NAVAL AIR TRAINING COMMAND

NAS CORPUS CHRISTI, TEXAS **CNATRA P-481 (NEW 05-22)**

FLIGHT TRAINING INSTRUCTION

LOGISTICS SEA AND SAR
TH-73A

2022

DEPARTMENT OF THE NAVY
CHIEF OF NAVAL AIR TRAINING
250 LEXINGTON BLVD SUITE 179
CORPUS CHRISTI TX 78419-5041

CNATRA P-481
N714
05 May 22

CNATRA P-481 (New 05-22)

Subj: FLIGHT TRAINING INSTRUCTION, LOGISTICS SEA AND SAR, TH-73A

1. CNATRA P-480 (New 05-22) PAT, "Flight Training Instruction, Logistics Sea and SAR, TH-73A," is issued for information, standardization of instruction, and guidance to all flight instructors and student aviators within the Naval Air Training Command.

2. This publication will be used as an explanatory aid to support the flight training curriculum. It will be the authority on the execution of all flight procedures and maneuvers herein contained.

3. Recommendations for changes shall be submitted via the electronic Training Change Request (TCR) form located on the Chief of Naval Air Training (CNATRA) website.

4. CNATRA P-481 (New 05-22) PAT is a new publication.

T. P. ATHERTON
By direction

Releasability and distribution:
This instruction is cleared for public release and is available electronically only via Chief of Naval Air Training Issuances Website, https://www.cnatra.navy.mil/pubs-pat-pubs.asp.

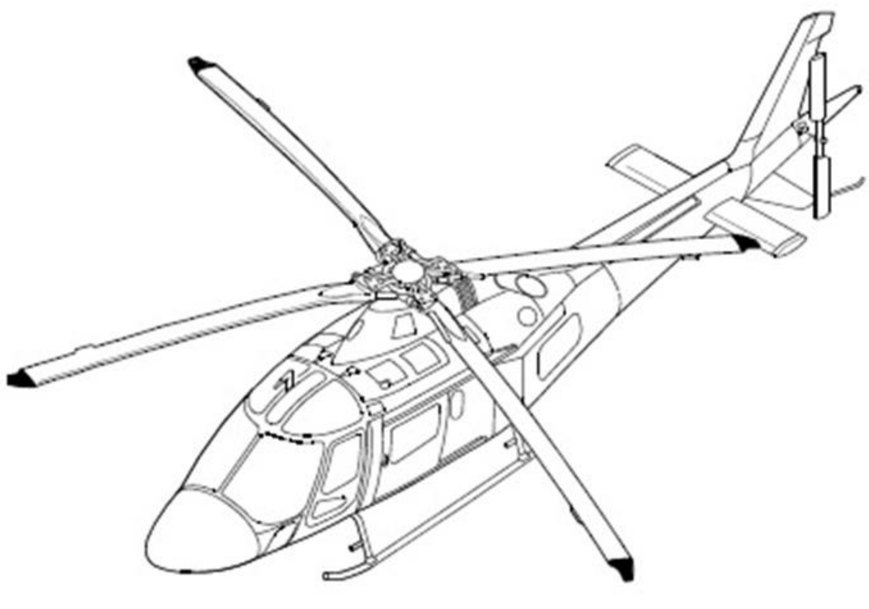
FLIGHT TRAINING INSTRUCTION

FOR

LOGISTICS SEA AND SAR

TH-73A

P-481



LIST OF EFFECTIVE PAGES

Dates of issue for original and changed pages are:

Original…0…05 May 22

TOTAL NUMBER OF PAGES IN THIS PUBLICATION IS 48 CONSISTING OF THE FOLLOWING

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
COVER	0		
LETTER	0		
iii – viii	0		
1-1 – 1-10	0		
2-1 – 2-9	0		
2-10 (blank)	0		
3-1 – 3-2	0		
4-1 – 4-8	0		
5-1 – 5-5	0		
5-6 (blank)	0		
A-1 – A-3	0		
A-4 (blank)	0		

CHANGE SUMMARY

The following changes have been previously incorporated into this document.

CHANGE NUMBER	REMARKS/PURPOSE

The following interim changes have been incorporated into this change/revision:

INTERIM CHANGE NUMBER	REMARKS/PURPOSE	ENTERED BY	DATE

INTRODUCTION

This Flight Training Instruction (FTI) provides information on shipboard operations as well as Search and Rescue (SAR) operations. You will draw upon and apply the fundamentals you have learned from the previous stages of instruction to successfully complete these instructional divisions. The objective is to show helicopter operational versatility and various mission capabilities you may encounter in the fleet.

SCOPE

This publication contains maneuver descriptions encompassing the Instrument events for both helicopter and simulator listed in the Advanced Multi-Service Pilot Training System Curriculum (CNATRAINST 1542.186 series); however, it does not contain maneuver descriptions previously covered in other Flight Training Instruction (FTI) publications. It is your responsibility to have a thorough knowledge of the contents within all FTIs.

TABLE OF CONTENTS

LIST OF EFFECTIVE PAGES ...... **iv**
CHANGE SUMMARY ...... **v**
INTRODUCTION ...... **vi**
TABLE OF CONTENTS ...... **vii**
LIST OF FIGURES ...... **viii**

CHAPTER ONE – LOGISTICS AT SEA **1-1**
100. INTRODUCTION 1-1
101. TYPES OF SHIPS 1-1
102. REFERENCES FOR SEA LOGISTICS 1-2
103. AIR TRAFFIC CONTROL DOCTRINE 1-2
104. HELICOPTER HANDLING SIGNALS 1-5
105. COMMUNICATION BREVITY TERMS FOR SHIPBOARD OPERATIONS 1-10

CHAPTER TWO – SHIP DEPARTURE AND RECOVERY PROCEDURES **2-1**
200. INTRODUCTION 2-1
201. VFR PROCEDURES 2-1
202. DECK LANDING PROCEDURES 2-5
203. EMERGENCY PROCEDURES IN THE SHIPBOARD ENVIRONMENT 2-8

CHAPTER THREE – SEARCH AND RESCUE ORGANIZATION **3-1**
300. INTRODUCTION 3-1
301. MARITIME SAR 3-1
302. OVERLAND SAR 3-1
303. USEFUL SAR REFERENCES 3-1
304. SAR ORGANIZATION 3-2

CHAPTER FOUR – SEARCH PATTERNS AND PROCEDURES **4-1**
400. INTRODUCTION 4-1
401. DETERMINING DATUM 4-1
402. MARITIME SEARCH PATTERNS 4-1
403. CRM DURING A SEARCH 4-7
404. SURVIVOR SIGNALING DEVICES AND POSITION MARKING 4-8

CHAPTER FIVE – RESCUE METHODS AND PROCEDURES **5-1**
500. INTRODUCTION 5-1
501. OVERWATER RECOVERY 5-1

APPENDIX A – GLOSSARY **A-1**

LIST OF FIGURES

Figure 1-1 Control Area and Control Zone Dimensions 1-3
Figure 1-2a LSE Signals 1-7
Figure 1-2b LSE Signals 1-8
Figure 1-2c LSE Signals 1-9
Figure 1-3 Table for Brevity Codes for Shipboard Operations 1-10

Figure 2-1 Charlie Patterns for Helicopters 2-2
Figure 2-2 Typical LHA/LHD Helicopter/Tilt-rotor Landing Spot Diagram 2-3
Figure 2-3 Typical Air-Capable Ship Landing Spot 2-5
Figure 2-4 Deck Landing Pattern 2-6
Figure 2-5 Shipboard Lost Communication Procedures 2-9

Figure 4-1 Single SRU Parallel Pattern 4-4
Figure 4-2 Creeping Line Pattern 4-4
Figure 4-3 Expanding Square Pattern 4-5
Figure 4-4 Sector Pattern 4-6
Figure 4-5 Overlapping Visual Scan 4-7

Figure 5-1 Hovering at the Three o’clock Position 5-2
Figure 5-2 Relative Wind Quadrants 5-3
Figure 5-3 Teardrop Windline Rescue Pattern 5-4
Figure 5-4 Racetrack Windline Rescue Pattern 5-5

CHAPTER ONE
LOGISTICS AT SEA

100. INTRODUCTION

This chapter introduces the fundamentals of shipboard operations. Ultimately, logistics at sea frequently refers to Vertical Replenishment (VERTREP) – external load operations to a ship. You have already learned about external load operations over land, which is procedurally very similar. The main difference is learning how to operate from a ship deck that is moving through the water and susceptible to environmental conditions. This training will not include VERTREP – you will learn that in the fleet – but will concentrate on all other operations with a ship. The information and procedures contained here will build the foundation of shipboard operational knowledge for the fleet. Flight deck operations present unique challenges not found at land-based aviation facilities. These operations focus on solid procedural skills to mitigate many hazards, including the pitch and roll of the flight deck, landing on a small spot, avoiding shipboard obstructions, operating in close proximity to the water, and accounting for wind turbulence. Procedural compliance, proficiency, and CRM are paramount to safe, successful operations.

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101. TYPES OF SHIPS

It is important to understand that each type of ship with helicopter landing capability provides different support services and facilities based on configuration, size, and certification level. Before flying to a ship for landing practice, you should study the pertinent details for shipboard operations such as the size of the flight deck, fuel, and power facilities available, hangar and maintenance services, communication procedures, and landing patterns. The flight operations at an Aircraft Carrier (CVN) are different from operations at a Destroyer (DDG), and it is expected that your crew knows these differences as you approach their airspace.

Aviation ships – Refers to CVNs and Amphibious Assault Ships (Amphibious Assault Ship (General Purpose) [LHA]/Amphibious Assault Ship (Multi-Purpose) [LHD]). These ships are large seagoing platforms for fixed-wing and helicopter flight operations with the highest level of aviation support services available.

Air-Capable Ships – Refers to smaller ships with helicopter capability such as DDGs, Cruisers (CG), and Amphibious Transport Docks (LPD). Due to their smaller size and crew composition, air-capable ships are more susceptible to wind turbulence and flight deck movement and have varying levels of support services available. Additionally, ship personnel generally have less operational training when dealing with helicopters than those on aviation ships. Before launching, it is important to review the Shipboard Aviation Facilities Resume to understand the configuration and services available to helicopter crews by a particular ship.

102. REFERENCES FOR SEA LOGISTICS

The information in this FTI is derived from the following publications:

- Aircraft Operating Procedures for Air Capable Ships NATOPS Manual (NAVAIR 00-80T-122)
- CV NATOPS Manual (NAVAIR 00-80T-105)
- LHA/LHD NATOPS Manual (NAVAIR 00-80T-106)
- Shipboard Aviation Facilities Resume (NAEC-ENG-7576)
- Aircraft Signals NATOPS Manual (NAVAIR 00-80T-113)

103. AIR TRAFFIC CONTROL DOCTRINE

The shipboard Air Traffic Controllers (ATC) monitor and control the airspace surrounding a naval vessel similar to the airspace around airports. All aircraft while operating at sea are under positive control unless otherwise directed. You will change frequencies as directed by the controlling agency. During extended flights, frequent radio checks shall be made. You shall be informed by the ship of any changes such as deteriorating weather, loss of radar contact, or alteration of the ship's course or speed.

1. Airspace

    a. Control Area. The control area is a circular airspace within a radius of 50 Nautical Miles (NM) around the ship, extending upward from the surface to infinity, under control by Carrier Air Traffic Control Center (CATCC)/Amphibious Air Traffic Control Center (AATCC) on aviation ships and the Combat Information Center (CIC) on air-capable ships.

    b. Control Zone. The control zone is airspace within a circular limit defined by five miles horizontal radius from the ship, from the surface up to and including 2,500 feet (unless otherwise designated for special operations). It is under the control of Primary Flight (Pri-Fly) Control on aviation ships and Tower/the Helicopter Control Officer (HCO) on air-capable ships in VMC (Figure 1-1).

