there are 25 or less wraps of cable remaining on the drum when final brake has been applied, reset the pressurizing piston 65 turns.

b. When the pressurizing piston has been reset 65 turns (counterclockwise) and additional payout capability of approximately 100 feet is available for an emergency payout.

**WARNING**

If the NORMAL/FINAL BRAKE control handle is placed in the NORMAL brake position prior to boarding of the apex tie, loss of package, injury to personnel and/or damage to winch or aircraft may result. Powered reel out should be utilized to lower the package, if required, prior to boarding of the apex tie.

4. Level wind rollers - DOWN.

**WARNING**

Use two hands when positioning the rollers from the UP position to the DOWN position. Exercise extreme caution to preclude injury to fingers.

a. Rotate the cam handle 90 degrees downward from the horizontal to the vertical position before positioning rollers.

b. Together lower rollers and rotate cam handle 90 degrees downward to the original horizontal position. Insert plunger into new lock position.

**CAUTION**

Do not let rollers and roller support drop from the UP position to the DOWN position. Wear to carriage lock hole will result, due to the weight of the assembly.

5. Well cover - OPENED.

**WARNING**

Exercise extreme caution during the entire reel-in sequence. Whenever possible, maintain body well clear of load-bearing members. Keep hands clear of rotating drum.

6. Reel-in - AS REQUIRED.

**WARNING**

When using the outside of the level wind rollers to wrap load line on winch, do not permit the winch line or load line to rub against the drum flanges. Damage to load line will result. The winch cable should only be reeled in between the rollers.

**WARNING**

During reel-in, the operator will continuously monitor package and keep pilot informed as to conditions.

The reel-in sequence is as follows:

a. Stop winch when thimble reaches CG rollers. Connector link, loop assembly, and engagement chute will not fit through throat of cable cutters.

b. Place level wind rollers up.

**WARNING**

Use two hands when positioning the rollers from the DOWN position to the UP position. Exercise extreme caution to preclude injury to fingers.

c. Rotate the cam handle 90 degrees downward from the horizontal to the vertical position before positioning rollers.

d. Together raise rollers and rotate cam handle 90 degrees downward to the original horizontal position. Insert plunger into new lock position.

e. The winch operator will request the pilot to place the ARMED/SAFE switches in SAFE prior to moving the cable cutters.

f. Forward trough cover opened.

**WARNING**

Ensure that the cable cutter ARMED/SAFE switches are safe prior to moving cutters. Otherwise, accidental firing and subsequent injury to personnel could result.

g. Unlock and raise cable cutters. Winch operator will retract sheave.

Note

The cable cutters must be raised during reel-in because hardware will not fit through throat of cable cutters. The cable cutters are raised from the time the thimble reaches the CG rollers.

h. Reel the thimble and loop assembly over the CG roller, placing the loop evenly on the drum and padding the hardware as required. Inspect the hook(s) for load bearing members prior to bringing them over the CG roller, which may require the use of a pry bar and/or suitable padding to assist hook(s) in maintaining proper position in relation to the CG roller. After the engagement hook(s) are over the CG roller, the free hook(s) may be removed at this time by removing screw pin shackles which attach them to the loop assembly.

**WARNING**

To preclude injury to personnel, reel-in rate must be slow and extreme caution exercised when bringing hook(s) over CG roller.

**CAUTION**

Extreme caution should be used during this portion of reel-in process to ensure that engagement hook(s) are properly positioned in relation to the CG rollers, so that hook(s) will not be rotated out of engagement chute with subsequent loss of package.

Note

Desired placement of loop and hooks is to the left side of the drum.

Note

Suitable padding will vary with the situation, but may include locally procured blocks (6 x 8 x 3/8 inches) of rubber composition, pre-cut tire casing, etc.

i. Carefully reel in, placing the hook(s) and padding near the side of the drum and leaving the remaining space on the drum for chute, risers, and load line.

**WARNING**

While wrapping engagement chute around shroud lines, keep hands well clear of rotating drum.

**CAUTION**

The impact of hardware and/or parachute shroud lines on the level wind rollers may cause failure of the roller assembly and loss of the level wind function.

j. Continue reel-in using caution while positioning the load line position indicator on drum.

k. Continue reel-in until package is in the stowed position. A stowed position is when the release mechanism is reeled into the trough area below the CG roller.

Note

Due to certain adverse conditions, it may not be possible to reel-in package to a stowed position. It is possible to recover the package while it is still in a tow position. Refer to DOCKING FROM OTHER THAN STOWED POSITION in section V.

7. Forward trough cover - LOCKED.

8. Level wind roller - UP.

**WARNING**

Use two hands when positioning the rollers from the DOWN position to the UP position. Exercise extreme caution to preclude injury to fingers.

a. Rotate the cam handle 90 degrees downward from the horizontal to the vertical position before positioning rollers.

b. Together raise rollers and rotate cam handle 90 degrees downward to the original horizontal position. Insert plunger into new lock position.

BEFORE DOCKING. Perform the before docking check when directed by the pilot.

1. Safety harness - SECURED.
   Safety harness will be worn and secured any time personnel are at the open cargo door.

2. Cargo door - OPEN.
   Winch operator will position himself at the open door to provide terrain clearance of external package from ground.

3. Well cover - AS REQUIRED.
   Will be closed when package has an active ground release.

4. Knife - READY.
Winch operator should be prepared to cut load line.

AFTER DOCKING.

1. Cable cutter ARM/SAFE switches - SAFE.

2. Load line - STOWED.
Winch operator will stow remaining load line.

BEFORE LEAVING THE HELICOPTER. The winch and pole operators will perform the following check before leaving the helicopter.

1. Cable cutter cartridges - REMOVED.

2. Winch control panel switches - OFF.
Winch control panel PANEL PWR and WINCH LIGHTS switches will be turned off.

3. Discrepancies - ENTERED IN YELLOW SHEET.

NO PICK-UP. This check will be performed in the event of an unsuccessful MAR and when directed by the pilot.

1. Cable cutter ARM/SAFE switches - SAFE.

2. Reel-in/out - AS REQUIRED.
It may be necessary to reel-out to obtain slack in cable so poles can be stowed.

3. Poles - UP AND STOWED.

SURFACE PICK-UP PROCEDURES.

1. From ready for pick-up position (light illuminated) - CRANK PRESSURIZING PISTON 165 TURNS IN CLOCKWISE DIRECTION.

2. Brake control handle - IN FINAL BRAKE POSITION.
To prevent normal payout of loadline/cable.

3. MARS loop assembly and winch cable - DISCONNECTED.
Be sure to retain the spacer in the loop connector.

4. Rapid pick-up assembly load line to winch cable - CONNECTED.

a. Approximately 75 feet of the 100-foot load line is then reeled onto the winch.

b. Assure cable cutters are in the UP position.

5. Loadline to running line - ATTACHED.
Tie free end of load line to the running line.

6. Safety harness (gunner's belt) - SECURED.

7. Load line - RIGGED.
Using the running line, pass the end of the load line under the fuselage and in through personnel door.

8. Pick-up hook - ATTACHED.

9. Loadline - REELED ON WINCH.
Reel all but approximately 25 feet of the load line on the winch drum.

# SECTION X

# NATOPS EVALUATION

(See NAVAIR 01-230HLC-1)

# SECTION XI

## PERFORMANCE DATA

(See NAVAIR 01-230HLC-1 for performance data applicable to T58-GE-8F engine, with and without ice shield installed.)

# ALPHABETICAL INDEX

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