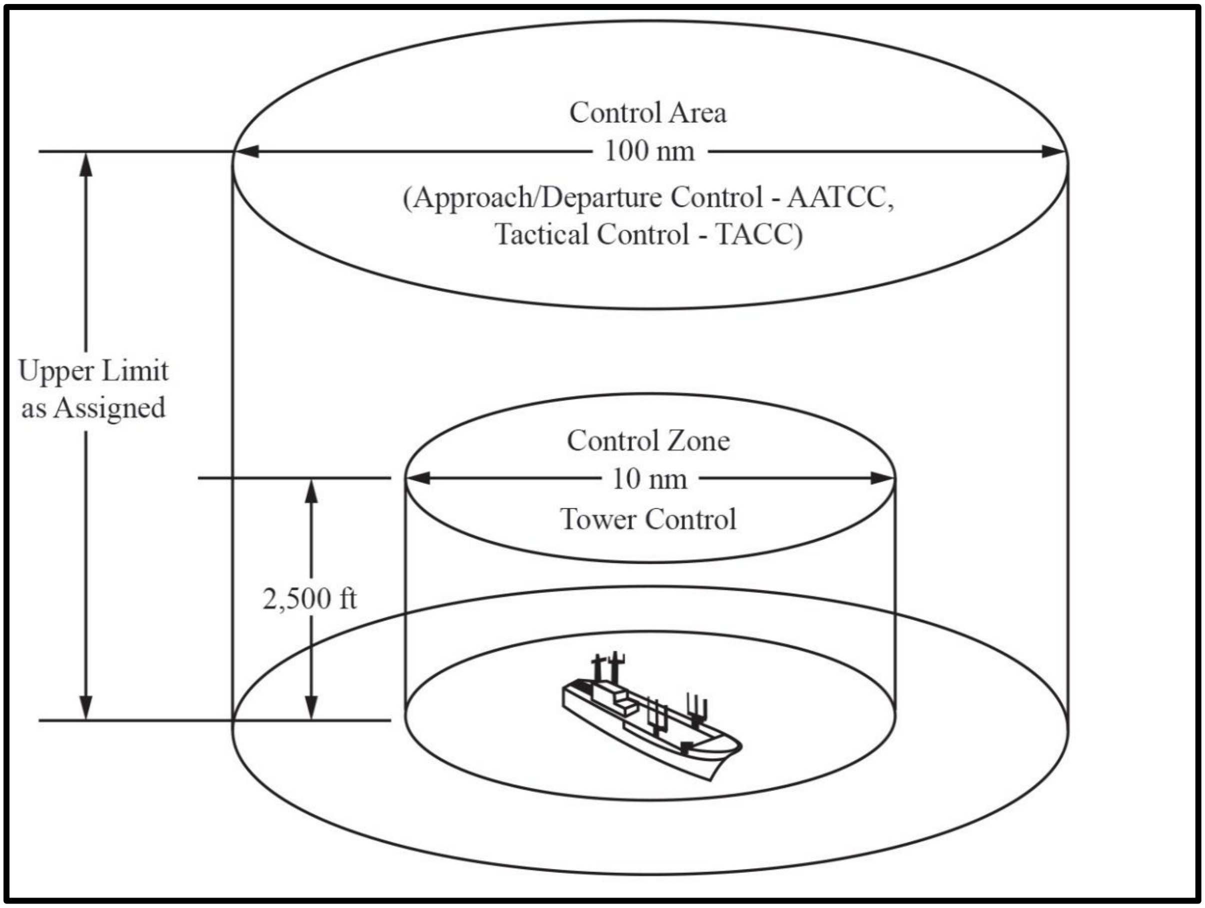

Figure 1-1 Control Area and Control Zone Dimensions

2. Aviation Ships

a. **ATC Agencies**

Aviation ships utilize a large department of dedicated personnel to safely and effectively execute flight operations. There are some differences between CVN and LHA/LHD ATC, but they are similar in many ways.

i. **Pri-Fly Control.** Pri-Fly is responsible for the visual control of aircraft operating within the control zone. It is also responsible for the control of aircraft during and immediately following launch. It is also referred to as Tower.

ii. **CATCC/AATCC.** CATCC/AATCC is the centralized ATC branch responsible for aircraft separation and radar services in the control area and during launch and recovery operations. The type of ATC services provided will vary depending on airspace, weather, time of day, and the type of aircraft operating.

iii. **Combat Direction Center (CDC)/Icepack**. The CDC is responsible for mission control of Carrier Strike Group (CSG) aircraft. Icepack is responsible for the mission control of the airspace assigned to the Expeditionary Strike Group (ESG). That airspace may extend out to 50 NM. CDC/Icepack provides multiple services to assigned aircraft, including radar control, procedural deconfliction, and administrative accounting of CSG/ESG aircraft.

iv. **Red Crown.** Red Crown is the Air Defense Identification Zone (ADIZ) controlling agency in a CSG.

b. **Weather Requirements**

Weather in the control zone is the primary factor affecting the type of departure or recovery. There are three types of departure and recovery operations: Case I, Case II, and Case III.

i. Case 1: When it is anticipated that flights will not encounter instrument conditions during daytime departures, recoveries, and the ceiling and visibility in the control zone is no lower than 3,000 feet and five NM for CVN and 1,000 feet and three NM for LHA/LHD.

ii. Case 2: When it is anticipated that flights may encounter instrument conditions during a daytime departure or recovery, and the ceiling and visibility in the control zone is no lower than 1,000 feet and five NM for CVN and below Case I but no less than 500 feet and one NM for LHA/LHD.

iii. Case 3: When it is anticipated that flights will encounter instrument conditions during a departure or recovery because the ceiling or visibility in the control zone is lower than 1,000 feet and five NM respectively, or a nighttime departure or recovery (one-half hour after sunset and one-half hour before sunrise). LHA/LHD requirements are below Case II and/or no visible horizon, all unaided flight operations between one-half hour after sunset and one-half hour before sunrise except as modified by the Officer in Tactical Command (OTC) or ship’s Commanding Officer (CO).

3. Air-Capable Ships

a. **ATC Agencies**

i. **HCO**. The HCO is responsible for launching and recovering aircraft and all aircraft operating under VFR in the ship’s control zone. Additionally, the HCO is the control zone clearing authority, and aircraft desiring to operate within the control zone shall obtain the HCO’s approval prior to entry. The HCO is referred to as Tower in radio communications.

ii. **CIC.** The CIC officer on an air-capable ship is responsible for the control of airborne aircraft, except during actual launching and recovery when the aircraft is under the control of the HCO or Landing Signals Officer (LSO). This includes safe separation from other traffic in the vicinity of the ship or under the ship's radar surveillance. The CIC is referred to as "Control" in radio communications.

b. **Weather Requirements**

During periods when ceiling and/or visibility is below VFR minimums (500-1), IFR procedures shall be used to provide separation for maximum safety. The CO may establish more restrictive approach minimums if there is a degradation in the ship's IFR capabilities. When a suitable alternate landing platform is available, aircraft shall not commence an approach to the ship if the weather is below the approach minimums unless the aircraft has enough fuel to divert to the alternate after a missed approach.

104. HELICOPTER HANDLING SIGNALS

Various light and hand signals are used aboard CVN, LHA/LHD, and air-capable ships to communicate with helicopter crews. The two to review are deck status and Landing Signalman Enlisted (LSE) signals.

1. Deck Status Lights

The following light signals apply to helicopters and shall be used in U.S. Navy and U.S. Marine Corps operations and when operating with NATO forces. The deck status lights have meaning to the ship, as well.

a. Red Deck – the ship is not restricted in movement and can maneuver as necessary to get the ship within limits (wind and pitch/roll) for flight operations. The ship is not ready for flight operations.

b. Amber Deck – the ship is ready for the pilot to engage/disengage rotors. The ship is restricted from maneuvering, and the winds are within engagement limits. The ship is not ready for flight operations.

c. Green Deck – the ship is ready in all respects for flight operations. The ship is established on flight course and restricts maneuvering.

2. Landing Signalman Enlisted Signals

The LSE is responsible for visually signaling the aircraft, thus assisting the flying pilot with a safe takeoff or approach and landing on the ship. The LSE is responsible for directing the pilot to the desired deck spot and ensuring general safety conditions of the flight deck area, including control of the flight deck crew.

Wave-off, hold, and breakaway are mandatory LSE signals. All the other signals are advisory in nature to help the flying pilot. The LSE shall request permission for the following evolutions through Flight Deck Control or Pri-Fly:

- Engine start
- Rotor engagement/disengagement
- Removing chocks and tiedown
- Takeoff

Refer to Figure 1-2a – 1-2c LSE Signals for examples.

Signal	Day	Night	Remarks
 Ready for Takeoff (LSE)	Face Fly Control. Holds right thumb up at eye level holds left fist at eye level.	Signal not required. Pilot's STEADY DIM indicates readiness to fly control.	The air officer shall signal authority for launch of helicopters by illuminating a green rotating beacon in addition to the rotating yellow beacon.
 Remove Chocks and Tiedowns (Pilot)	Swings arms apart thumbs extended outwards.	Using hand held light or flashlight, gives on/off signals at 1-second intervals.	Conforms to ICAO signal.
 Insert Chocks and Tiedowns (Pilot)	Swings arms together thumbs extended inwards. In single piloted aircraft, pilot may swing one arm alternately from side, thumb extended inwards.	Moves hand held light or flashlight at eye level in a horizontal plane alternately inwards from each side.	Conforms to ICAO signal.
 Remove Tiedowns (LSE)	To tiedown crew: Makes wiping motion down left arm with right hand.	Same as day except with addition of wands.	
 Install Tiedowns (LSE)	To tiedown crew: Rotate hands in a circle perpendicular to and in front of their body.	Same as day except with addition of wands.	Give "Hold" signal as soon as first tiedown is attached.

Figure 1-2a LSE Signals

Signal	Day	Night	Remarks
 Ready to Start Engine	Moves hand in a circle perpendicular to the deck; follows with a thumbs up signal. Signify by number of fingers engine to be started.	Turns on flashlight or movable light and moves it in a circle perpendicular to the deck.	
 Ready to Engage Rotors (Pilot)	Moves hand in horizontal circle at eye level, index finger extended. Aircraft lights FLASHING BRIGHT.	Same as day except holds red light in hand. Aircraft lights FLASHING DIM.	At night, aircraft lights should be FLASHING DIM until aircraft is declared up and ready for takeoff by the pilot.
 Ready to Engage Rotors (LSE)	FACES FLY CONTROL. Holds left fist above head; gives circular motion of right hand above head, index finger extended.	Rotates one wand at chest level; holds other wand above head.	The air officer shall signal authority to engage rotors by illuminating a yellow rotating beacon.
 Ready to Takeoff (Pilot)	Gives thumbs up signal at eye level. Aircraft lights STEADY BRIGHT.	Places running and formation lights on STEADY DIM. May give thumbs up signal by turning on flashlight or other moveable lights and moving it up and down.	

Figure 1-2b LSE Signals

Signal	Day	Night	Remarks
 Move Upward	Arms extended horizontally sideways beckoning upwards, with palms turned up. Speed of movement indicates rate of ascent.	Same as day signal with addition of wands.	Conforms to ICAO signal.
 Hover	Arms extended horizontally sideways, palms downward.	Same as day signal with addition of wands.	Conforms to ICAO signal.
 Move Downward	Arms extended horizontally sideways beckoning downwards, with palms turned down. Speed of movement indicates rate of descent.	Same as day signal with addition of wands.	Conforms to ICAO signal.
 Swing Tail Left	Use standard fixed-wing turn signal, pointing with hand to wheel to be pivoted and giving "come-on" with other hand.	Same as day except with amber of wands.	
 Swing Tail Right	Use standard fixed-wing turn signal, pointing with hand to wheel to be pivoted and giving "come-on" with other hand.	Same as day except with amber of wands.	

Figure 1-2c LSE Signals

105. COMMUNICATION BREVITY TERMS FOR SHIPBOARD OPERATIONS

The common, though not all inclusive, terms in the table below are used for communication standardization and brevity for shipboard operations.

TERM	MEANING
ANGELS	Altitude in thousands of feet.
CHERUBS	Altitude in hundreds of feet.
Base Recovery Course (BRC)	The ship's magnetic heading during flight operations.
CHARLIE (Spot #/Number)	A signal for aircraft to land aboard the ship. A number suffix indicates time delay before landing.
FEET DRY	Over land
FEET WET	Over water
FATHER	A brevity code for TACAN. The ship's TACAN, referred to as "father," functions in the same manner as a land-based TACAN. It is primarily used for positional navigation and holding. When asked to "mark your father," aircrew will reply with the radial and Distance Measuring Equipment (DME) of the aircraft from the ship's TACAN. The ship itself is referred to as "mother."
MOTHER	Commonly used term to define ship of origin or ship providing control.
POPEYE	A pilot term used to indicate that the aircraft is flying in clouds or an area of reduced visibility (IMC).
SPLASH	Fuel remaining until engine flameout in HOURS + MINUTES format.
WAVE-OFF	An action to abort a landing, initiated by the bridge, primary flight control, the LSO/LSE, or the pilot at their discretion. The response to a wave-off signal is mandatory.

Figure 1-3 Table for Brevity Codes for Shipboard Operations

CHAPTER TWO
SHIP DEPARTURE AND RECOVERY PROCEDURES

200. INTRODUCTION

This chapter introduces the ship departure and recovery procedures. These procedures are more complex for aviation ships than air-capable ships, but it is important to be familiar with both as a helicopter pilot.

201. VFR PROCEDURES

The VFR procedures differ based on type of ship, pattern, and type of procedure. Review the following procedures and patterns for aviation and air-capable ships.

1. Aviation Ships

   a. **VFR Pattern**. Day VFR traffic patterns for helicopters at aviation ships consist of holding patterns for traffic separation and a landing pattern.

      - **Helicopter Charlie Pattern**: The Charlie pattern is the standard Case I helicopter landing pattern. The landing pattern for port spots starts with an approach abeam the landing spot and a turn to intercept the 45-degree lineup line at the 90-degree position. Aircraft that are cleared to "prep Charlie" shall follow normal Charlie pattern entry procedures and conform to the racetrack pattern depicted in

      - Figure 2-1 until cleared to land on a specific spot by Pri-Fly.

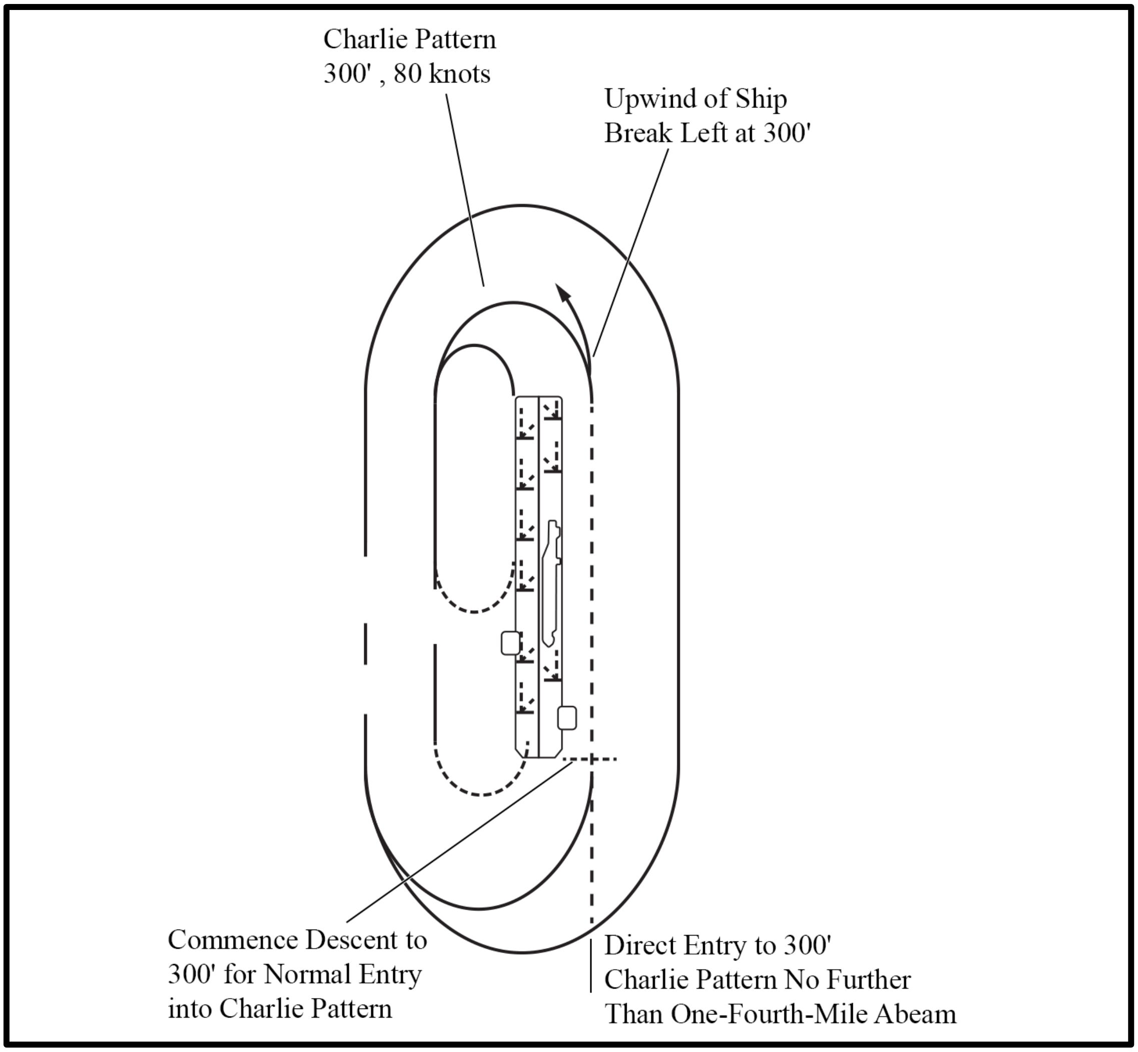

Figure 2-1 Charlie Patterns for Helicopters

b. **Helicopter Landing Procedures**

i. **LHA/LHD Landing Spots**: The LHA/LHD helicopter landing spots consist of an inverted "T" with a landing lineup line offset 45 degrees inboard (Figure 2-2), commonly referred to as the "crow's foot." Fly the approach centered on the lineup line, terminating in a hover over the spot. When directed by the LSE, pedal turn to line up with the fore/aft centerline and maintain the horizontal line bisecting the cockpit to maintain fore/aft alignment. Once cleared to land by the LSE, execute a vertical landing.

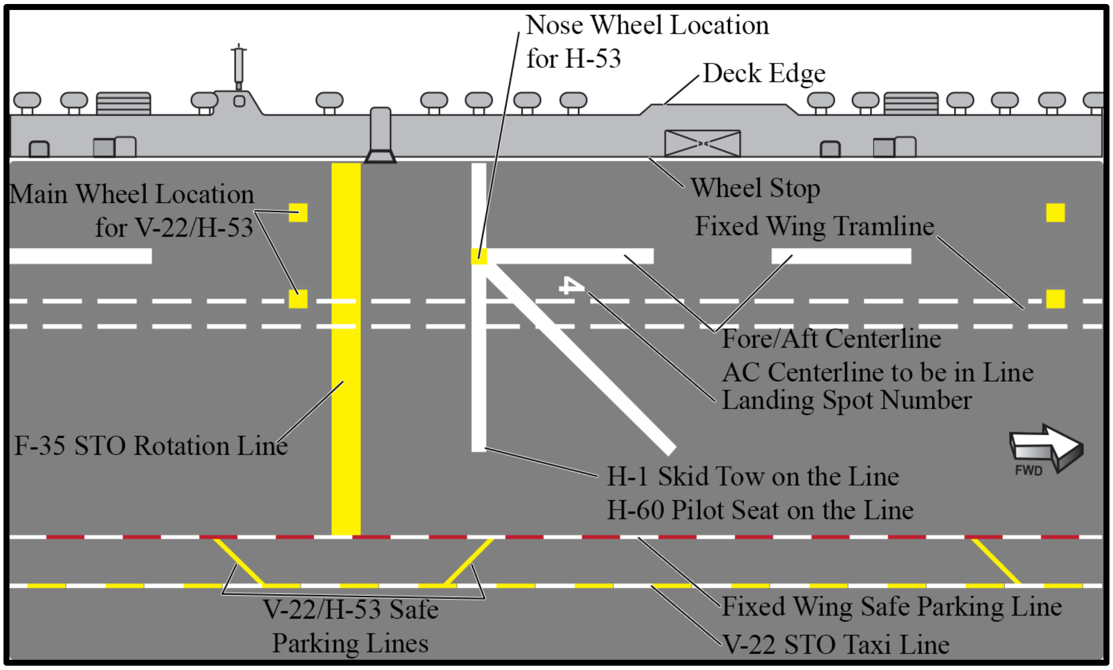

Figure 2-2 Typical LHA/LHD Helicopter/Tilt-rotor Landing Spot Diagram

ii. **CVN Landing Spots**: CVN helicopter precision landing spots consist of an inverted "T" similar to the LHA/LHD but do not have a 45-degree offset landing lineup line. Beneath the base of the "T" is a pair of square painted boxes. These indicate proper main landing gear placement for H-60 helicopters. Fly the approach to arrive in a hover aligned with the fore/aft centerline just off the edge of the flight deck. When directed by the LSE, slide to position the aircraft aligned with the centerline and maintain the horizontal line bisecting the cockpit. Once cleared to land by the LSE, execute a vertical landing.

c. **Helicopter Departure Procedures**. Case I/II departures may be used when conditions are VMC down to 500-1. Helicopters shall clear the control zone at or below 300 feet or as directed by Pri-Fly.

2. Air-Capable Ships

a. **Helicopter Departure Procedures**. After launch, depart the ship on the assigned course. The aircraft shall be launched on the HCO's Land/Launch frequency. Establish a positive climb, check gauges and caution lights, then report "operations normal" plus fuel state and souls onboard. The HCO will then pass control to CIC.

b. **Helicopter Recovery Procedures**. When arriving within the control area, report to the CIC for control. The pilot shall provide the following information in the IPASS format:

i. **I**dentification and type aircraft

ii. **P**osition

iii. **A**ltitude

iv. Fuel **S**tate (in hours and minutes to splash)

v. **S**ouls on board

vi. Other pertinent information that may affect the recovery (aircraft status, pilot's assessment of weather conditions, etc.)

The CIC shall provide the inbound flight with:

i. Altimeter setting, wind, and weather

ii. Base Recovery Course

Control will be passed to the HCO, and the LSE will complete the recovery. If the ship is not prepared, CIC shall issue holding instructions until the ship is ready for recovery.

c. **Air-Capable Ship Landing Procedures.** The air-capable ship landing spot consists of a lineup line and a landing circle. Obstacle clearance is assured when the aircraft lands with the main mounts, nose wheel, or forward skid cross tube within the landing circle and the fuselage centerline aligned with the landing lineup line. Some ships landing spots require a straight-in approach (Figure 2-3), and others are angled for a starboard or port approach.

Some aircraft and ship combinations require more restrictive landing envelopes. For example, MH-60S helicopters landing on a CG or DDG must land with the main mounts directly on a pair of square boxes in the forward part of the landing circle to ensure tail wheel clearance.

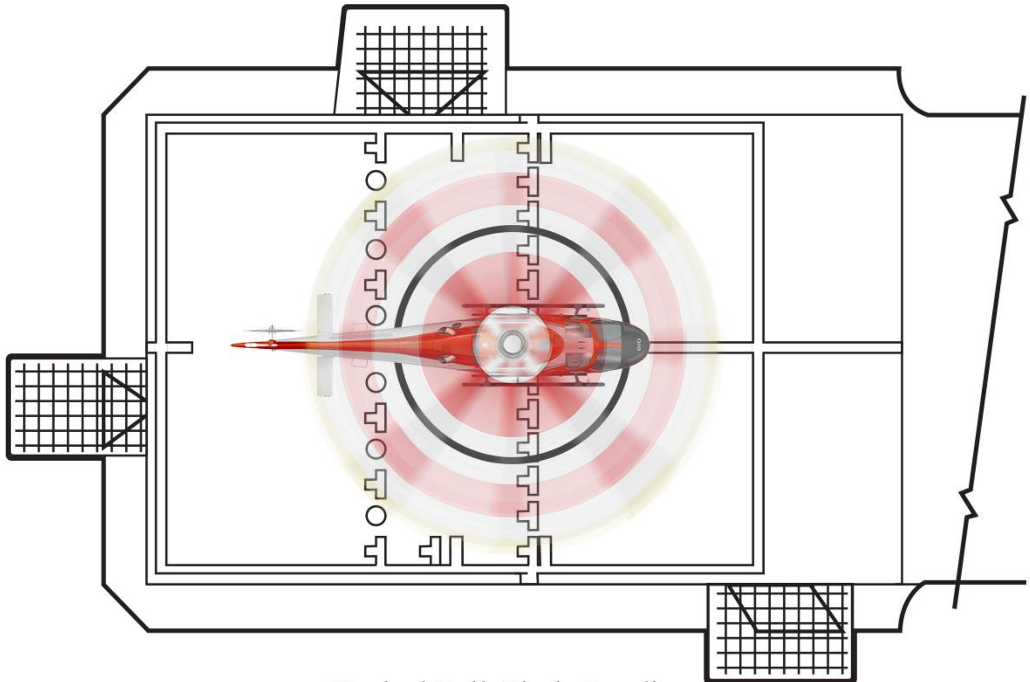

Figure 2-3 Typical Air-Capable Ship Landing Spot

202. DECK LANDING PROCEDURES

Description. The deck-landing pattern is used for your initial air-capable ship landing NATOPS qualification/requalification (Figure 2-4). The pattern enables you to practice repeated shipboard takeoffs and landings expeditiously at a pattern altitude of 200 feet AGL and 80 KIAS.

1. Procedures

   a. PNAC checks gauges and caution lights, then signals to the LSE "ready for takeoff."

   b. When cleared by the LSE, lift to a stable five-foot hover. The PNAC checks the gauges and reports, *"Gauges green, CAS checked."*

   c. Upon LSE signal, commence a slide to the port side of the ship.

   d. When signaled by the LSE, transition to forward flight. Maintain takeoff power until three indications of a climb (IVSI, RADALT, and BARALT) and positive airspeed. The PNAC reports, "*Three rates of climb, airspeed is increasing.*"

NOTE

When clearing the deck edge, additional power will be necessary to prevent settling due to loss of ground effect.

e. Climb straight ahead to 150 feet AGL, accelerating through 70 KIAS and turn to arrive on downwind parallel to the lineup line at 200 feet AGL and 80 KIAS.

f. Just prior to abeam, PAC announces left or right seat and type approach (starboard-to-port) to the HCO. The HCO will respond with deck status, winds, and pitch and roll.

g. At the 180-degree position, begin a level turn towards the line-up line. Decelerate to 60 KIAS.

h. Intercept the line-up line with 0.5 DME of straight-away on final at 200 feet AGL and decelerate to 50 KIAS.

i. Set a decelerating attitude and adjust collective to maintain a constant glideslope to arrive over the spot in a five-foot hover.

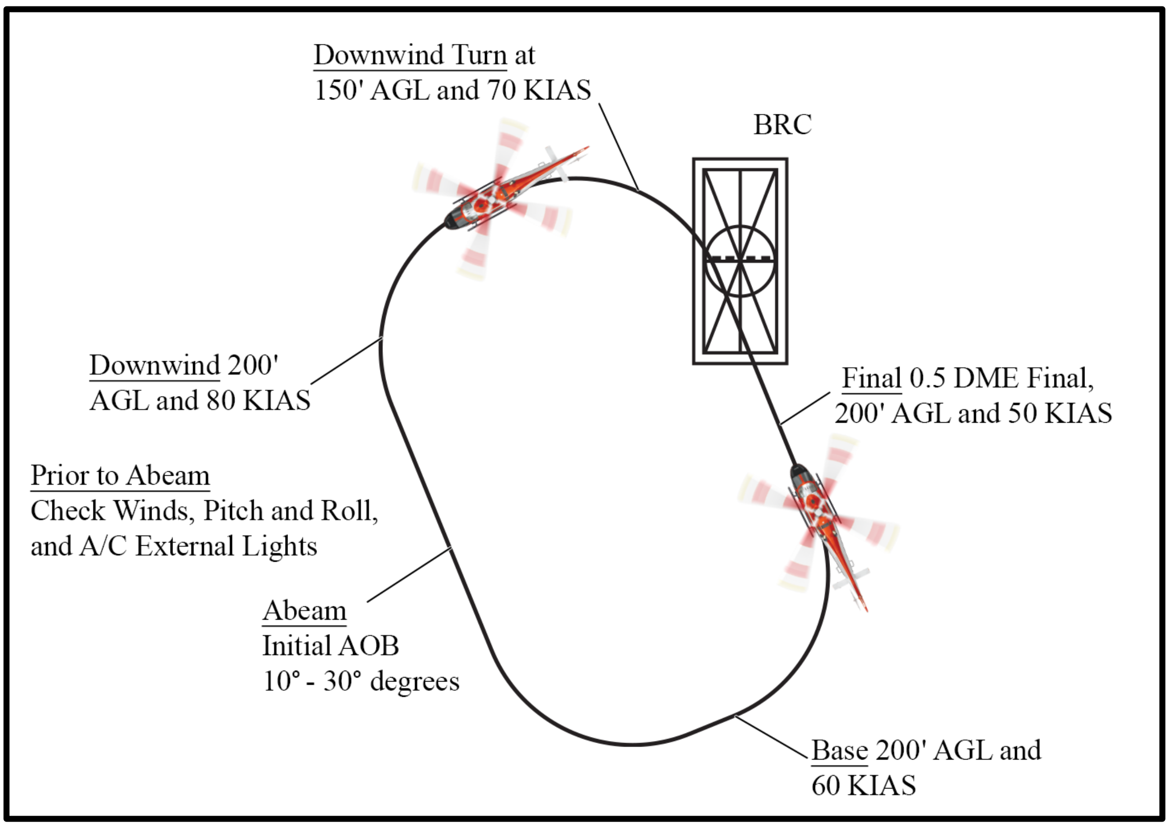

Figure 2-4 Deck Landing Pattern

2. Amplification and Technique

   a. To maintain spatial orientation while in the pattern, tune the TACAN to the ship's TACAN frequency. Twist the Horizontal Situation Indicator (HSI) course indicator to align with the line-up line, and the heading bug to the ship's BRC is helpful for orientation.

   b. Fly the downwind at 200 feet AGL and 80 KIAS. The PNAC will ensure the Landing Checklist is complete, report the fuel state, and set the proper lighting configuration.

   c. Just prior to abeam, report seat of PAC and type approach (starboard-to-port) to the Tower. The Tower will respond with deck status, winds, and pitch and roll.

   Example:

   i. Pilot: *"(Aircraft call sign), abeam, right seat, starboard-to-port."*

   ii. Tower answers: *"Roger, (aircraft call sign), you have a green deck, wind ten degrees to port at five KTS, pitch one, roll one."*

   d. Fly a constant glideslope to cross the deck at eight to ten feet. A crewmember will report crossing the deck edge over ICS. Continue flying glideslope to arrive at a stable five-foot hover. When the LSE signals to land, smoothly execute a vertical landing, maintaining line-up and fore/aft positioning.

   e. Execute a wave-off if directed or required.

3. Common Errors and Safety Notes

   a. Since visibility is limited in a nose-high attitude, use an early deceleration to control closure rate, or else you may lose sight of the ship, landing area, and/or obstacles.

CAUTION

High nose attitudes upon crossing the deck could result in a tail strike or fouling in the nets.

   b. Avoid extending the pattern downwind.

   c. A wave-off signal from the LSE, Tower, or wave-off light is mandatory. If the PAC feels uncomfortable (during the approach due to a high sink rate, excessive closure rate, etc.), a wave-off should be executed.

   d. Thoroughly brief all emergencies around the flight deck. It should be clearly understood when you intend to land on the spot, ditch, or continue flying in the event of an emergency.

e. Avoid the tendency to slow excessively and lose translational lift prior to crossing the deck edge. Do not fixate on the spot; continue to scan the entire deck.

f. During wave off, ensure three positive rates of climb and increasing airspeed while maintaining takeoff power. Excessive nose-low attitudes can result in inadvertent descent.

203. EMERGENCY PROCEDURES IN THE SHIPBOARD ENVIRONMENT

Although the NATOPS landing criteria are the same, determining the best course of action is much more difficult over the open water. The size of the ship deck, proximity to a larger ship or land-based airfield, fuel state, and nature of the emergency will dictate the best course of action. For example, with a tail rotor emergency it would make sense to transit from an air-capable ship to an LHD to have more landing area available during the approach and landing. On the other hand, if there is a transmission chip light with secondary indications it would make sense to reduce the time airborne and accept the smaller landing area of an air-capable ship rather than transit somewhere else. If an aircraft loses communication, with a ship while VMC, they should remain VMC and continue the approach using lost communication signals listed in Figure 2-5.

From Aircraft to Ship	
Pilot's Desires or Intentions	**Signal**
1. I require immediate landing.	Fly by or hover close aboard starboard quarter, remaining clear of other traffic, with gear DOWN and floodlight/landing light ON. With complete electrical failure, fire a red flare on a safe bearing away from the ship.
2. I desire to land but can wait for the next recovery or scheduled recovery time.	Fly by or hover on the starboard side, low and close aboard with navigation lights BRIGHT and FLASHING and anticollision lights ON. With complete electrical failure, fire a red flare on a safe bearing away from the ship.
3. I am proceeding to the divert field.	Fly by the starboard side of the ship, rocking wings with landing gear UP, navigation lights BRIGHT and STEADY and anticollision lights ON. If fuel state and the nature of the emergency permit, continue making passes until joined by a wingman. Upon reaching divert fuel state proceed alone, setting IFF to emergency when departing.

Note

At night, aircraft flying close aboard the port side of the ship without lights are considered to have an emergency requiring immediate landing.

From Ship to Aircraft			
	Signal		
Command/Advisory	**OLS**	**Aldis Lamp**	**Blinker**
1. †Bingo — Proceed to Alternate Landing Field.	Flashing Cut and Waveoff Lights.	Flashing Red Light.	M, M — —, — —
2. Add Power — (Jets and Turboprops Only).	Flashing Cut Lights	N/A	N/A
3. Cleared to Enter CHARLIE Pattern.	N/A	Flashing Green	N/A
4. CHARLIE — Cleared to Land Aboard.	N/A	Steady Green Light.	C — — • — —
5. DELTA — Delay in Landing. Enter DELTA Pattern and Maintain Visual Contact with the Ship.	Flashing Landing Area Lights.	Steady Red Light.	D — — • •
6. Closed Deck. Do Not Land.	Landing Area Lights Off (Right Only).	N/A	N/A
7. Do Not Land. Ditch or Bail Out/Eject in the Vicinity of the Ship.	N/A	Z — — — — • •	Z — — — — • •
8. LSO Has Control of the Aircraft on Final Approach at Approximately 1-1/2 miles.	Flashing Cut and Waveoff Lights.	N/A	N/A

Figure 2-5 Shipboard Lost Communication Procedures

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CHAPTER THREE
SEARCH AND RESCUE ORGANIZATION

300. INTRODUCTION

This chapter introduces the fundamentals of SAR operations. The principles of SAR apply to a wide range of situations across the spectrum of military operations. The information contained herein is intended to provide a foundation for SAR, time management, and in-flight critical thinking, which will meet most mission requirements. Regardless of service or platform, any military rotary-wing aviator may be required to conduct a short-notice search for survivors or isolated personnel.

301. MARITIME SAR

As Naval Aviators, we primarily operate from blue water or littoral environments. Flight operations from ships are inherently hazardous and may result in planned or unplanned ejections or ditching. A strike pilot facing a planned ejection will always try to get "feet wet" if able since the odds of a successful rescue are greatly improved by remaining out of the reach of ground-based enemy forces. Additionally, accidents such as a man overboard will often necessitate SAR operations. Open-ocean searches can encompass vast areas and last for days. Without flotation or signaling devices, a survivor can be extremely difficult to locate in even moderate sea states with good visibility.

302. OVERLAND SAR

Overland SAR imposes many additional considerations and difficulties. Elevation, terrain, vegetation, severe weather, or enemy activity can make overland SAR operations considerably more complicated and dangerous. Search objects will often be obscured or extremely difficult to locate in mountainous, forested, or jungle terrain. The only visible clue to a crash site may be broken treetops or a reflection from a broken fuselage or windshield. Anything that appears out of the ordinary may be a clue. Survivors in distress may be impossible to see unless they signal or move into an open area.

303. USEFUL SAR REFERENCES

When preparing for the simulator and flight briefs, consider the references below for more information. In particular, the SAR Tactical Aid (TACAID) will be used to demonstrate examples of short-notice SAR scenarios in this FTI and the SAR class. Additionally, it may be referenced during simulator and flight events. The information presented here is drawn from the following references:

- International Aeronautical and Maritime SAR Manual (IAMSAR)
- U.S. National Search and Rescue Supplement to the IAMSAR Manual (JCS 3-50)
- Navy SAR Manual (NTTP 3-50.1)

- SAR TACAID (NWP 3-22.5)

Do not let the limited scope of this instruction create the misconception that searching is done only for survivors. Many fleet missions will draw from similar search principles. This may include searching for a submarine hidden under the sea, warships evading detection in a vast expanse of ocean or a downed aircraft in mountainous terrain. Even if your follow-on training does not include search missions, you will be flying an aircraft that possesses the unique ability to fly at low altitude and slow airspeeds. So regardless of platform, as professional Naval Aviators, you may be expected to conduct a short-notice search for survivors based on proximity to the search area.

304. SAR ORGANIZATION

The United States, in accordance with the Safety of Life at Sea (SOLAS) Convention, is a participant in the International SAR System. Participating countries provide 24-hour SAR response within their respective areas of responsibility, as described in the National SAR Supplement to the International Aeronautical Search and Rescue Manual (IAMSAR).
Just as in any operation or mission, a SAR effort requires a command structure in order to efficiently organize and task units. The IAMSAR specifies three levels of coordination: the SAR Coordinator (SC), SAR mission coordinator (SMC), and On-Scene Commander (OSC). The SMC and SC are higher-level leaders and planners who work with their staffs from remote locations to coordinate on-going search and rescue efforts. Their duties and roles within a SAR situation are outside the scope of this document so we will limit our discussion to the OSC.

– **OSC**. The first asset on-scene will usually assume the role of OSC. If multiple Search and Rescue Units (SRU) are involved, the SMC will designate the OSC. The OSC is responsible for managing and coordinating the efforts of all participating air and surface assets. The duties of OSC are detailed in the IAMSAR and National Search and Rescue Supplement (NSS). Due to their rapid response and flexibility, helicopters are likely to be on-scene during the early portions of a SAR case as well as the main SRU available to the SMC.

CHAPTER FOUR
SEARCH PATTERNS AND PROCEDURES

400. INTRODUCTION

This chapter focuses on the planning and operations phases of short-notice SAR missions. The procedures provide a foundation of SAR knowledge to build upon during your fleet training.

Helicopters are a versatile platform and are often utilized for different types of search missions and survivor rescue missions. These missions can include searching for a covert submarine or warships across the open ocean, a downed aircraft in mountainous terrain, or survivors of a capsized boat. Even if SAR is not the primary mission of your fleet aircraft, you will have the unique capability to fly at low altitudes and slower airspeeds to conduct a short-notice search for survivors. Depending on the aircraft configuration and equipment onboard, you may be able to aid with the rescue as well.

The following planning considerations mirror the flow in the SAR TACAID, which is the primary reference for short-notice SAR missions. The TACAID is designed so a pilot can start at the front of the manual and work towards the back, finding all of the crew brief and planning information needed to execute a search. The TACAID, as a quick reference guide, does not contain as much detail as the Navy SAR Manual (NTTP 3-50.1) and is only meant to be used when an aircrew is responding quickly to SAR tasking.

Time is the most critical element in SAR operations. The three major constraints on the time available to conduct a SAR mission are the fuel onboard your aircraft, the human body's limited ability to handle environmental exposure, and crew day remaining. It is important to consider the worst-case scenario and assume the survivors are incapacitated, capable of surviving only a short time and requiring emergency medical care. Time of day will affect the search as well. While searching at night is possible, it is more challenging to locate survivors, even if the searching units are aided with NVGs or other sensors. The ability to manage time wisely will affect the success of the SAR effort.

401. DETERMINING DATUM

The Search and Rescue Unit (SRU) may be given a probable location of the search object but may need to calculate the initial position. The initial position is subject to uncertainty based on position and movement errors. The initial position corrected for movement over time is known as the datum. A datum is a geographic point, such as a reported or estimated position, at the center of the area where it is estimated that the search object is most likely to be located.

402. MARITIME SEARCH PATTERNS

Deciding which search pattern to use is dictated by the size of the search area and the accuracy of the datum. During the SAR simulator and flight events, it will be up to you to determine the search patterns, altitudes, and airspeeds that provide the best Probability of Detection (POD) for the scenario. It is expected that you will use the SAR TACAID in this process.

The following four patterns are used in the Advanced Helicopter Training Syllabus:

- Parallel
- Creeping line
- Expanding square
- Sector

The TH-73A PFD and MFD allow the pilot to develop and display search patterns on the MAP display. Select LADDER for a parallel or creeping line pattern, EXP SQUARE for a square pattern, and SECTOR for a sector pattern.

The pilot must know the following information to create the pattern using the Genesys software:

- Initial Turn (INIT TURN) – Choose left (L) or right (R) based on the direction of turn at the end of the first leg.
- Initial Track (INIT TRACK) – Choose the heading of the first search leg. Input a number 1–360 degrees.
- Leg Length (LEG LENGTH) – Set desired leg length for the pattern.
- Leg Spacing (LEG SPACING) – Set the track spacing (S) previously calculated.
- Number of Legs (NUMBER OF LEGS) – Set legs only for the Expanding Square Pattern.

1. Search Pattern Precision and Effectiveness

One of the factors that will determine search success is how precisely the search pattern is flown. The SAR TACAID planning will take into account many factors that affect search execution, but sometimes a quick transit to the initial point reduces planning time. Factors to consider:

a. **Effect of Wind**. Wind will almost always be a factor in maritime search efforts. The best way to minimize errors created by the wind is to orient the search pattern into the wind as much as practical. The search pattern legs should be displayed on the MFD, but timing can be used as a last resort.

b. **The Radius of Turn**. With the small track spacing typical of short-notice SAR operations, failing to take the radius of turn into account when executing your pattern will result in flying the pattern with reduced accuracy.

c. **Flying versus Searching**. Flying a precise pattern will require focus and concentration by the flying pilot. This will detract from their ability to scan for survivors. Since the majority of fleet aircraft have aircrewmen onboard, they should be assigned to scan the same side of the aircraft as the flying pilot for overlapping coverage.

2. Marking the Initial Position

Some tools to consider using to maintain orientation are:

a. **GPS**. Determining aircraft position and navigating to a datum for a SAR mission is most accurate when using GPS information. Many aircraft, including the TH-73A, have software that uses GPS data, and that data should be the primary source for navigation during a SAR mission. If GPS is not available, there are other less precise means for maintaining orientation, as described below.

b. **Shipboard Radar**. The accuracy of a ship's radar is a function of its design and calibration. For example, phased array radar is considerably more accurate than a generic air search radar. To minimize errors, it is best to have the same ship that created the initial position vector you to the point.

c. **Shipboard NAVAIDs**. A position from a ship's TACAN may be used to fix the initial position. There are several drawbacks to this method. First, ships move. This means the TACAN station used to determine the initial position is also moving and less accurate. Second, at most search altitudes, you may not be able to receive the signal.

d. **Datum Marker Buoy**. If available, they should be used to mark the datum. They are designed to drift at a predetermined rate and have a built-in transmitter that can be used as a Non-Directional Beacon (NDB) to maintain orientation.

e. **Sonobuoys**. If a DATUM marker buoy is unavailable, a sonobuoy can be used in the same manner. However, due to the deployed hydrophone, they do not drift at the proper rate.

f. **Smokes**. If no other means are available for marking the datum, a smoke may be used. Smokes have a serious drawback. The longest burning smoke will only last 45–55 minutes. If a search lasts longer than this, it will be necessary to stop the search pattern to deploy another datum smoke.

3. Search Patterns

a. **Parallel Pattern**. This pattern (Figure 4-1) is normally used for a large search area where only the approximate initial position is known, and there is an equal probability of finding the search object/survivor anywhere in the search area. Track legs for the parallel pattern are flown parallel to the wind line or "major axis."

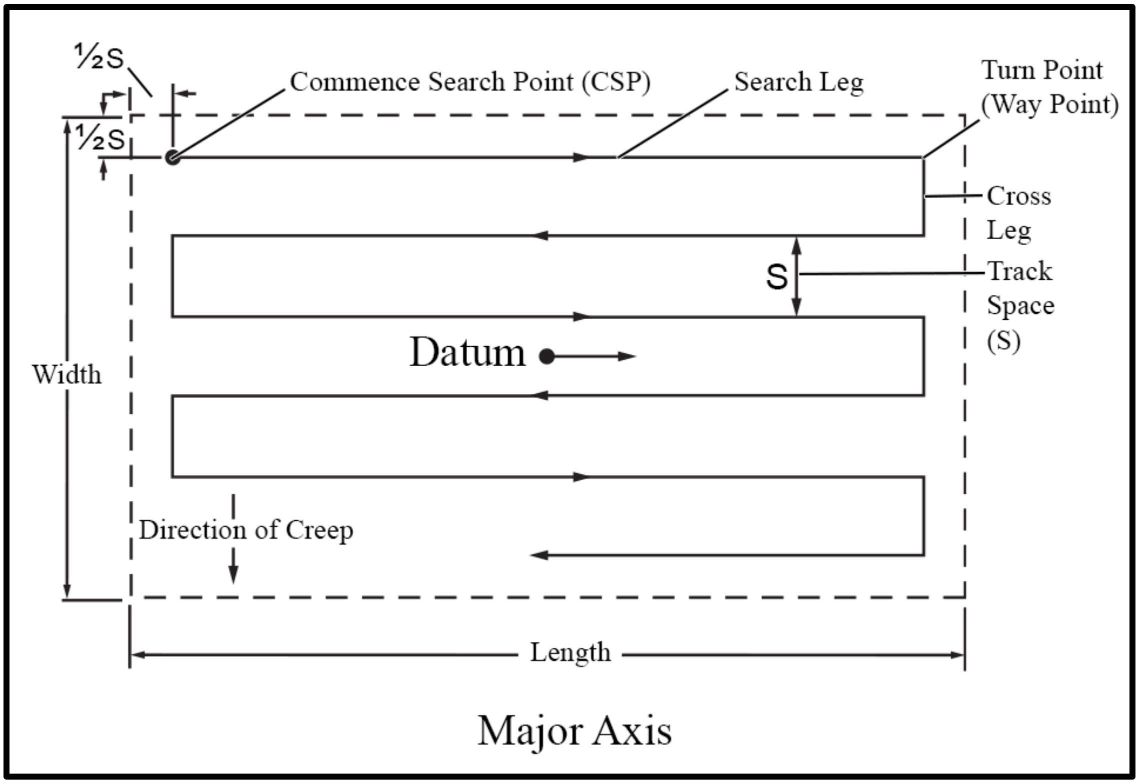

Figure 4-1 Single SRU Parallel Pattern

b. **Creeping Line Pattern**. This pattern (Figure 4-2) is a specialized version of the parallel pattern. It is used when the probable location of the search object is thought to be on either side of a line between two points, and there is more chance of the target being at one end of the search area than the other. For example, the creeping line pattern would be useful during a man overboard scenario.

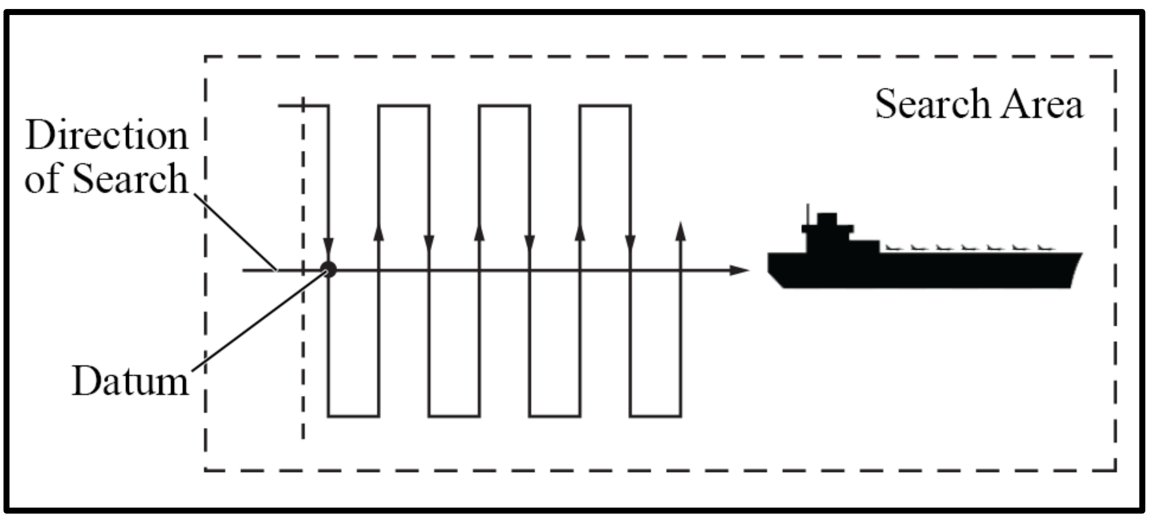

Figure 4-2 Creeping Line Pattern

c. **Square Pattern**. This pattern, also known as the expanding square, is used to search a small area when the position of survivors is known within close limits (Figure 4-3). It provides more uniform coverage than a sector search and is easily expanded if the search area increases. An expanding square search starts at the datum and moves outward. It requires the full attention of the PAC to precisely fly the pattern.

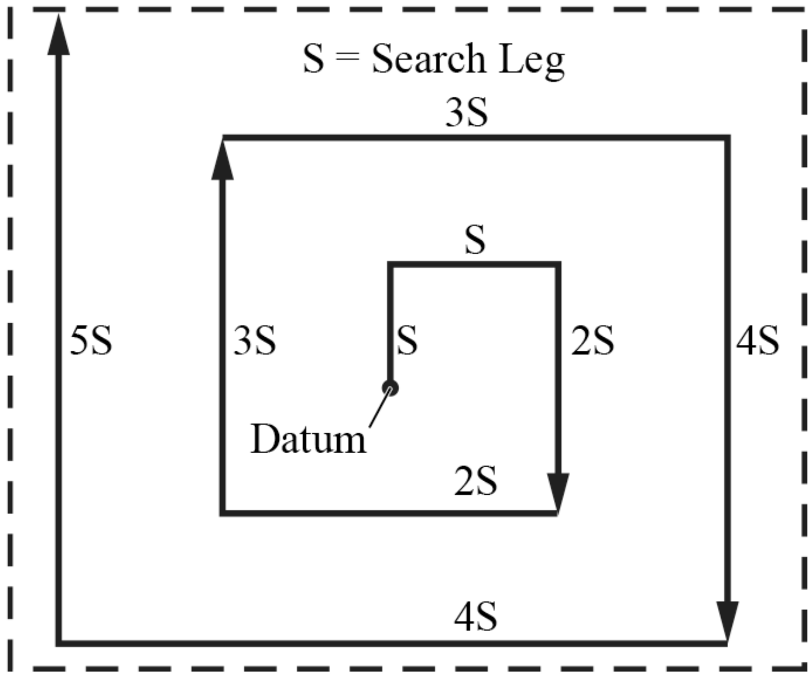

Figure 4-3 Expanding Square Pattern

d. **Sector Pattern**. This pattern (Figure 4-4) is used when the datum is highly reliable, and the search area is not extensive. It is centered on the datum and passes over it with each leg, which concentrates the search effort in a smaller area. It is useful when the target is difficult to detect, but the probability of detection is high.

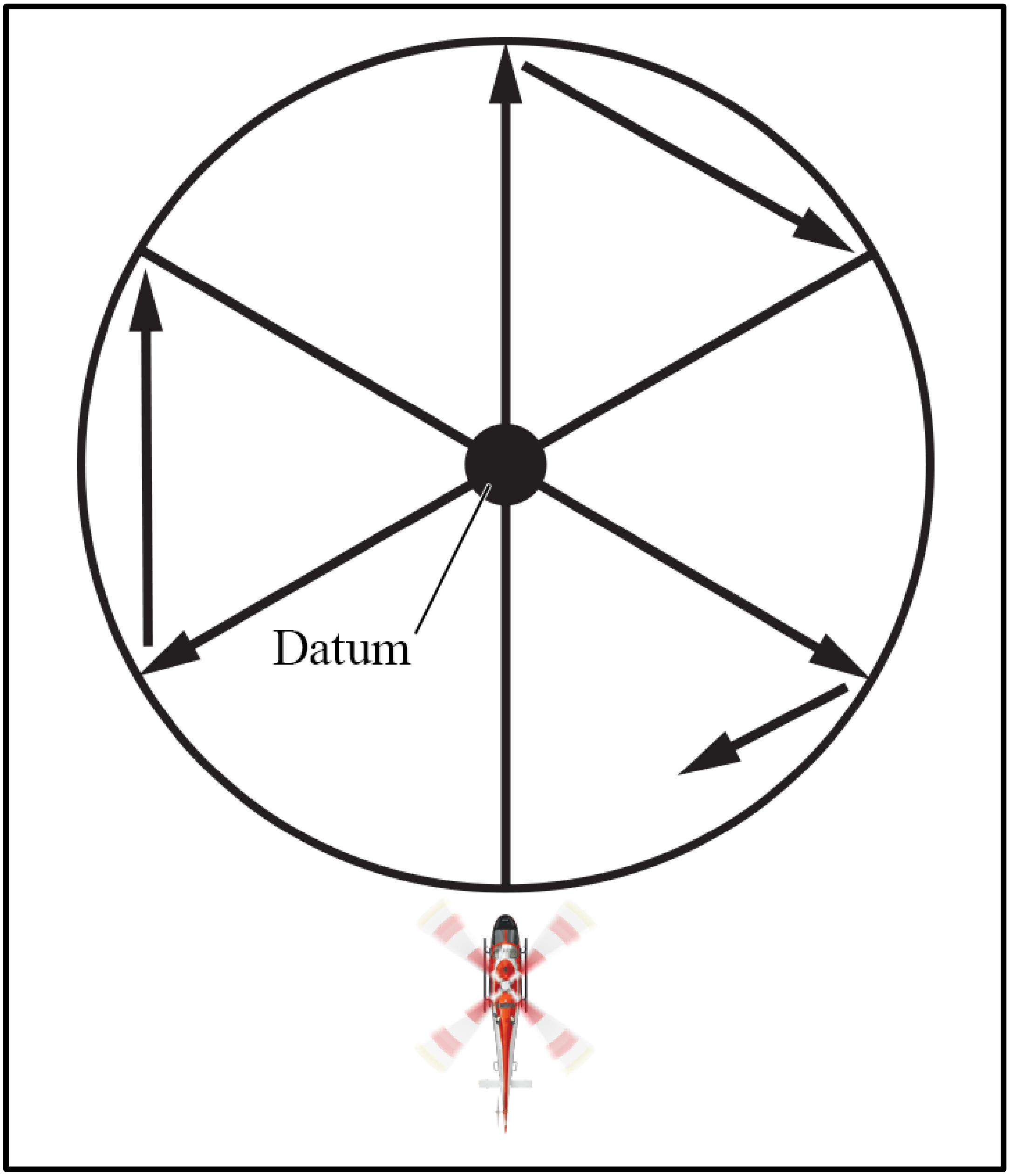

Figure 4-4 Sector Pattern

403. CRM DURING A SEARCH

Effective use of CRM is integral to a successful SAR mission. Extended searches can be fatiguing and diminish morale over time, so it is important for the Pilot in Command (PIC) to set clear expectations for the crew, brief everyone's responsibilities, and monitor for fatigue. The crew NATOPS and SAR mission brief should cover the mission, fuel planning, contingencies, and criteria for suspending the search.

Ideally, there are enough people on board to conduct an overlapping scan. The pilots will search the area that passes underneath the aircraft while a crewman on each side of the aircraft scans their respective side of the aircraft. Remember, though, that the integrity of the search depends on the ability of the flying pilot to precisely fly the search pattern. This low-level, integrated scan (combination of visual and instrument scan) may require the PAC to make the scan for survivors secondary to safely flying the aircraft (Figure 4-5). Additionally, if the PNAC is also busy performing OSC duties, this should be considered.

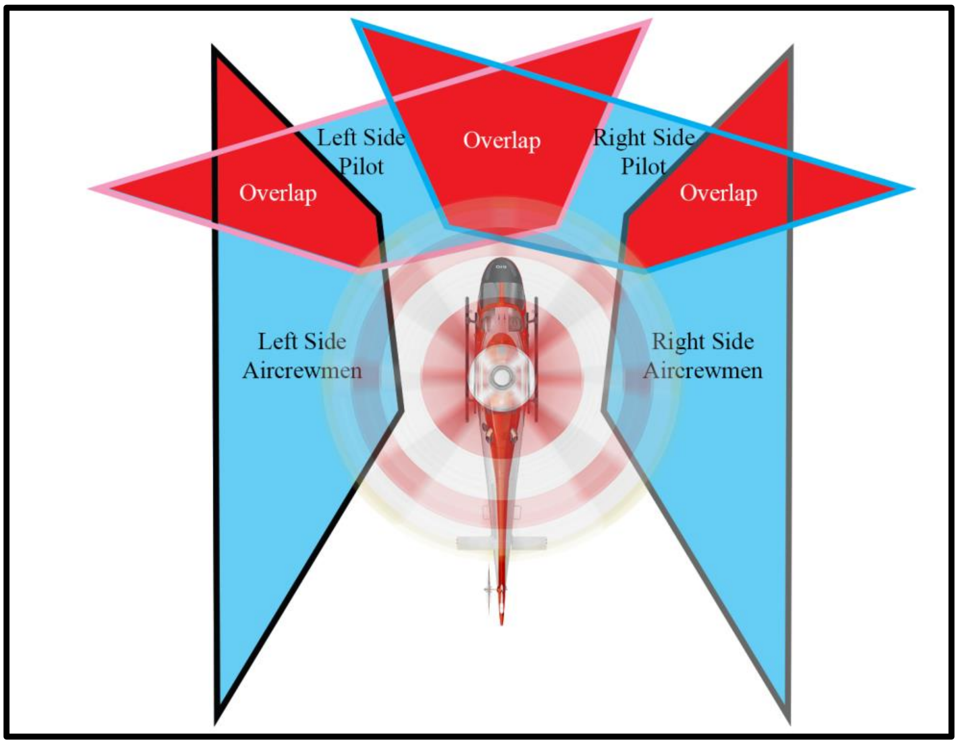

Figure 4-5 Overlapping Visual Scan

If possible, establish a scanning rotation no longer than 60-minute intervals to reduce fatigue. If there are no extra people on board, have the aircrewman switch sides of the aircraft. Scan from under the aircraft out to the horizon. Divide the search area into visual sections and try not to exceed 10 degrees per second while scanning. Move the whole head, not just the eyes, to delay eyestrain.

These techniques work well for overwater and flat terrain VMC searches. If there is rising terrain, obstacles in the search area, a low visibility environment, or the search is being conducted at night, the PAC will need to focus primarily on flying the helicopter and avoiding obstacles. This means the PNAC and aircrewmen will have to expand their scan to cover the extra area.

404. SURVIVOR SIGNALING DEVICES AND POSITION MARKING

A survivor may have signaling devices available to aid the search assets. If a Navy pilot is in the water, look for the reflective helmet, strobe light, mirror flash, smoke, pencil flare, or sea dye marker. There may be a personal or group life raft, debris in the water, or smoke from a sinking vessel.

In addition to the standard signaling devices carried by aviators as part of the standard Aviation Life Support Systems (ALSS) gear, you may encounter other overt or covert signals used by conventional ground forces and Special Operations Forces (SOF) personnel. Common examples are infrared strobes and chemlights only on NVGs or Forward Looking Infrared (FLIR).

– Position Marking

Once the survivors are found, it is critical to mark the location to keep track of them and set up the rescue approach. Methods for position marking include:

a. **Mark on Top (MOT)**: The MOT push button should be pressed whenever a crewmember sees something in the water. The pilot should also note the heading at that time. The MOT is saved to the User Waypoint List and records the position (latitude/longitude) and altitude. The waypoint can then be inserted into the flight plan or be used to build a search pattern.

b. **Pyrotechnic Devices**: SAR crews carry a variety of survivor position-marking devices. The MK 58 Smoke is designed for day or night use in any condition calling for a long-burning (at least 45 minutes) smoke reference point on the ocean surface. The MK 18 Smoke is the only pyrotechnic designed for overland use. It can be used for signaling on the ground or for wind determination from an aircraft. It burns for 50–90 seconds.

WARNING

Pyrotechnic devices shall not be used in areas where flammable fluids or other combustible materials may be ignited.

c. **Electric Marine Marker Light**: The “matrix light” is a droppable floating strobe light that provides a visual reference to a survivor when there is fuel or other flammable material nearby. However, a flashing marker light may cause vertigo, especially at night.

CHAPTER FIVE
RESCUE METHODS AND PROCEDURES

500. INTRODUCTION

This chapter reviews the rescue methods and procedures for SAR missions. Once a survivor is found, it is time to execute the rescue effort. The type of rescue pattern used will be determined by the time of day, rescue location, and weather conditions in the area.

501. OVERWATER RECOVERY

The type of rescue pattern used will be determined by whether or not the crew has reference to a visible horizon.

1. Day VMC Rescue

During a day VMC rescue, the primary rule is to never take eyes off of the survivor. It is very difficult to find a single person or small object in the water, so once someone finds the survivor or search object, the crew must maintain visual contact at all times. A pattern shall be flown so that whoever has sight of the survivor maintains visual contact. Set up the pattern into the wind. Things to consider:

a. Rotor wash will make the rescue difficult, so set up an approach downwind of the survivor. Then let the aircrewman talk you into a hover position for hoist procedures (Figure 5-1).

b. Scan the water for excessive sea state, debris, sea predators, fuel spills, or fire that could endanger the aircrewman or survivor. If there is debris in the water, it may be unsafe to have the rescue swimmer jump into the water; therefore, a hoist deployment may be safer. If there is fuel in the water, it is unsafe to deploy a smoke or flare due to the chance of igniting a fire.

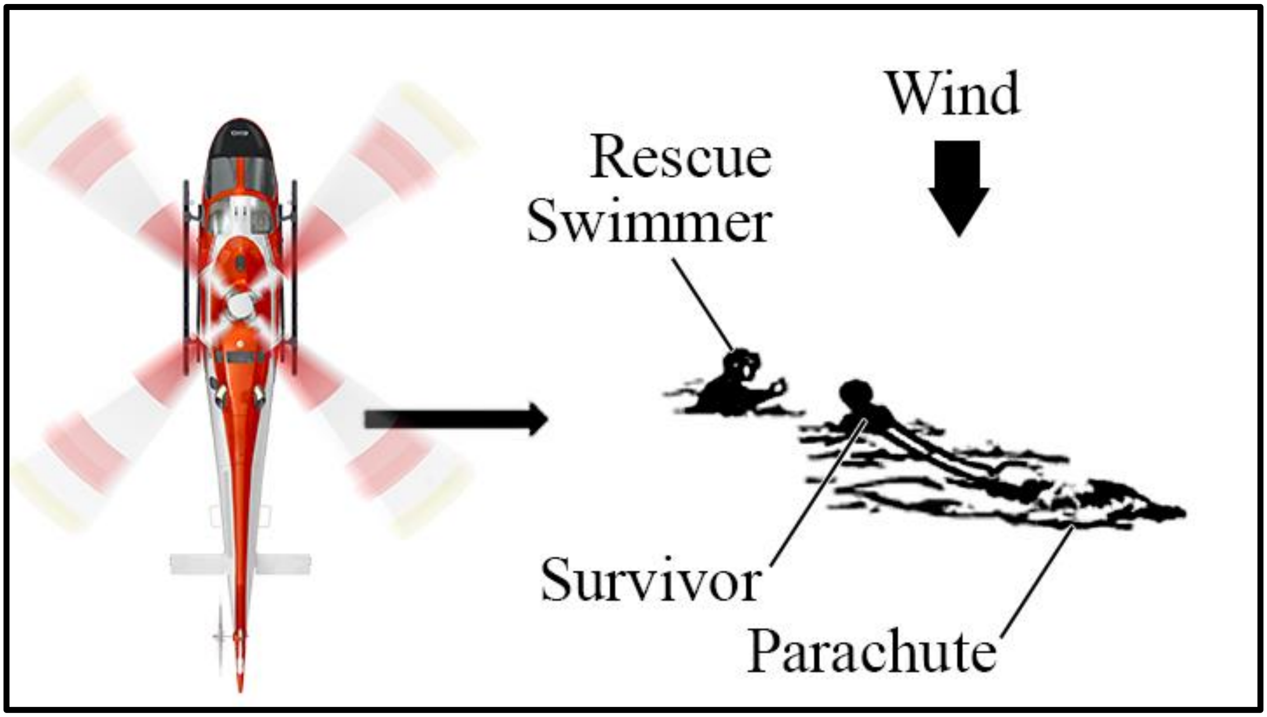

Figure 5-1 Hovering at the Three o'clock Position

2. Daytime VMC Overwater Rescue Procedures

   a. Execute the Landing Checklist and Hoist Operating Procedures Checklist.

   b. Mark the survivor's location. Press the MOT button and deploy a marker or smoke, as necessary.

WARNING

Any time there is a chance of igniting aviation fuel in water, smokes shall not be used to mark the survivor's position.

   c. Set up the final approach into the wind. Use environmental cues, smoke, or wind information on the PFD to determine wind direction.

   d. Determine swimmer deployment method (hoist, 10-foot/10-knot jump, 15-foot/0-knot jump). If there is no swimmer on board, set up for a bare hook, sling, or basket delivery.

   e. Once in a stable hover with the survivor at the 2 o'clock position, note power required and fuel remaining/compare to fuel required.

   f. Communicate with the OSC/SAR Mission Coordinator (SMC) if in communication range.

3. Determining the Windline Rescue Pattern

The windline rescue pattern you use depends on the relative winds when the aircraft flies over the survivor's position. The idea is to fly a pattern that sets up into the wind with standard rate turns to minimize dynamic maneuvering.

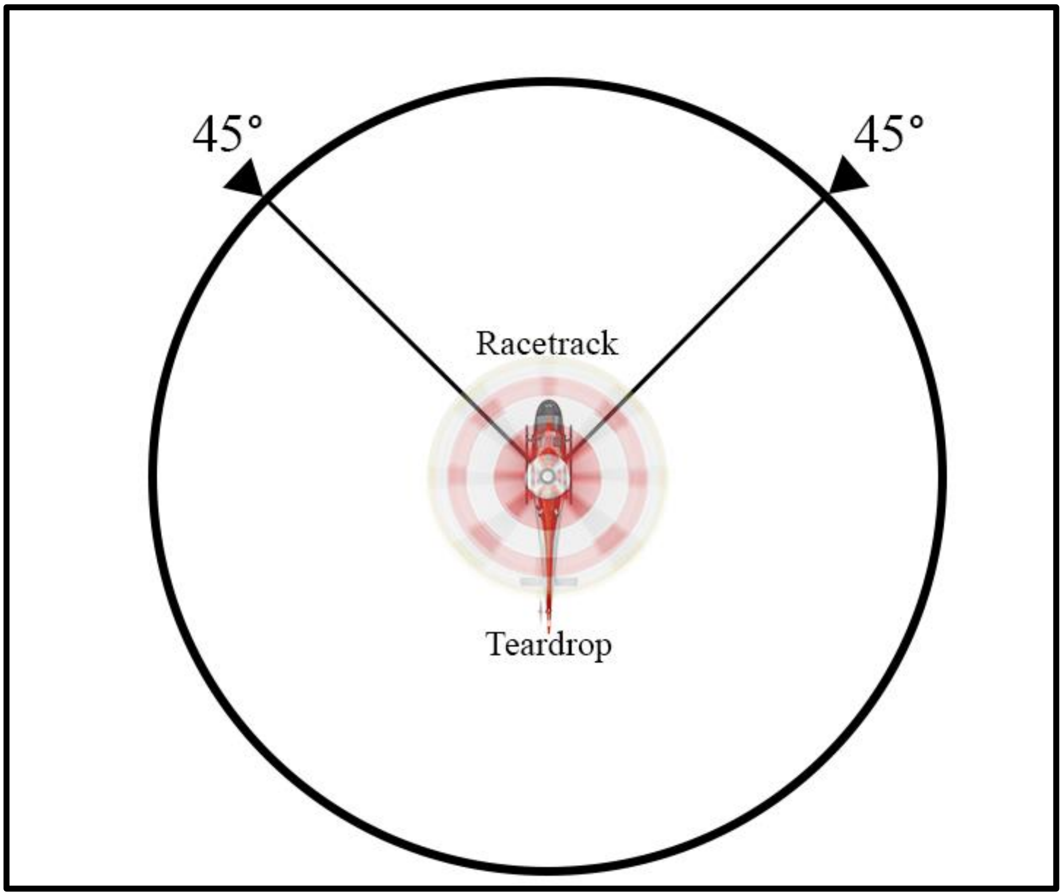

Figure 5-2 Relative Wind Quadrants

When passing over the survivor, if the wind is off the aircraft nose (up to 45 degrees either side), use the racetrack windline pattern (Figure 5-3). If the wind is a crosswind or tailwind, use the teardrop windline rescue pattern (Figure 5-4).

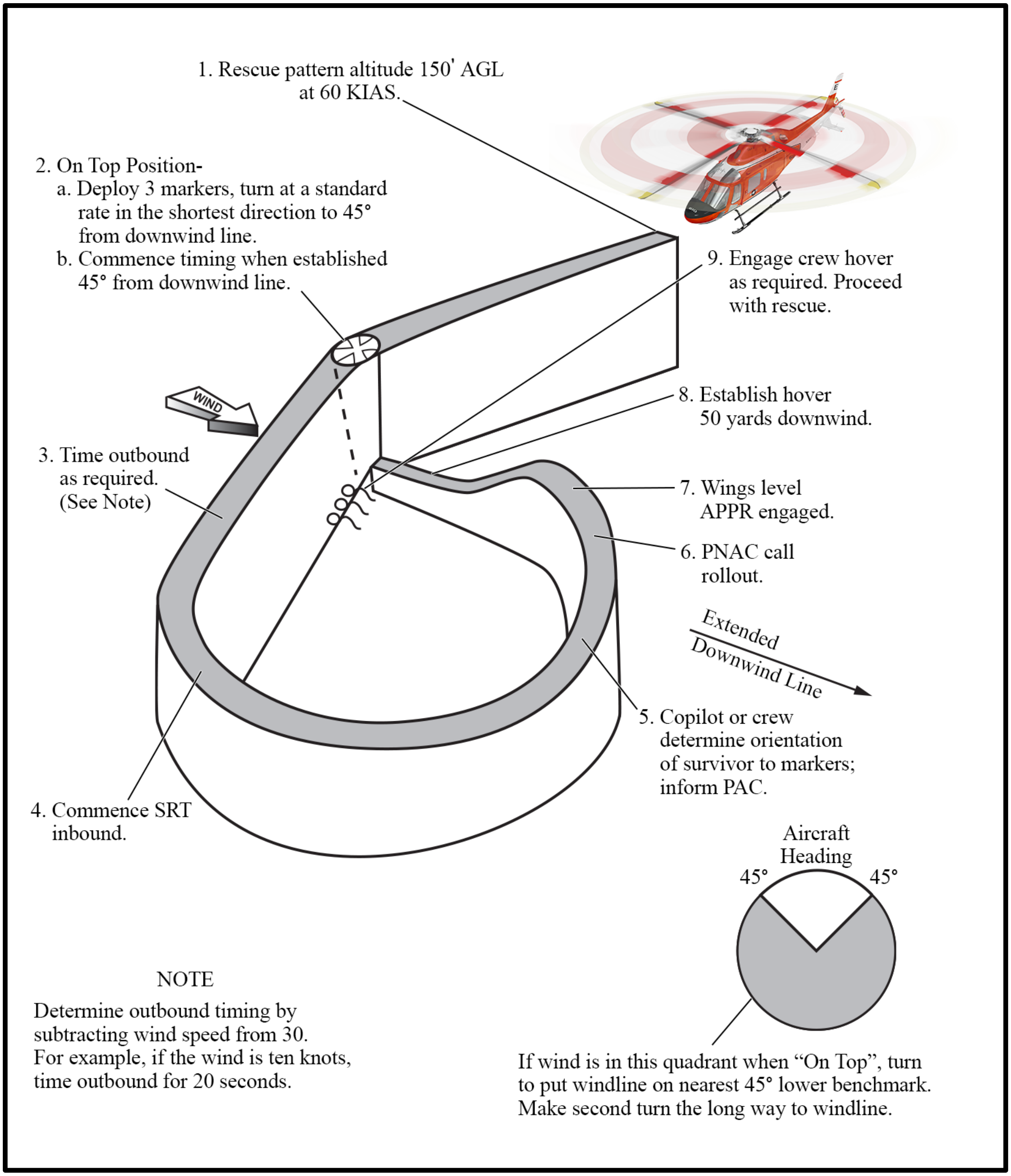

Figure 5-3 Teardrop Windline Rescue Pattern

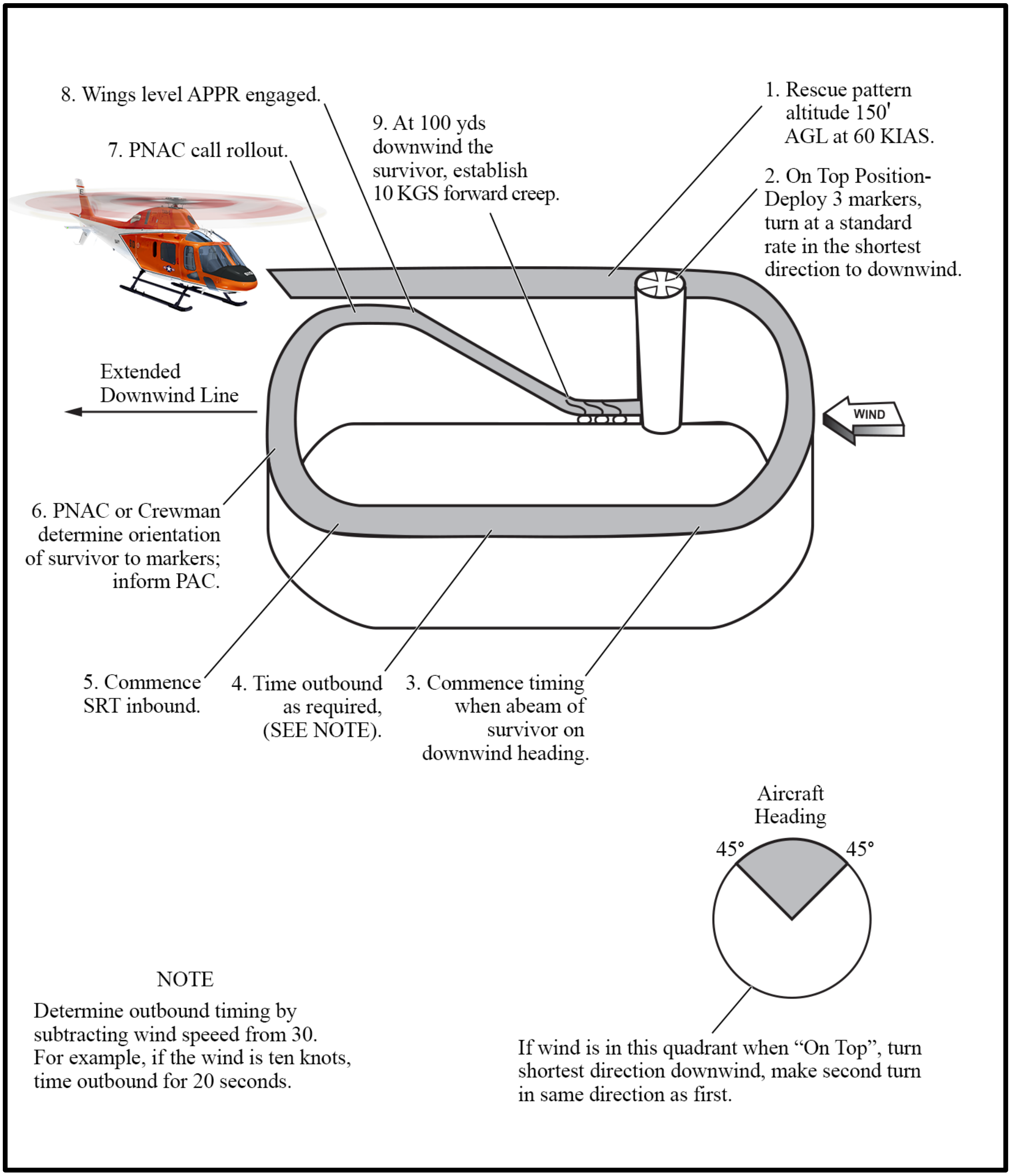

Figure 5-4 Racetrack Windline Rescue Pattern

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APPENDIX A
GLOSSARY

Aerospace drift – This is the sum of drift caused by aerodynamic forces. Sources of aerospace drift include aircraft glide, aerospace (ballistic) trajectory, and parachute drift. To determine an estimate of aircraft glide, it is often necessary to contact someone with knowledge of that airframe. Values for aerospace trajectory and parachute drift can be found in the SAR TACAID.

Air-capable ships – Refers to smaller ships with helicopter capability such as DDGs, Cruisers (CG), and Amphibious Transport Docks (LPD).

Aviation ships – Refers to Aircraft Carriers (CVN) and Amphibious Assault Ships (LHA/LHD).

Carrier Air Traffic Control Center/Amphibious Air Traffic Control Center (CATCC/AATCC) – The centralized ATC branch responsible for aircraft separation and radar services in the control area and during launch and recovery operations.

Combat Direction Center (CDC)/Icepack – The CDC is responsible for overall mission control of the Carrier Strike Group (CSG). Icepack is responsible for mission control for the Expeditionary Strike Group (ESG). They are responsible for the airspace out to 50 NM and provide multiple services to assigned aircraft, including radar control, procedural deconfliction, and administrative accounting of CSG/ESG aircraft.

Combat Information Center (CIC) – The CIC officer on an air-capable ship is responsible for the control of airborne aircraft, except during actual launching and recovery when the aircraft is under the control of the HCO or Landing Signals Officer (LSO). This includes safe separation from other traffic in the vicinity of the ship or under the ship's radar surveillance. The CIC is referred to as "Control" in radio communications.

Control area – A circular airspace within a radius of 50 Nautical Miles (NM) around the ship, extending upward from the surface to infinity, under control by Carrier Air Traffic Control Center (CATCC)/Amphibious Air Traffic Control Center (AATCC) on aviation ships and the Combat Information Center (CIC) on air-capable ships.

Control zone – The airspace within a circular limit defined by five miles horizontal radius from the ship, from the surface up to and including 2,500 feet (unless otherwise designated for special operations) and is under the control of Primary Flight (Pri-Fly) Control on aviation ships and Tower/the Helicopter Control Officer (HCO) on air-capable ships in VMC.

Datum point – A geographic point, such as a reported or estimated position, at the center of the area where it is estimated that the search object is most likely to be located. The datum uses the initial position information and corrects for position and movement errors.

Helicopter Control Officer (HCO) – Responsible for launching and recovering aircraft from an air-capable ship and all aircraft operating under VFR in the ship's control zone. Additionally, the HCO is the control zone clearing authority, and aircraft desiring to operate within the control zone shall obtain the HCO's approval prior to entry. The HCO is referred to as "Tower" in radio communications.

Landing Signalman Enlisted (LSE) – This individual is part of the ship's company and is trained to conduct flight deck operations. They are responsible for directing the pilot to the desired deck spot and ensuring general safety conditions of the flight deck area, including control of the flight deck crew.

Maritime drift – This is the sum of drift caused by maritime forces. Sources of maritime drift can be a leeway (sideward drift), sea current, wind current, or tidal current.

Movement error – Refers to the cumulative drift forces that affect the datum point in a maritime SAR. Aerospace and maritime drift forces are used to calculate the movement of the search object. Movement errors are represented as velocity vectors. Since it is necessary to fix at least two positions to calculate a velocity, calculating movement errors will add an additional position error into the solution. However, in most short-notice scenarios, this additional position error is negligible.

On-Scene Commander (OSC) – The aircraft designated as the OSC is responsible for managing and coordinating the efforts of all participating air and surface assets in the search area. The duties of OSC are detailed in the IAMSAR and National Search and Rescue Supplement (NSS).

Position error – This error represents the accuracy of the initial position in a SAR mission. If the search object has been missing for a long time or only a general area is known, this error can be quite large. In short-notice SAR scenarios, the position error is primarily due to the method used to determine the initial position. For example, an aircraft's self-reported global positioning system (GPS) position is more accurate than the aircraft's position on a ship's radar.

Primary Flight (Pri-Fly) Control – The Air Traffic Control agency on aviation ships responsible for the visual control of aircraft operating within the control zone. It is also responsible for the control of aircraft during and immediately following launch. It is also referred to as Tower.

SAR Coordinator (SC) – The SAR Coordinator is the specific agency in charge of a particular area. The US Air Force is tasked as the SC within the Continental US, excluding Alaska. US Pacific Command covers Alaska. The US Coast Guard covers all other US Search and Rescue Regions (SRRs), including Hawaii and all waters under US jurisdiction. The SC is only responsible for coordinating and assigning available assets, not necessarily executing all SAR missions in their area.

SAR Mission Coordinator (SMC) – The SMC is the chief coordinating agency for a specific SAR incident. The SC generally designates the SMC for the specific SAR mission. In the case of a military search, the Officer in Tactical Command (OTC) or unit designated by the OTC will fill the role of SMC. For example, in the event of a man overboard on a ship, the SMC is the ship's commanding officer.

Vertical Replenishment (VERTREP) – Refers to logistical operations where a helicopter uses the cargo hook to move items from one ship deck to another. This is often performed as a re-supply operation from a supply ship to an operational vessel at sea, mitigating the need to pull into port for supplies.

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